Implementing Blended Classroom Pedagogy to Deepen Student Understanding in High School Biology

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Implementing Blended Classroom Pedagogy to Deepen Student Understanding in High School Biology

By

David Krebs

December, 2015

A culminating project submitted to the Department of Education and Human Development of The College at Brockport, State University of New York in partial fulfillment of the requirements for the degree of Master of Science in Education
Implementing Blended Classroom Pedagogy to Deepen Student Understanding in High School Biology

By

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APPROVED BY:

Advisor

Date

Chairperson, Education and Human Development

Date
Abstract

The blended classroom model offers excitement and increased student engagement to an aging education system. The objective of this project is to demonstrate how teachers can best deepen student learning founded within 3 main focuses; first, transitioning away from passive lecture centered environments towards active student centered environments, second, to embrace technology as an educational tool, and third, to implement effective hands-on learning protocols. In this comprehensive literature review both benefits and concerns to applying blended classroom frameworks in a 9th grade living environment setting are addressed and reveal it’s effectiveness specifically stating higher student achievement and positive student perception. Complementing the literature review is a collection of designed lesson plans that support developing deeper student learning. The lesson plans are targeted for teaching at an urban school and follow the Rochester City School District science-pacing chart. Each lesson does not involve any class lecture and emphasizes learning through technology and hands-on experience.
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Chapter I

Rationale

The National Research Council (NRC) has created a K-12 framework for improving science standards across the United States of America. Deriving from extensive pedagogical research, the NRC has concluded that science education needs to realign its focus to emphasize on deeper student understanding (NRC, 2011). Studies reveal that deep science understanding can be achieved through increasing student engagement with content (Akçay, 2009; Ark & Schneider, n.d; Francis, 2013; Khalil, Lazarowitz, & Hertz-Lazarowitz, 2014; Light & Pierson, 2014; Wan, 2014). Effective student engagement has been illustrated to be most influenced by a number of factors including designing lessons based on solving authentic problems, offering student individualized support, increasing activities that involve collaborating with others, providing student-centered learning autonomies, and choosing relevant learning topics that can build upon student intrinsic interest.

A key component to increasing student engagement in class is to transition learning segments from passive learning environments to active learning environments (Gilboy, Heinerichs, & Pazzaglia, 2015). Essentially moving class time away from traditional lecture formats to an environment that requires student individual participation and content differentiation. Both technology and experiential learning have shown to be successful in engaging students in school (Schultz, Duffield, Rasmussen & Wageman, 2014; Yasar & Demirkol, 2014;).

Due to technology’s current embedded role in our society, it would be impractical to not utilize its powerful potential as a tool for the classroom. Much research advocates for incorporating technology in learning by referring to positive student and teacher perceptions,
individualized educational supports, and expanding learning opportunities (Ainley, 1993; Danker, 2015; Light & Pierson, 2014). For example, access to a computer allows students to work at their own pace, easily identify and look up answers to their own questions, and allow for greater science learning experiences such as learning through collaboration across physical barriers and use of simulating science concepts (Danker, 2015; Schultz et al, 2014).

Studies conducted on e-learning education platforms indicate that technology learning alone does not meet all (special needs, mainstream, & gifted) student-learning needs (Light & Pierson, 2014; Ronisvalle & Watkins 2005; Sun & Cheng, 2007). Many studies show that student learning improves with hands-on face-to-face interaction, which online learning programs fail to satisfy (Ark & Schneider, n.d; Clem, Mennicke, & Beasley 2014; Schultz et al., 2014; Yasar & Demirkol, 2014). The blended classroom model can pose as a solution to education improvement through combining technology and face-to-face instruction. The blended classroom modeled will accomplish raising student engagement in school, thus encouraging deeper learning experiences and higher student performance outcomes.

**Significance of Project**

Research indicates that students have positive perceptions of both learning with technology and through hands-on experience (Shultz et al., 2014). Additional research suggests direct correlations between academic achievement and student active engagement (Yasar & Demirkol, 2014). Because students tend to be highly engaged when interacting with technology and in experiential learning activities, it can be inferred that the blended teaching/learning model can serve to improve student academic performance (Demirer & Sahin, 2013; Light & Pierson, 2014; Ronisvalle & Watkins, 2005; Shegog, Lazarus, Murray, Diamond, Sessions, & Zsigmond, 2012; Wan, 2014).
According to the National Research Council, “America’s children face a complex world in which participation in the spheres of life—personal, social, civic, economic, and political—require deeper knowledge of science and engineering among all members of society” (NRC, 2011). Blended classroom teaching offers a response to meeting the need for deeper crosscutting understanding of science concepts for two reasons; 1, students will have greater access to information via technology inside and outside school, 2, students will have the opportunity to learn relevant authentic information through hands-on problem-based learning (Akçay, 2009). Teachers have reported to be concerned about embracing the blended classroom due to insufficient training for implementation and time constraints involved in developing new classroom structure and lesson plans (Shultz et al, 2014). The proposed blended teaching model will aid teachers in gaining confidence through providing them structure and guidelines for how to best employ this new effective pedagogy practice.

Definition of Terms

**Blended Classroom**: “Blended learning can…be defined as integrating face-to-face learning and electronic learning or distance learning, using difference learning theories, methodologies and techniques in the same place and supporting the learning with various online technologies during the learning process in the classroom” (Yasar & Demirkol, 2014). Specifically to this project, the term, blended classroom, is used to describe a classroom that embraces technology with hands on learning experiences.

**Technology-based learning (TBL)/ Web-based learning**: “TBL…encompasses related terms, such as online learning and web-based learning that only include learning that occurs via the Internet, and computer-based learning that is restricted to learning using computers… TBL is
distinguished from distance learning or technology-delivered learning in that TBL includes methodologies where instructors and learners are in the same room or instruction is computer-based and there is no ‘distance’ involved…Furthermore, technology-enhanced learning describes a methodology in which technology plays a subordinate role and serves to enrich a traditional face-to-face classroom” (Koller et.al, 2015).

**Engagement:** “Refers to the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education” (“Student engagement”, 2015).

**Personalized/Individualized Learning:** “The term personalized learning, or personalization, refers to a diverse variety of educational programs, learning experiences, instructional approaches, and academic-support strategies that are intended to address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students” (“Personalized learning”, 2012).

**Collaborative Learning:** “Collaborative learning is based on the view that knowledge is a social construct. Collaborative activities are most often based on four principles:

- The learner or student is the primary focus of instruction.
- Interaction and ‘doing’ are of primary importance
- Working in groups is an important mode of learning.
- Structured approaches to developing solutions to real-world problems should be incorporated into learning” (“Collaborative learning”, 2015)

**Experiential Learning:** “Various terms have been used to label the process of learning from experience. John Dewey (Dewey and Dewey 1915) discussed “learning by doing,” while Wolfe
and Byrne (1975) used the term “experienced-based learning.” The term “trial and error” learning is used to explain inductive learning processes” (Gentry, 1990). Each of these definitions encompasses how the term is used in this project.

**Problem-based Learning**: “Project-based learning as a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks” (Coffey, 2015)
Chapter II: Literature Review

Introduction

“A coherent and consistent approach throughout grades K-12 is key to realizing the vision for science and engineering education embodied in the framework: that students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of each field’s disciplinary core ideas.” –The National Research Council, 2011, p. 2.

The National Research Council (NRC) has implemented a science framework for influencing new K-12 learning standards. New standards have been repurposed to focus on building deeper science understanding opposed to rote memorization (NRC, 2011). It is believed that deeper science comprehension can be achieved through increased science engagement of core concepts, experience in conducting science, and the ability to use cross-cutting ideas to make informed decisions and become effective problem solvers (NGSS Lead States, 2013; NRC, 2011). As stated in the NRC science framework (2011), changes in the current classroom education model are vital in order to prepare students for an ever-changing competitive world.

Traditional classrooms are increasingly being perceived as ineffective and out dated (DiPiro, 2009; Gilboy, Heinerichs, & Pazzaglia, 2015). Such education settings can be described by pedagogical approaches that focus singularly on dissemination of content (known as “dumping”) where students rarely are engaged in peer on peer interaction, discourse, and hands-on learning (Gilboy et al., 2015). In this model, the students primary role is to take notes, stay seated, and be quiet (Gilboy et al., 2015). Most instruction is teacher-centered, failing to provide students’ autonomy and ownership in their learning that often drives student intrinsic interest in school (Gilboy et al., 2015). Consequently this creates a passive learning environment, which can have negative implications on student performance, behavior, and interest in their studies (Eshel & Kohavi, 2003).
To better prepare students for citizenship, college, and to meet the needs of future employers, our education system needs to evolve from passive learning environments to active learning environments. The NRC (2011) focus on fostering deep learning experiences through heightened student engagement is a step in the right direction. Engagement is central to fomenting student interest, motivation, and involvement in their studies (Francis, 2012; Wan, 2014). Student engagement has been directly correlated to increased student academic achievement (Akçay, 2009; Ark & Schneider, n.d; Francis, 2013; Khalil, Lazarowitz, & Hertz-Lazarowitz, 2014; Light & Pierson, 2014; Wan, 2014).

Studies have illustrated that students are most engaged in their learning when technology is integrated with hands-on face-to-face instruction (Alijani, Kwun, & Yu, 2014; Chacko, Appelbaum, Kim, Zhao, & Montclare, 2015; Montgomery, Larson, & Hale, 2011; Yapici & Akbayin, 2012). The rising availability and accessibility of technology has opened new and diverse ways that schools can incorporate active learning in the classroom (Yasar & Demirkol, 2014), redefining how traditional classrooms function to improve student engagement and academic achievement. Teachers can engage their students through adaptive mixed pedagogical methods gaining influence from technology tools and content application or practice (Danker, 2015). Two different studies by Yasar & Demirkol (2014) and Schultz, Duffield, Rasmussen & Wageman (2014) have shown that a combination of both technology-based instruction and hands-on (face-to-face) instruction can improve student academic success. In science classrooms, Web-based instruction, videos, and social media explorations can be mixed with hands-on experiments, laboratory investigations, simulations, research projects, and project based learning to expand knowledge (Danker, 2015; Yasar & Dermirkol, 2014).
With new alternative technology options, students are able to build and explore content knowledge in a variety of different ways that best suite their learning preferences (Ainley, 1993; Light & Pierson, 2014). In addition, academic research points to the importance of tailoring instruction to meet individual student needs (Schulz et al, 2014). In effort to satisfy state curriculum standards and high student achievement, teachers should employ the best teaching practices that involve offering personalized student supports (differentiated material, quick feedback, accessibility) and teaching in a manner that is reflective of the school community and student culture (Gilboy et al., 2015; Inserra & Short, 2012; Light & Pierson, 2014). Student centered approaches have been shown to increase intrinsic interest in a student’s learning, and contribute to student engagement (Gilboy et al, 2015; Schaber, Wilcox, Whiteside, Marsh, & Brooks, 2010).

This study will demonstrate how teachers can implement blended teaching pedagogy in a High School Living Environment classroom. The blended classroom-teaching model will integrate technology-based learning with hands-on learning experiences. Technology will be used to replace traditional 45-minute lectures with 10-15 minute Web-based screen casts or other educational resources, in effort to free up more class time for hands-on face-to-face problem-based learning (PBL) activities. The objective of the module is to deepen student understanding of science core concepts through designing learning segments that increase student engagement, student interest, and individualized support.

**Main Idea**

The concept of blended classrooms has evolved from the development of the Internet and other technological advancements in the 1990’s (Gouseti, 2013). Naturally establishing a medium for information to be shared and opened direct lines for efficient varied forms of
communication. Today, these technologies are accessible outside realms imagined previously. They are becoming exponentially more convenient via increased Wi-Fi zones and hand held devices such as tablets and smart phones. Integrating the use of these resources for education purposes is an inevitable next step in pedagogy, but is currently limited by teacher training and confidence in implementation (Gouseti, 2013). At the moment, the blended classroom is primarily employed in higher education settings where students’ tend to have regular access to the Internet and more accustomed to having responsibilities (Wan, 2014). While its being explored further in the secondary classroom more data is needed to determine its overall effectiveness (Gilboy et al., 2015).

Blended classroom-teaching models integrate Web-based learning technology and face-to-face instruction, offering a solution to heighten education quality, with emphasis on student engagement and meeting student individual learning needs (Danker, 2015; Schultz et al., 2014). Technology and hands-on learning will be utilized to increase student engagement in the classroom to curb passive learning of the traditional lecture to an engaged and more active learning environment. Research has shown that students are more engaged when learning via technology (Chacko et al., 2015, Kipila & Iskander, 2014, Wan, 2014,) and also suggest student favorability with regards to using technology (Kaiser Family Foundation, 2010; Kapila & Iskander, 2014). Hands-on experiences further enhance science learning through deepening understanding (Ark & Schneider, n.d). In such environments, students are able to apply information that they learn in class to solving authentic world problems, science laboratory investigations, and other hands-on activities. According to Wan (2014) blended (flipped) classrooms has raised student interest in school and deepened their learning experiences.
**Theoretical Background**

Incorporating a blended classroom into science curriculum repurposes class time for active learning opportunities. New advances and ever increasing accessibility of technology will continue to transition the classroom away from teacher-centered passive lecturing environments into more interactive learning experiences.

Theoretical support for using technology in the classroom derives from learning through differentiated media outlets. The Media Richness Theory (MRT) is a powerful component of the blended classroom framework. Founded within information processing theory, MRT describes the methods that individuals or communities share meaning and understanding (Sun & Cheng, 2007). Examples of media richness include video, audio, word processing programs and face-to-face interaction. Media richness encompasses technology, discourse, and hardcopy text. Studies indicate that rich media presented in multiple forms can implicate higher levels of learner achievement (Liu & Slotta, 2007). Media Richness is important in learning as it reduces uncertainty in communication under a framework identified by Daft & Lengel (1984): 1, to provide capacity for immediate feedback, 2, differentiated communication (visual & audio), 3, Language variation, 4, personalization.

One of the principal challenges for educators is how to ensure that each and every student is engaged in their learning during class. Csikzentimahyi’s flow theory introduces four characteristics that directly influence student engagement, measured by: 1, challenging activity, 2, merging action and awareness, 3, concentration on the task at hand, and 4, providing clear goals and feedback to students (Whitson & Consoli 2009). Whitson & Consoli (2009) emphasize the importance of how to maintain engagement in the classroom by designing a scaffold that educators can use to develop lessons. A blended science curriculum that
incorporates such featured pedagogical objectives can establish engaging science classroom environments that are student-centered, individualized, and experiential learning focused.

Linking experiential learning attributes with virtual (Web-based) instruction can ensure all students are kept actively learning in class. Learning by doing is respected as the cornerstone of science education (Dewey, 1910). Stemming from Jean Piaget, John Dewey, and Kurt Lewin research in psychology, experiential learning theory is defined as learning through hands-on experience (Kolb 1984; Kolb, 2001). Experiential learning is grounded within four capacities, “Interpersonal Skills (Concrete Experience), Information Skills (Reflective Observation), Analytical Skills (Abstract Conceptualization), and Behavioral Skills (Active Experimentation)” (Kolb, 2001). It is through experience that students can establish strong connections to their learning and develop deeper retention of content (Shieh & Chang, 2014). Clem, Mennicke, & Beasley (2014) infer that a combination of virtual teaching and experiential learning exercises are able to help increase student academic performance.

Problem-based learning (PBL) frameworks are used to facilitate science phenomena investigations where the students become engaged scientists (Akçay, 2009). In many PBL studies, students exercise self-directed inquiry-based protocols and teamwork collaboration to develop critical thinking skills needed to determine an authentic solution to real life problems (Akçay, 2009). When students assume ownership over their study, they tend to be more engaged in their learning and are “…empowered to have an impact on the outcome of their investigation” (Akçay, 2009, p.6.). This responsibility, again, drives student desire to become active intrinsic learners, as they are able to connect school learning to real world applications (Hmelo-Silver, 2004). In comparing traditional teaching approaches to PBL environments, Hmelo-Silver (2004)
has found that students are “rewarded” with deeper understanding, “independent thought”, and “action.”

Cooperative learning and collaboration within the blended classroom context can assume two forms: Web-mediated collaboration and face-to-face collaboration. Web-mediated collaboration allows students to interact in learning across disciplinary studies, geographic locations, with professionals, and beyond limited learning offerings present in typical classroom domains. To enhance cooperation and collaboration learning experiences, student task specialization and teacher guidance are necessary supports in order to promote continued engagement, communication, and “knowledge and skill exchange” (So & Brush, 2008, p. 320). When implemented appropriately, “…collaborative learning strategies can provide learners with several advantages, such as opportunities to experience multiple perspectives of other distance learners from different backgrounds, and to develop critical thinking skills through the process of judging, valuing, supporting, or opposing different viewpoints” (So & Brush, 2008, p. 320).

Embracing the use of Web-based instruction paired with hands-on science practice heightens student engagement, differentiation supports, and can offer new student learning opportunities to collaborate with both peers and professionals (Schultz et al., 2014).

**Benefits**

Research has indicated that students’ perceptions and performance of learning in a blended classroom are positive, and outperform that of traditional classroom peers (Gilboy et al., 2015; Greitzer, 2002; Shultz et al., 2014; Wan, 2014). Both Yasar & Demirkol (2014) and Schultz et al. (2014) determined that blended teaching classrooms outperform traditional classroom models. In these models students demonstrate enhanced engagement through having autonomy, independence, experiential practice, improved individualized support, and access to
differentiated presentations that assist them in developing their level of understanding (Wan, 2014). Schools practicing blended teaching also have seen a decrease in discipline issues (Shultz et al., 2014). This is most likely a result of increased student engagement in their studies, less student frustration, and boosted student–teacher interaction (Shultz et al., 2014).

Teacher perceptions of the blended classroom reveal similar positive feedback too. According to Demirer & Sahin (2013), Light & Pierson (2014), López-Pérez, M.V, López-Pérez, M.C., Rodríguez-Ariz, & Argente-Linares (2013), Lage, Platt, & Treglia (2000), Ronisvalle & Watkins (2005), Shegog, Lazarus, Murray, Diamond, Sessions, & Zsigmond (2012), and Wan (2014) student learning with technology tools has lead to improved student performance, increased student-teacher interactions, and improved classroom management. The most significant benefit of the blended classroom model is that the teacher is “freed-up” or available in class, permitting the instructor to spend more time accommodating student needs” (Shultz et al., 2014). With that said the teacher becomes available in class to provide students with individual support; assuming the role aligned with being a “guide on the side” instead of the “sage on the stage” (Shultz et al., 2014). Effectively having more “free” time to offer students help that require extra guidance and answer more questions (Wan, 2014).

The blended learning model increases student engagement in class. Class time is dedicated to active learning via technology and hands-on practice. Students are able to take more control over their learning through studying at their own pace and being able to revisit lectures for further clarification (Danker, 2015, Shultz et al., 2014,). Within this teaching model students are busy “doing” work, by either applying their knowledge to solve authentic problems or actively utilizing technology to build up their knowledge base to participate in such activities (Lui & Slotta, 2013). Because students are responsible for their learning, they are given more
autonomy, providing them more choices which further fosters them to fine-tune self-regulation skills (self-advocacy skills, organizational skills, critical thinking skills, decision-making skills and problem solving skills) essential for becoming career, college and real world ready (ChanMin, Park, & Cozart, 2014). Research has suggested that learning in this climate fosters intrinsic learning in students and may be a strong predictor academic achievement (ChanMin et al., 2014).

Integrated technology use in the science classroom has lead to alternative arenas for cultivating collaboration between peers, educators, and professionals (Carpenter & Krutka, 2014). Students are able to use social media and convenient technology to conduct discourse across geographic and community barriers. With access to twitter learners have the capability to follow and interact with scientists (Carpenter & Krutka, 2014). That being said, they also have the ability to work with professional scientists and contribute to real life studies. Creating additional avenues for science talk, learning, and exploration even outside of school walls. This concept can translate to heightened peer on peer communication as well. Where the teacher can prompt continued student science talk by posting thought provoking questions.

The benefits of technology in the science classroom pertain to solving everlasting issues with lacking science materials and addressing difficulties conveying accurate examples of time and scale that most investigations require. Technology can bridge both these science education struggles by offering students virtual lab and simulation options (Kapila, 2014; Lui & Slotta, 2013). In the virtual lab, students are not limited to the supplies on hand, nor does time continue to be a challenge for grasping content comprehension (Shegog et al., 2012). Furthermore, technology based learning provides students with varied alternative solutions to overcome learning obstacles to best meet their preferred learning style.
Other advantages of technology incorporated science classrooms entail miscellaneous contexts. These span from teacher assessments to student access to their science learning information. For example, students that miss class in a blended classroom can catch up without the risk of falling behind in school (Shultz, 2014). According to Light & Pierson (2014), the blended classroom targets teaching students individually and is an efficient approach to disseminating information. Due to this elevated student engagement, there are less behavioral issues, meaning less class disturbances, allowing class to move ahead at a more efficient and effective pace (Light & Pierson, 2014; Shultz et al., 2014).

Concerns

Two foreseeable obstacles in applying the blended teaching model to science curriculums will be how to guide teachers in implementation (Schultz et al. 2014) and issues with student increased responsibility for their learning (Wan, 2014). Teacher challenges point to issues with having adequate training with technology, time for planning and designing, and classroom management (Danker, 2014; Shultz et al., 2014). Because not every student arrives to class motivated to participate, it will be difficult to determine if each student is staying on task (Gilboy et al., 2015). In this environment students might use this time unproductively on the Internet and subsequently fall behind in class. Other concerns regarding the blended classroom model rest strictly on the availability of technology for students outside the classroom (Danker, 2014; Shultz et al., 2014). Many of the limitations associated with the blended classroom will depend on teacher, district, and student circumstance.

Implementation

The National Research Council (NRC) states that active engagement in science practices should be employed in the classroom in order to develop deeper science understanding. Research
indicates that the blended classroom model with a focus of problem-based learning objectives could be an effective approach to teaching science and thus satisfy the NRC overarching goal. When technology and face-to-face interaction are paired with problem-based learning protocols improved opportunities to create such content depth are possible. Studies mentioned above illustrate that blending Web-based instruction with face-to-face learning can result in increased student engagement as they offer increased differentiation, individualized student supports, content relevancy, and intrinsic interest.

In effort to ameliorate teacher concerns with implementing the blended classroom model, the researcher will create 15 Living Environment teaching modules that scaffold the implementation process and design into easy to follow detailed steps. The researcher will provide specific instructions and expectations for both student and teacher. Learning targets will be established and linked to New York State Living Environment Standards. Each lesson will be described in an outline with corresponding time stamps. The modules can be used as a guide to help teachers design their own blended classrooms.

To manage student productivity rubrics, self-monitoring checklists, and weekly meetings with the instructor will be assigned and included in modules. The rubrics will be used for student self-assessment and self-monitoring as well as for formal teacher assessments. Students will be held responsible for their learning and will actively keep track of their progress in science class through a work checklist sheet that is to be completed daily and submitted to the instructor. The instructor will later discuss each students work progress assessed by the work checklist sheet individually or in a small group meeting sessions. Because students will have autonomy in their problem-based investigations, it is important that all expectations are clearly understood. For this reason, daily agenda and class updates will be given verbally, in writing, and will also be
accessible online frequently reminding students of deadlines and due dates to encourage them to stay on task. It is important that these tasks are challenging yet not overwhelming to not discourage student interest.

The blended classroom being introduced to the reader is set in a classroom with a complete class set of Google Chrome Books (Chrome Books). This technology will be readily available before school, during class, and after school. For students without access to the Internet or computer at home, students’ can sign out and borrow a Chrome Book from their teacher. They could utilize Internet resources on school campus or the public library. Fears of increased screen time and inability to ask questions pertaining to their work will not be an issue as the majority of class time will be used for hands-on learning experiences with access to “freed up teacher” that can assist with any questions.

The blended classroom described, will comprise of two transitions. The first will be using technology. The students will enter science class and retrieve their Chrome books from the charging cart to engage in 10-15 minute Web-based screen casts or videos assigned by the teacher. Research by Wan (2014) and Bunce, Flens, & Neiles (2010) determined that students have only a 10 -15 minute span of attention. In order to optimize student learning at this point, the Chrome Books will be utilized to engage, focus, and prepare students for the day’s activity replacing the “warm-up” worksheet. The second component of class will entail engaging in science practice. In most cases it will involve physical hands-on learning whereas in other cases it may include using technology to conduct science related simulations.

The Google Classroom will be the primary foundation for the blended classroom structure. Google Classroom can be used to post, assign, and announce daily class agenda, learning targets, as well as formal assessments. It can also be accessed from any location. Daily
worksheets will be posted and organized on this website by date and secondly assignment title so that students can access their work and know their expectations. Worksheets will be scaffolded with explicit directions, always beginning with the protocol of clicking on the daily link provided by the teacher. This link can include education resources from You Tube, TedTalks, to teacher created screencasts and twitter. Accompanying the Web-based instruction, the teacher will be free to answer questions and guide students along the way.
Chapter III: Capstone Project

Overview

The blended classroom model offers more engagement in classrooms through embracing technology and hands-on learning. This project entails a collection of 3 units for use in the Living Environment 9th grade classroom. Each lesson will involve students building background knowledge through watching an educational video (technology-based learning), followed by an activity designed to capture student interest. The lessons will emphasize meeting student individualized learning needs, experiential learning, collaborative learning, promote student self-monitoring, and connecting the learning to real world investigations (problem-based learning).

Project Outline

This project will demonstrate how to effectively integrate a blended use of technology-based instruction and face–to-face learning in the classroom. The 3 units will be guided by 1-3 essential questions that drive student learning. These modules are grounded within meeting the New York State (NYS) Living Environment curriculum standards for instruction following the Rochester City School District (RCSD) Living Environment pacing chart. Each lesson will be designed with the goal of aligning state standards to practice with the objective for students to master science inquiry skills and develop deeper understanding in biology. The standards focused on include Standard 1 (Key Ideas 1,2, & 3) and Standard 4 (Key Ideas 1, 6, & 7).

The curriculum will establish a predictable routine where students will clearly know the teacher’s expectations and daily procedures of the classroom. At the start of class, students will pick up a chrome book. They will log into their Google Classroom and find their daily assignment. The “engage” section is to be worked on individually, and they will have between 5-
15 minutes to complete this section. Most lessons will follow a predictable format. Following the engage section, students will explore the lesson topic in detail, explain what they’ve learned, and then further elaborate on their learned knowledge. At the end of each class, there will be an evaluation of student learning presented as an “exit ticket”. The science class schedule will rotate daily between 45-minute class periods and 90-minute lab days.

**Project Design Unit Topics**

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<th>Unit</th>
<th>Topic</th>
<th>Lessons plans</th>
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<td>2</td>
<td>Characteristics of Life</td>
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<td>3</td>
<td>Human Structure &amp; Function</td>
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**Format of Project Design**

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<td>➢ Title of Unit</td>
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<td>➢ Rationale</td>
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</tr>
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<tbody>
<tr>
<td></td>
<td>➢ Instructions for activities</td>
</tr>
<tr>
<td></td>
<td>➢ Assessments</td>
</tr>
</tbody>
</table>
Unit 1: Inquiry

Rationale:

The unit introduces and builds upon student scientific inquiry skills. Students begin by practicing scientific inquiry without recognizing it in a scavenger hunt. The lessons scaffold student learning in small chunks; students learn and experience how to observe, make an inquiry, and make an inference. After practice, they learn the scientific method, and then apply the scientific method in conducting as well as designing a lab experiment.

Outline of Lesson Plans

<table>
<thead>
<tr>
<th>Day</th>
<th>What is biology?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Scavenger Hunt</td>
</tr>
<tr>
<td>Day 2</td>
<td>What skills do scientists use?</td>
</tr>
<tr>
<td></td>
<td>Observation and Inference practice</td>
</tr>
<tr>
<td>Day 3</td>
<td>What skills do scientists use?</td>
</tr>
<tr>
<td></td>
<td>Observation, Inquiry, Inference practice</td>
</tr>
<tr>
<td>Day 4</td>
<td>What skills do scientist use?</td>
</tr>
<tr>
<td></td>
<td>Conduct class survey</td>
</tr>
<tr>
<td>Day 5</td>
<td>What skills do Scientists use?</td>
</tr>
<tr>
<td></td>
<td>Scientific method, Vocabulary</td>
</tr>
<tr>
<td>Day 6</td>
<td>How do I perform an experiment?</td>
</tr>
<tr>
<td></td>
<td>Design and conduct an experiment guided practice</td>
</tr>
<tr>
<td>Day 7</td>
<td>What makes a good experiment?</td>
</tr>
<tr>
<td></td>
<td>Analyze an experiment</td>
</tr>
<tr>
<td>Day 8</td>
<td>What makes a good experiment?</td>
</tr>
<tr>
<td></td>
<td>Analyze another experiment</td>
</tr>
<tr>
<td>Day 9 - 10</td>
<td>NYS Connections Lab.</td>
</tr>
<tr>
<td></td>
<td>Conduct and design own experiment.</td>
</tr>
</tbody>
</table>
**Teacher Notes Lesson 1: What is Biology?**

<table>
<thead>
<tr>
<th><strong>Time</strong></th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will use their inquiry skills to build background knowledge in NYS Living Environment Curriculum. This information will include defining the term biology, identifying topics they will learn in class, and elaborating on prior knowledge to learn more about the course through asking questions, interpreting information, and locating information through a scavenger hunt.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 1, Key Idea 1.1: Elaborate on basic scientific and personal explanations of natural phenomena. Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, &amp; Chrome Books.</td>
</tr>
<tr>
<td><strong>Lesson outline</strong> (refer to lesson plan for instructions and details)</td>
<td>1. <strong>Engage</strong> - 10 Minute Video: -Students will learn the definition of biology. 2. <strong>Scavenger Hunt</strong> - 20 Minutes: -Students will use inquiry skills through asking questions, locating information online, and processing the information located to answer task prompt questions. 3. <strong>Digging Deeper</strong> - 10 Minutes: -Students will elaborate on one current living environment issue of their choice and elaborate on their basic scientific and personal explanations of the natural phenomena being explored. 4. <strong>Exit Ticket</strong> – 5 minutes: -Students will take a self assessment</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>1. <strong>Formal Assessment:</strong> -Collected Lab work -Post self-assessment on Observation and Inference. 2. <strong>Informal Assessments:</strong> -Teacher student check in.</td>
</tr>
<tr>
<td><strong>Images/Videos</strong></td>
<td>1. <strong>Engage, What is Biology?</strong> <a href="https://www.youtube.com/watch?v=7L7x0BAqWis">https://www.youtube.com/watch?v=7L7x0BAqWis</a></td>
</tr>
</tbody>
</table>
What Is Biology?

Homework due: None

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

Engage Do Now (10 minutes)

1. Watch this video: [https://www.youtube.com/watch?v=7L7x0BAqWis](https://www.youtube.com/watch?v=7L7x0BAqWis). Record observations and wonderings.

<table>
<thead>
<tr>
<th>Observations</th>
<th>Wonderings/Inquiries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. List 3 burning questions/inquiries that you have in anything Biology related.

a.)
b.)
c.)

Today’s Learning Targets

1) I can gain a better understanding for what Biology means.
2) I can ask questions, interpret, and locate information from a variety of sources.
3) I can elaborate on basic scientific and personal explanations.

Agenda

★ Engage - 10 minutes
★ Scavenger Hunt - 20 minutes
★ Digging deeper - 10 minutes
★ Exit Ticket - 5 minutes
Explore The World of Biology - Scavenger Hunt
(20 minutes)

-Partner with your neighbor to your left. Answer all of the questions below using text, internet, and discussion. Best of luck!

1. What does the root word “Bio” mean? __________________________
2. What does the root word “logy” mean? __________________________

3. List the 8 biological topics you will study in this NYS Living Environment course?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

4. How many lab hours are you required to have in order to pass NYS Living Environment?

___________________________________________________________

5. Make a list of the 8 most famous biologists in history in the tables below. [List them in chronological order (by date, earliest to latest) and describe the importance of their discovery.]

<table>
<thead>
<tr>
<th>Famous Biologists in History Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Date: Scientist Name: Discovery: 2</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

6. Find 3 recent biological discoveries made in this year and describe why they are important.

<table>
<thead>
<tr>
<th>Discovery</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>
7. What 3 biological issues or concerns do we face today? (Environment, medical, etc.)

1.

2.

3.

8. List 3 scientific tools that we will use in this classroom.

1.

2.

3.

9. Explain in 3 sentences why you think it is important to learn biology?

Explain & Elaborate: Digging Deeper
(10 minutes)

- You will return to your original seats and work independently
- Choose 1 concern from question 7 to conduct further research on.

Task 1: What topic did I choose? _____________________

Task 2: Why is this a concern?

Task 3: Who does this concern?
Task 4: Are we working on any solutions?

Task 5: How will this impact my life?

Task 6: What can I do about it?

Exit Ticket (5 minutes)
- Rate your understanding by highlighting the number below (1 is lowest, 5 is highest).

Did I improve my understanding of biology today? 1 2 3 4 5
I am excited to learn more about biology. 1 2 3 4 5
I had fun today! 1 2 3 4 5
# Teacher notes Lesson 2: What Skills Do Scientists Use?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will know the terms, observation and inference, used to increase their understanding of science inquiry. Students will make observations and inferences while practicing different science skills in a stations lab activity.</td>
</tr>
</tbody>
</table>
| NYS Living Environment Curricula Standards | -Standard 1: Students will use scientific inquiry to pose questions and seek answers, and develop solutions.  
-Standard 1, Key Idea 1.1: Elaborate on basic scientific and personal explanations of natural phenomena.  
-Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. |
| Instructional Resources | Information (text [spoken, written, visual], SmartBoard, Chrome Books, Google timer set, Metric Rulers, calculators, skeleton/bones, Mystery Box and 4 items, Science Vocabulary reference sheets, Visual image (zoomed in, then slowly zoomed out), 4-6 Preserved bugs (any will do) and information about each bug. |
| Lesson outline (Refer to lesson plan for instructions and details) | 5. Engage - 3 Minute:  
-Scientific inquiry pre-assessment.  
6. Explore & Explain Terms - 10 minute video:  
-Students will learn the scientific terms observation and inference.  
-Students will create their own definition, learned definition, and add an example for each term on a graphic organizer  
7. Science Skills Lab- 75 minutes:  
-Students will rotate between 6 (10 minute) stations.  
-Stations = Measurement, Bones, Mystery Box, Definition Telephone, Reading a Visual Image, & Bugs captured in time (See lesson plan).  
-Each station should be set up before class time.  
8. Exit Ticket - 2 Minutes:  
-Post Assessment on observation and inference |
| Assessment | 3. Formal Assessment:  
- Collected Lab work  
- Post Assessment on Observation and Inference.  
4. Informal Assessments:  
- Station lab check-ins |
| References | 2. Mystery Box:  
2. Reading a visual image:  
<table>
<thead>
<tr>
<th>3. Exit Ticket:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Images/ Videos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Observation and Inference Video</td>
</tr>
<tr>
<td>1. <a href="https://www.youtube.com/watch?v=D-5HCOUGDdg">https://www.youtube.com/watch?v=D-5HCOUGDdg</a></td>
</tr>
</tbody>
</table>
What Skills Do Scientist Use?

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class

_____ I have my materials ready for class

_____ I am focused and ready to learn

Engage: Do Now (3 minutes)
List all the skills that you think scientists use. The student with the biggest list wins a prize!

Today’s Learning Targets
1) I can understand the science terms observation and inference.
2) I can make observations and inferences.
3) I can collaborate with my classmates and follow lab procedures.

Agenda
★ Engage - 3 minutes
★ Explore Science term - 10 minutes
★ Science Skills Lab- 75 minutes
★ Exit Ticket - 2 minutes

Explore & Explain: What Are These Terms? (10 minutes)
-Students will follow the task prompts and work independently.

Task 1: Dig deep using your prior knowledge and define the scientific terms in the chart below. Only complete the “My Definition” column.

Task 2: Watch the video: https://www.youtube.com/watch?v=D-5HCOUGDdg.
-Add new definitions from the video to the “Learned Definition Column”

Task 3: Add an example for each of the definitions.

Complete this science vocabulary chart below.
<table>
<thead>
<tr>
<th>Science Term</th>
<th>My Definition</th>
<th>Learned Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inference</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Elaborate: Lab Time!** (75 minutes)

**Directions:**
- There will be 6 pre-assigned groups and 6 stations
- Each station will be labeled with a number
- We will have 10 minutes at each station
- When you hear “5,4,3,2,1” it will be time to move to the next station.
- We will rotate from stations numbered 1 to 2, 2 to 3, 3 to 4, 4 to 5, 5 to 6, 6 to 1.
- Complete each worksheet. Use the worksheet as a guide.
Exit Ticket (2 minutes)

A student is given a ruler and a hand lens and asked to make observations and inferences about a rock sample collected on a field trip. The student wrote the nine statements below. Please circle all of the observations.

1. The rock is mostly gray with white speckles on the outside surface.
2. The white speckles are probably the mineral calcite.
3. The rock probably formed in a water environment.
4. The rock measures 4 cm wide, 8 cm long, and 2 cm thick.
5. Fossil shells embedded in the rock can be seen with a hand lens.
6. If the rock is broken with a hammer, it will probably contain more fossil shells within its interior.
7. The rock has a smooth surface.
8. The smooth surface is most likely the result of weathering and erosion over many years.

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will recall the terms, observation and inference from yesterday's lab. They will be introduced to a new term, inquiry. Students will pre-assess their understanding of the terms. Students will practice their scientific inquiry skills to determine what is in the mystery bag. Students will apply their understanding of the terms to develop their own observations, inquiry, and inferences with regards to images placed on the smartboard. Lastly, students will read and analyze a text that will introduce 4 new science inquiry vocabulary terms. They will record the important terms and explain how they are connected.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 1, Key Idea 1.1: Elaborate on basic scientific and personal explanations of natural phenomena. Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and Mystery Bag.</td>
</tr>
<tr>
<td><strong>Preparation</strong></td>
<td>2. Mystery Bags - Place 1-4 related items in a brown lunch bag. You will need to prepare enough of these for half the class.</td>
</tr>
<tr>
<td><strong>Lesson outline (refer to lesson plan for instructions and details)</strong></td>
<td>1. Engage - 3 Minute:   o Scientific inquiry term pre-assessment. 2. Explore &amp; Explain Mystery Bag - 15 minute:   o Task 1: Students will be guided through task prompt questions to observe, inquire, and make an inference as to what is in their mystery bag.   o Task 2: Students will create their own definitions for each of the words.   o Each group will share their definition with the class, the teacher will write each definition on the smartboard. Once each definition is posted, the students will vote on which one is the best. This definition will be used and recorded as the class definition. 3. Digging Deeper - 24 minutes:   o Task 1: Students will apply their understanding of the science inquiry terms to creating their own example of an observation, inquiry, and inference without guided task prompts.</td>
</tr>
</tbody>
</table>
| Assessment | Task 2: students will read and analyze an observation text.  
|           | Students will determine 4 new key terms and explain how they are connected.  
| Assessment | Exit Ticket - 2 Minutes:  
|           | Post Assessment, students will explain what they learned today and rate their learning with a happy or frown face.  
| References | Formal Assessment:  
|           | - Collected student work  
| References | - Post Assessment – Exit ticket  
| References | Informal Assessments:  
| References | - Student definitions shout out.  
| References | - Student check-ins  
| References |  
| References | Mystery Bag:  
| References | http://reading.ecb.org/teacher/pdfs/lessons/in_lp_ScienceMysteryBags.pdf  
| References | Idea extracted from  
| References | - Christopher Widmaier, Rochester City School District, New York State, Science Teacher.  
| References | Observation text:  
| References | - http://undsci.berkeley.edu/article/howscienceworks_05  
| Images/ Videos | None  

What Skills Do Scientists Use? Observation, Inquiry, and Inference

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (3 minutes)

1. Define the science terms below.

Observation = _____________________________________________________

Inquiry =  _____________________________

Inference  =  _______________________________________________________

2. Rate how well you understand each term by drawing/adding a smiley face or a frown face next to the definition that you wrote.

Today’s Learning Targets
1) I can understand the science terms observation, inquiry, and inference.
2) I can practice making observations, making inquiries, and inferences.
3) I can analyze a text to determine important scientific terms.

Agenda
★ Engage - 3 minutes
★ Mystery Bag - 15 minutes
★ Digging Deeper - 24 minutes
★ Exit Ticket - 3 minutes
Explore & Explain: What’s In The Mystery Bag? (15 minutes)
- Get in pairs.
- Each pair will receive a mystery bag from the teacher.
- Follow the task prompts below.

**Task 1:** **DO NOT OPEN THE BAG YET.**
- **Take a minute to look at the bag on your desk.**

**TASK 2:** Record what you OBSERVE (notice) about the bag.

I observe

......________________________________________________________________

____________________________________________________________________

**Task 3:** Record any inquiries (questions/wonders) you have about the bag

I wonder

......________________________________________________________________

____________________________________________________________________

**Task 4:** Record any inferences (guesses) you have about the answers to your questions

I think

......________________________________________________________________

____________________________________________________________________

**Task 5:** Discuss with a partner and record your definitions for the three words in the chart below under the “Definition” column.

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Class Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inquiry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Task 6: Each group will share their definitions and Mr. Krebs will write them on the board. Once the whole class has shared their definition, the class will vote on which definitions they like the most. Add this definition to the column “Class Definition”.

<table>
<thead>
<tr>
<th>Inference</th>
</tr>
</thead>
</table>

**Elaborate: Digging Deeper** (24 minutes)
- You will return to your original seats and work independently

Task 1: Observe the animal on the whiteboard. Record an example of an observation, inquiry and inference. Be Prepared to share out.

Whiteboard animal:

<table>
<thead>
<tr>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Task 2: Read the Observation text below.

**Observations yield what scientists call data.** Whether the observation is an *experimental* result, radiation measurements taken from an orbiting satellite, an infrared recording of a volcanic eruption, or just noticing that a certain bird species always thumps the ground with its foot while foraging — they're all data. Scientists analyze and interpret data in order to figure out how those data inform their hypotheses and theories. Do they support one idea over others, help refute an idea, or suggest an entirely new explanation? Though data may seem complex and be represented by detailed graphs or complex statistical analyses, it's important to remember that, at the most basic level, they are simply observations.

Task 3: Read the paragraph about observations and write the words that are important for understanding the main idea.

**Important**

Task 4: How are the Important words from the paragraph connected? Explain how the Important words are connected in 2-3 sentences.
Exit Ticket (3 minutes)

1. What did you learn today?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

2. Rate your learning today by drawing/adding a smiley face or a frowny face next to your response above.
# Teacher notes Lesson 4: What Skills Do Scientists Use?
## Class Survey Lab

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will participate in taking a class survey. Students will organize the class data on sticky notes to create a live classroom graph. Students will practice using their inquiry skills of data observation as evidence to write a conclusion. For the second part of the lab, the students will conduct their own class surveys.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.1: Elaborate on basic scientific and personal explanations of natural phenomena. Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and sticky notes.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print worksheets 2. Classroom sticky notes</td>
</tr>
<tr>
<td>Lesson outline (Refer to lesson plan for instructions and details)</td>
<td>1. Engage - 10 Minute: 1. Watch video and describe how to conduct a survey. 2. Lab Part 1: Class Survey - 30 minute: 1. Task 1: Each student will have 4 sticky notes. Each student will answer the 4 questions and create a sticky note graph on the board per question. 2. Students will analyze the class data for each question and record explain what the evidence indicates. 3. Part II: Conduct your own class survey - 45 minutes: 1. Task 1: Each student will create their own class survey. They will write 20 survey questions and then walk around the room and record their answers. All the answers will be compiled into a data table. Using this data table the students will then create a graph. Students will analyze their data by looking at their graph and determine a conclusion for their survey. 4. Exit Ticket - 5 Minutes: 1. Post Assessment, students will explain what conducting a survey and science have in common.</td>
</tr>
<tr>
<td>Assessment</td>
<td>• Formal Assessment: o Collected student survey.</td>
</tr>
</tbody>
</table>
| References | 1. Idea extracted from  
| o Christopher Widmaier, Rochester City School District, New York State, Science Teacher. |
| Images/Videos | 2. How to conduct a survey video:  
What Skills Do Scientists Use?  
Class Survey Lab

Homework due: None

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

Engage Do Now (10 minutes)


2. Describe how conducting a survey provides us with information.

____________________________________________________________________
___________________
_________________________________________________
____________________________________________________________________

Today’s Learning Targets

1) I can collect data about my classmates.
2) I can analyze the data I have collected.
3) I can use the data I have collected as evidence to make a conclusion.

Agenda

★ Engage - 10 minutes
★ Lab Part I - 30 minutes
★ Part II - 45 minutes
★ Exit Ticket - 5 minutes
Lab Part I: Class Survey (30 Minutes)

Directions: Each student has 4 sticky notes. You will answer 4 questions and place your answers on the corresponding sticky note labeled 1, 2, & 3. Once sticky note is filled out, pass it to the right.

Task 1 = Number your sticky notes 1 to 3.

Task 2 = On sticky note #1 write the letter for your answer to question #1

Question #1 = Which place would you most to go for vacation?

A. the Bahamas
B. New York City
C. the Adirondack mountains
D. the pyramids of Egypt

Task 3 = Pass your sticky note to the right.

Task 4 = Which answer do you think will be most popular and why?

___________________________________________________________________

Task 5 = Analyze the sticky notes graph and answer the question

What can you conclude about where the people in this class want to go on vacation? Explain how the evidence shows this.

___________________________________________________________________

Task 6 = On sticky note #2 write the letter for your answer to question #2

Question #2 = Which activity is most fun?

A. playing basketball
B. swimming
C. dancing to music
D. cooking food

Task 7 = Pass sticky note # 2 to the right.

Task 8 = Which answer do you think will be most popular and why?
Task 9 = Analyze the sticky notes graph and answer the question

What can you conclude about what do most people in this class like to do? Explain how the evidence shows this.

Task 10 = On sticky note #3 write the letter for your answer to question #3

Question #3 = Which movie is the best?

A. Guardians of the Galaxy
B. Dawn of the planet of the apes
C. Frozen
D. The Amazing Spiderman 2

Task 11 = Pass sticky note # 3 to the right.

Task 12 = Which answer do you think will be most popular and why?

Task 13= Analyze the sticky notes graph and answer the question:

What can you conclude about the movie most people in this class like? Explain how the evidence shows this.

Task 14 = On sticky note #4 write the letter for your answer to question #4

Question #4 = Why are some students successful in school and others are not?

A. they are born smarter
B. teachers like them more
C. they work harder
D. they are lucky

Task 15 = Pass sticky note # 4 to the right.

Task 16 = Which answer do you think will be chosen most and why?
Task 17 = Analyze the sticky notes graph and answer the question

What can you conclude about this class’s opinion about what makes a person successful? Explain how the evidence shows this.

________________________________________________________________________

Task 18 = What did you learn about this class after analyzing the data?

________________________________________________________________________

________________________________________________________________________

Part II: Conducting Your Own Class Survey (45 minutes)

Directions: Follow the task prompts to conduct your own class survey.

Task 1: Think of a question and four possible answers you can ask your classmates to find out more about who they are. The more creative and interesting the question and the possible answers, the more fun this will be.

Question:

________________________________________________________________________

Possible Answers:

A. ______________________________

B. ______________________________

C. ______________________________

D. ______________________________
Task 2: Rotate around the room and ask everyone your question. Record their name and their answer.

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
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<td>17</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>
Task 3: Once you have collected data from all of your classmates it is time to analyze it.
-Count how many students chose each answer and record that number below:

<table>
<thead>
<tr>
<th>Answer</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

Task 4: Make a graph that shows how many students chose each answer below:

Task 5: Write out sentences that describe and compare how students answered your question:

_______Out of _____ students interviewed ___________ students said that
__________________________________________________________________________________

_______Out of _____ students interviewed ___________ students said that
__________________________________________________________________________________

_______Out of _____ students interviewed ___________ students said that
__________________________________________________________________________________

_______Out of _____ students interviewed ___________ students said that
__________________________________________________________________________________
Most students I interviewed chose

____________________________________________________________________________________________________

The least number of student I interviewed chose________________________

Task 5: Write a conclusion about your data based on your analysis by completing the writing prompts below:

I can conclude that________________________________________________________

________________________________________________________

because_______________________________________________________________________________

Exit Ticket (5 minutes)

What does conducting a survey and science have in common?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
**Teacher notes Lesson 5: What Skills Do Scientists Use? Vocabulary**

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will record steps involved in the scientific method. Students will define and understand new vocabulary terms (hypothesis, data, analysis, evidence, conclusion) necessary for performing and creating their own experiment.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions. Standard 2, Key Idea 2.3a: Hypotheses are predictions based upon both research and observation. Standard 3, Key Idea 3.1a: Interpretation of data leads to... explanations of natural phenomena.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and textbooks.</td>
</tr>
<tr>
<td><strong>Preparation</strong></td>
<td>2. Textbooks and chromebooks should be available</td>
</tr>
</tbody>
</table>
| **Lesson outline (Refer to lesson plan for instructions and details)** | 3. **Engage - 10 Minute:**  
  - Students will watch video, record steps of the scientific method, and connect the steps to a real life experience.  
  4. **Explore The Scientific Process - 15 minute:**  
  - Task 1: Students will read the concept map below and will write a paragraph to their classmates to describe how the scientific process works.  
  - Task 2: Students will create their own concept map using a topic of their choice.  
  5. **Explain Vocabulary Challenge - 15 minutes:**  
  - Task 1: Students will be assigned one vocabulary term to master.  
  - Task 2: Students will form two lines and will have 30 seconds to describe their term to one another. That means that each meeting will be 1 minute. 
  --After 1 minute, one line will move forward. Conclusion for their survey. Students will record their partners definition as they move down the line.  
  6. **Exit Ticket - 5 Minutes:**  
  - Post Assessment  
  1. Students will explain how the scientific method can be used to solve a problem using all 8 of the vocabulary terms.  
  2. Students will also take a quick multiple-choice survey for tomorrow’s class. |
| **Assessment** | 2. Formal Assessment:  
  1. Collected student worksheet. |
<table>
<thead>
<tr>
<th>References</th>
<th>None</th>
</tr>
</thead>
</table>
| Images/Videos | 1. Scientific method video:  
  1. [https://www.youtube.com/watch?v=SMGRe824kak](https://www.youtube.com/watch?v=SMGRe824kak)  

2. Post Assessment.

2. Informal Assessments:
   - Student participation
   - Student check-ins
# What Skills Do Scientists Use?

## Vocabulary

<table>
<thead>
<tr>
<th>Homework due: None</th>
</tr>
</thead>
</table>

### Habits of Scholarship Checklist (how would you rate yourself 1-4)

- _____ I was on time to class
- _____ I have my materials ready for class
- _____ I am focused and ready to learn

## Engage Do Now (10 minutes)

1. Watch [https://www.youtube.com/watch?v=SMGRe824kak](https://www.youtube.com/watch?v=SMGRe824kak) and record the steps of the scientific method.
   - watch the video for 1:15 seconds

<table>
<thead>
<tr>
<th>1.</th>
<th>4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>5.</td>
</tr>
<tr>
<td>3.</td>
<td>6.</td>
</tr>
</tbody>
</table>

2. Watch [https://www.youtube.com/watch?v=SMGRe824kak](https://www.youtube.com/watch?v=SMGRe824kak) a second time and answer the question below.
   - watch the video for 1:15 seconds

Describe an example where you have used the scientific method to solve a problem in your life.

________________________________________________________________________

________________________________________________________________________
### Today’s Learning Targets

1) I can interpret and describe a concept map to a classmate.
2) I can define and explain a vocabulary term to my classmates.
3) I can describe the scientific method using all 8 of the science vocabulary terms.

### Agenda

- ★ Engage - 10 minutes
- ★ Explore - 15 minutes
- ★ Explain Terms - 15 minutes
- ★ Exit Ticket - 5 minutes
Explore: The Scientific Process  (15 minutes)

Directions: Students will read the concept map below and will write a paragraph to their classmates to describe how the scientific process works.

**Scientific Method**
- Ask a Question
- Do Background Research
- Construct a Hypothesis
- Test with an Experiment
- Procedure Working?
  - Yes
  - Troubleshoot procedure. Carefully check all steps and set-up.
- No
- Analyze Data and Draw Conclusions
  - Results Align with Hypothesis
  - Results Align Partially or Not at All with Hypothesis
- Communicate Results

**Experimental data** becomes background research for new/future project. Ask new question, form new hypothesis, experiment again!

Task 1: Describe scientific process in this box.
**Task 2**: Turn and Talk to your neighbor. Share out your narratives.

**Task 3**: With your neighbor, follow the concept map above to create your own concept map with a research topic of your choice. Include terms inquiry and inference.

---

**Explain: Vocabulary Challenge** (15 minutes)

Directions: The class will be split into 4 groups of 8 students. Each student in each group will be assigned a vocabulary word to master. Everybody will have 3 minutes to learn their vocabulary words and record their definitions they wish to share with their classmates. After 3 minutes students will form two lines. Each student will have 30 seconds to describe their word to their peer across from them. That means that each meeting will be 1 minute long. After 1 minute, one line of students will rotate while one line of students will remain stationary. As students move down the line, they will record their peers definition on their worksheet.

**Task 1**: Learn your assigned science term. (3 minutes)
- Fill out the chart for your term!
<table>
<thead>
<tr>
<th>Term</th>
<th>What is it?</th>
<th>Example</th>
<th>Visual Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inquiry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 2: Form two lines. Each student has 30 seconds to share definitions.  
Task 3: After 7 minutes, students will return to their group seats. One student from each group will stand up and explain their vocabulary terms they discussed in their class. Describing what the term was, their example, and their chosen image reminder to the class.

**Exit Ticket** (5 minutes)

Task 1: Explain the scientific method and state one example of how it can be used to solve a problem. Try to use all 8-vocabulary terms.

__________________________________________________________________

________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________
Task 2: Read this letter and answer the Multiple Choice Questions.

Dear Class,

Tomorrow we will be designing our own lab. Please answer each of these questions so that we can conduct an experiment that we are interested in?

1. What should the task be?:
   A. Clothespin squeezing
   B. Puzzles
   C. Reading an article
   D. Writing a paragraph about science

2. Second - Which performance affecting variable should we test?
   A. Exercising or not
   B. Listening to music or not
   C. Lights on or off
   D. Messy or organized desk
   E. Snacks or no snacks

3. How should we set up the experiment?
   A. Split the class in half and group A is experimental and Group B is control
   B. Each person does both tests – experimental and control
   C. Split the class into 4s (small groups, 2 A experimental, 2 B control groups)
   D. Split boys and girls

4. How many trials should each group do?
   A – 1, B – 3, C- 10, D - 40
### Teacher notes Lesson 6: How Do I Perform An Experiment?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will plan and perform an experiment to determine if their hypothesis is correct. Students will create graphs to analyze data. Students will use their data to develop a conclusion. Students will evaluate their results and list 3 factors that would improve their experiment.</td>
</tr>
</tbody>
</table>
| NYS Living Environment Curricula Standards | Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions.  
Standard 3, Key Idea 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.  
Standard 3, Key Idea 3.5b: Scientists use peer review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations. |
| Instructional Resources | Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and puzzles. |
| Preparation | 1. Prepare 3 crossword puzzles. |
| Lesson outline (refer to lesson plan for instructions and details) | 1. Engage - 10 Minute:  
   1. Students will read the letter addressed to them with the perimeters that class decided to set for their experiment.  
   2. Students will develop an hypothesis regarding whether or not music will improve their ability to do puzzles.  
2. Lab - 65 minutes:  
   1. Task 1: Students will be split into two groups  
   2. Task 2: Group 1 will go for a hike outside with the Co-teacher. Group 2 will take the test.  
   3. Task 3: Each test will take 5 minutes. Each group will get 15 minutes to complete each of the 3 puzzles.  
   4. Task 4: Students will determine percentage completed.  
3. Lab Write-ups- 20 minutes:  
   1. Task 1: Students will analyze their data and graph to answer the task prompt questions.  
   2. Task 2: Students will use their data to develop a conclusion.  
   3. Task 3: Students will evaluate the experiment and add 3 |
| Assessment | 1. Formal Assessment:  
|            |   o Collected student lab.  
|            |   o Post self-assessment  
|            | 2. Informal Assessments:  
|            |   o Student participation  
|            |   o Student check-ins  
| References | 1. Idea extracted from  
|            |   o Christopher Widmaier, Rochester City School District, New York State, Science Teacher.  
| Images/ Videos | None |
## How Do I Perform An Experiment?

<table>
<thead>
<tr>
<th>Homework due: None</th>
</tr>
</thead>
</table>

### Habits of Scholarship Checklist (how would you rate yourself 1-4)

- [ ] I was on time to class
- [ ] I have my materials ready for class
- [ ] I am focused and ready to learn

### Engage Do Now (10 minutes)

**Task 1:** Read the letter below.

**Dear Students,**

*Before leaving class yesterday, each of us completed a survey attached to our exit ticket. Our results indicated that we would study the effects of listening to music on completing a puzzle.*

*Here is what we decided on:*

1. **What should the task be?**
   - A. Clothespin squeezing
   - B. **Puzzles**
   - C. Reading an article
   - D. Writing a paragraph about science

2. **Second - Which performance affecting variable should we test?**
   - A. Exercising or not
   - B. **Listening to music or not**
   - C. Lights on or off
   - D. Messy or organized desk
   - E. Snacks or no snacks

3. **How should we set up the experiment?**
   - A. **Split the class in half and group A is experimental and Group B is control**
   - B. Each person does both tests – experimental and control
C. Split the class into 4s (small groups, 2 A experimental, 2 B control groups)
D. Split boys and girls

4. How many trials should each group do?
A – 1, B – 3, C- 10, D - 40

Task 2: Read our experiment title and answer the question below.

Experiment Title: How does listening to music affect a student’s ability to do puzzles?

1. What is your hypothesis and why do you think that?

I predict that
______________________________________________________________
______________________________________________________________

Because
______________________________________________________________
______________________________________________________________

Today’s Learning Targets
1) I can plan and perform an experiment to determine whether my hypothesis is correct.
2) I can use comparison tables and graphs to analyze my data.
3) I can use my data to develop a conclusion

Agenda
★ Engage - 10 minutes
★ Lab - 55 minutes
★ Lab Write-up - 20 minutes
★ Exit Ticket - 5 minutes
Lab: Does Listening To Music Affect Our Ability To Do Puzzles? (55 minutes)

Directions:

1. Half of the class will take a walk and the other half will stay in the classroom.

2. The class that stays in the classroom will be given a puzzle and will be given five minute to complete it.

3. Step 2 will be repeated two more times so each person will have three puzzles to complete.

4. The groups will switch.

5. The class that stays in the classroom will be given a puzzle and will be given five minute to complete it. They will listen to music while they complete the puzzles.

6. Step 5 will be repeated two more times so each person will have three puzzles to complete.

7. The class will come together.

8. As a class we will calculate the percentage of the puzzle that has been completed.

   How to calculate percentage completed:
   Divide the number done by the total number and multiply by 100
   Percentage complete = (Number done / total number) *100
Lab Procedure

Task 1: Each student will have 5 minutes to complete the puzzle.

Task 2: Calculate the percentage of the puzzle completed using the equation above.

Task 3: Repeat Task 1 & 2 for each of the 3 puzzle trials. Record the percentage completed for each trial in the appropriate column as indicated by Mr. Krebs.

DATA TABLE:

<table>
<thead>
<tr>
<th>Percentage of puzzle completed</th>
<th>Music = experimental</th>
<th>No Music = Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puzzle #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puzzle #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puzzle #3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 4: Switch groups.

Task 5: Lab should be completed. Return to your seats.

Task 6: Calculate an average percent completed for each group

<table>
<thead>
<tr>
<th>Average completed</th>
<th>Music</th>
<th>No Music</th>
</tr>
</thead>
</table>

Task 7: Create a graph with the data from the table above.
Lab Write-Up (20 minutes)

1. What was the question you were trying to answer? (The inquiry)

2. Hypothesis that you tested:

3. A title for your experiment:
   The Effect of ________________ on ________________________________

4. How was the experiment planned. Note: What you studied and how you did it. (Prompts are available to guide you)
   - What did each person have to do? ________________________________
   - ___________________________________________________________________.
   - What were the two main variables being tested?
     1. ________________
     2. ________________
   - How many trials did you run? Why?
     _____________________________________________________________________
     _____________________________________________________________________

5. What does the data from your experiment show? (Explain what the data indicates or what you observe from the graph)

   _____________________________________________________________________
   _____________________________________________________________________

6. Using your description above, what is the answer to your question?

   _____________________________________________________________________
   _____________________________________________________________________
7. Was your hypothesis correct? Why not?

___________________________________________________________________

8. List 3 factors that could improve the experiment from today.
   1.
   2.
   3.

Exit Ticket (5 minutes)

1. Rate how well you understand what we did today in class?
   1  2  3  4  5

2. List 3 or more ideas that you do not understand or you would like to learn more about.
   1.
   2.
   3.
## Teacher Notes Lesson 7: What Makes A Good Experiment?

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will analyze the experiment, Plants Won’t Grow Near Wi-Fi Router, to understand the components of an experiment. Students will be able to determine the hypothesis, the dependent, independent, and controlled variables in the experiment.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions. Appendix A, Develop Laboratory or technical skills: - Differentiates between independent and dependent variables - Identifies the control group and/or controlled variables - Formulates an appropriate conclusion or generalization from the results of an experiment</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, and Google timer set.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print out worksheets.</td>
</tr>
<tr>
<td>Lesson outline (Refer to lesson plan for instructions and details)</td>
<td>1. Engage Video - 10 minutes:   - Students will be able to watch the video and learn the group components involved in a experiment.   - Students will identify the control group, independent group, and dependent group by recorded them from the video. 2. Explore &amp; Explain The Experiment - 20 minutes:   - Task 1: Students will read and annotate the text to learn about the experiment.   - Task 2: Students will return to each paragraph and draw a picture that illustrates the main idea of each paragraph. 3. Elaborate Make The Experiment Plan - 10 minutes   - Students will reference the article and their illustrations for each paragraph to identify all components present in the experiment. 4. Exit Ticket - 5 Minutes:   - Post Assessment   - Student will read a scenario and describe a controlled experiment that could be conducted to test the claim.</td>
</tr>
<tr>
<td>Assessment</td>
<td>1. Formal Assessment:   - Collected student work.   - Post assessment</td>
</tr>
</tbody>
</table>
| References                      | 1. Student Science Experiment Article:  
|                                | 2. Idea extracted from  
|                                |   o Christopher Widmaier, Rochester City School District, New York State, Science Teacher. |
| Images/ Videos                  | 1. Introduction to Controls and Variable Groups Video:  
|                                |   - [https://www.youtube.com/watch?v=aLesk8fuJH8](https://www.youtube.com/watch?v=aLesk8fuJH8)  

2. Informal Assessments:  
 o Student participation  
 o Student check-ins
What Makes A Good Experiment?

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class

_____ I have my materials ready for class

_____ I am focused and ready to learn

Engage Do Now (10 minutes)

1. Watch this https://www.youtube.com/watch?v=aLesk8fuJH8 as many times as you need to answer the questions below.

1. What is the control group?

________________________________________________________________

How do you know this?

________________________________________________________________

2. What is the independent group?

________________________________________________________________

How do you know this?

________________________________________________________________

3. What is the dependent group?

________________________________________________________________

How do you know this?

________________________________________________________________
Explore & Explain: Article (20 minutes)

Task 1: Read and text code the article with at least 5 text codes.

Text Codes:

C = I can connect something I know to this
V = I can visualize this
? = This makes me wonder....
! = This is surprising to me.

Student Science Experiment Finds Plants Won't Grow Near Wi-Fi Router

Ninth-graders design science experiment to test the effect of cellphone radiation on plants. The results may surprise you.

Five ninth-grade young women from Denmark recently created a science experiment that is causing a stir in the scientific community. It started with an observation and a question. The girls noticed that if they slept with their mobile phones near their heads at night, they often had difficulty concentrating at school the next day. They wanted to test the effect of a cellphone's radiation on humans, but their school, Hjallerup School in Denmark, did not have the equipment to handle such an experiment. So the girls designed an experiment...
that would test the effect of cellphone radiation on a plant instead.

The students placed six trays filled with Lepidium sativum, a type of garden cress, into a room without radiation, and six trays of the seeds into another room next to two routers that according to the girls' calculations, emitted about the same type of radiation as an ordinary cellphone. Over the next 12 days, the girls observed, measured, weighed and photographed their results. By the end of the experiment the results were blatantly obvious — the cress seeds placed near the router had not grown. Many of them were completely dead. Meanwhile, the cress seeds planted in the other room, away from the routers, thrived. The experiment earned the girls (pictured below) top honors in a regional science competition and the interest of scientists around the world.

According to Kim Horsevad, a teacher at Hjallerup Skole in Denmark where the cress experiment took place, a neuroscience professor at the Karolinska Institute in Sweden, is interested in repeating the experiment in a controlled professional scientific environment.


Task 2: Read each paragraph again and draw a picture that illustrates what the paragraph is saying.

The Cartoon Version
Elaborate: Make The Experimental Plan

(10 minutes)

Task 1: Re-Read the article and use your diagrams to fill in the experimental plan for the experiment the girls completed. Work with a partner.

<table>
<thead>
<tr>
<th>The Experimental Plan Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Observations: What did they notice that made them curious?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question Investigated: What was the question they investigated in their experiment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the effect of ___________ on ___________?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the Dependent Variable:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What is the Independent Variable:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What are the Controlled Variables:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
</tbody>
</table>
2.

3.

<table>
<thead>
<tr>
<th>Where was the control group placed?</th>
<th>Where was the experimental group placed?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What was the conclusion of their experiment?

Exit Ticket (5 minutes)

On a television talk show, a guest claims that people who exercise vigorously for 15 minutes or more every day are able to solve math problems more rapidly than people who have no vigorous exercise in their daily routine.

Describe a controlled experiment that could be conducted to test this claim:

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
# Teacher Notes Lesson 8: What Makes A Good Experiment?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will analyze 4 Simpson Experiments to learn how experiments are designed. Students will be able to determine an inquiry, hypothesis, the dependent variable, the independent variable, the controlled variables, and use evidence from the experiment to develop a conclusion.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.3a: Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions. Appendix A, Develop Laboratory or technical skills: - Differentiates between independent and dependent variables - Identifies the control group and/or controlled variables - Formulates an appropriate conclusion or generalization from the results of an experiment</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and puzzles.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print Worksheets</td>
</tr>
<tr>
<td>Lesson outline (Refer to lesson plan for instructions and details)</td>
<td>1. Engage - 12 minutes:  - Students will be able to compare and contrast the process of scientific inquiry with the scientific method.  - Students will state similarities and differences.  2. Simpsons Lab - 70 minutes:  - Task 1: Students will read and annotate the 4 Simpson Lab Experiments.  - Task 2: Students will analyze each experiment through following task prompt questions to identify all components needed for an experiment.  - Task 3: Students will use evidence from each of the experiments to develop a conclusion.  3. Exit Ticket - 3 Minutes:  - Post Assessment  - Student will explain how the dependent variable is different from the independent variable.</td>
</tr>
<tr>
<td>Assessment</td>
<td>1. Formal Assessment:  - Collected student lab work.  - Post self-assessment.  2. Informal Assessments:  - Student participation.  - Student check-ins.</td>
</tr>
</tbody>
</table>
| References          | 1. Simpson Experimental Design Lab:  
|                    | 2. Idea extracted from  
|                    |   o Christopher Widmaier, Rochester City School District, New York State, Science Teacher.  
| Images/Videos      | 1. Scientific Inquiry Process Video:  
|                    |   o https://www.youtube.com/watch?v=J6qPCUna6c8 |
What Makes A Good Experiment?  
Simpsons Lab

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (12 minutes)

1. Watch this [https://www.youtube.com/watch?v=J6qPCUna6c8](https://www.youtube.com/watch?v=J6qPCUna6c8)

2. What are the steps to perform scientific inquiry?
   
   a. ______________________
   b. ______________________
   c. ______________________
   d. ______________________

3. Compare and contrast scientific inquiry and the scientific method.

<table>
<thead>
<tr>
<th>Scientific Inquiry</th>
<th>Scientific Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask a question</td>
<td></td>
</tr>
<tr>
<td>Do Background Research</td>
<td></td>
</tr>
<tr>
<td>Construct a hypothesis</td>
<td></td>
</tr>
<tr>
<td>Test with an experiment</td>
<td></td>
</tr>
<tr>
<td>Analyze data</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td></td>
</tr>
<tr>
<td>Share results</td>
<td></td>
</tr>
</tbody>
</table>

4. How are they similar?
5. How are they different?

Today’s Learning Targets

1) I can understand experiment vocabulary terms.
2) I can determine the question, hypothesis, independent variable, dependent variable, and conclusion of an experiment.
3) I can analyze an experiment and use evidence from my experiment to develop a conclusion.

Agenda

★ Engage - 12 minutes
★ Explore Terms - 5 minutes
★ Lab - 70 minutes
★ Exit Ticket - 3 minutes
LAB # 4: Simpson’s Lab (70 minutes)

Instructions: Students will work in pairs and follow the task prompts to complete the lab. In each of the four experiments, students will read the experiment, determine the inquiry behind the experiment, the hypothesis, key variables, conclusions, and suggestions for alternative explanations.

Task 1 – Read Experiment 1 below.

Experiment 1: Smithers

Smithers thinks that a special juice will make people work faster.

He creates two groups of 50 workers each and assigns each group the same task (in this case, they’re supposed to staple a set of papers).

Group A is given the special juice to drink while they work. Group B is not given the special juice.

After an hour, Smithers counts how many stacks of papers each group has made.

<table>
<thead>
<tr>
<th>Group A made - special juice</th>
<th>1,587 stacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group B made – no special juice</td>
<td>2,113 stacks</td>
</tr>
</tbody>
</table>

Task 2: Read Experiment 1 again using the text code strategy.

Text Codes:

C = I can connect something I know to this
V = I can visualize this
? = This makes me wonder....
! = This is surprising to me

Task 3: List three things that you observe and question/inquire.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ________________</td>
<td>1. ________________</td>
</tr>
</tbody>
</table>
Task #4: Share your inquiries with your partner. Can they answer your inquiries? If not, record your inquiry below to share with the class.

Our Inquiry/Wondering:

________________________________________________________________________

Task 5: Answer the questions below using the definitions on page 1.

1. What question is Smithers trying to answer?
   _______________________________________________________________________

2. What is the Hypothesis to Smithers experiment?
   _______________________________________________________________________

3. What are the Control Variables?
   _______________________________________________________________________

4. What is the Independent Variable?
   _______________________________________________________________________

5. What is the Dependent Variable?
   _______________________________________________________________________

6. What should Smithers conclusion be?
   _______________________________________________________________________

________________________________________________________________________
7. What alternative explanations can be suggested for the same results?

________________________________________________________________

Task 6 – Read Experiment 2 below.

Experiment 2: Homer

Homer notices that his shower is covered in a strange green slime. His friend Barney tells him that coconut juice will get rid of the green slime.

Homer decides to check this out by spraying half of the shower with coconut juice. He sprays the other half of the shower with water.

After 3 days of “treatment” there is no change in the appearance of the green slime on either side of the shower.

Task 7: Read Experiment 2 again using the text code strategy.

Text Codes:

C = I can connect something I know to this
V = I can visualize this
? = This makes me wonder....
! = This is surprising to me

Task #8: Record notes from reading below.

Notes:
Task 9: Answer the questions below using the definitions on page 1 and your notes above.

1. What question is Homer trying to answer?

2. What is the hypothesis to Homer’s experiment?

3. What are the Control Variables?

4. What are the Independent Variable?

5. What are the Dependent Variables?

6. What should Homer’s conclusion be?

7. What alternative explanations can be suggested for the same results?
Task 10 – Read Experiment 3 below.

Experiment 3: Bart

Bart believes that mice exposed to microwaves will become extra strong (maybe he’s been reading too much Radioactive Man).

He decides to perform this experiment by placing 10 mice in a microwave for 10 seconds. He compared these 10 mice to another 10 mice that had not been exposed.

His test consisted of a heavy block of wood that blocked the mouse food.

He found that 8 out of 10 of the microwaved mice were able to push the block away. 7 out of 10 of the non-microwaved mice were able to do the same.

Task 11: Read Experiment 3 again using the text code strategy.

Text Codes:
C = I can connect something I know to this
V = I can visualize this
? = This makes me wonder....
! = This is surprising to me

Task #12: Record notes from reading below.

Notes:

Task 13: Answer the questions below using the definitions on page 1 and your notes above.

1. What question is Bart trying to answer?
2. What is the hypothesis to Bart’s experiment?
________________________________________________________________

3. What are the Control Variables?
________________________________________________________________

4. What are the Independent Variable?
__________________________________________
______________________

5. What are the Dependent Variables?
________________________________________________________________

6. What should Bart’s conclusion be?
________________________________________________________________

7. What alternative explanations can be suggested for the same results?
________________________________________________________________

Task #14 – Read Experiment 4 below.
Experiment 4: Krusty

Krusty was told that a certain itching powder was the newest best thing on the market, it even claims to cause 50% longer lasting itches.

Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes.

Task 15: Read Experiment 4 again using the text code strategy.
Text Codes:
C = I can connect something I know to this
V = I can visualize this
? = This makes me wonder....
! = This is surprising to me

Task 16: Record notes from reading below.

Notes:

Task 17: Answer the questions below using the definitions on page 1 and your notes above.

1. What question is Krusty trying to answer?
____________________________________________________________________

2. What is the hypothesis to Krusty’s experiment?
____________________________________________________________________

3. What are the Control Variables?
____________________________________________________________________

4. What are the Independent Variable?
____________________________________________________________________
5. What are the Dependent Variables?
________________________________________________________________

6. What should Krusty’s conclusion be?
________________________________________________________________

7. What alternative explanations can be suggested for the same results?
________________________________________________________________

Exit Ticket (3 minutes)

In an experiment, how is the dependent variable different than the independent variable?
________________________________________________________________
________________________________________________________________
________________________________________________________________
# Teacher Notes Lesson 9 & 10: NYS Making Connection Lab.

<table>
<thead>
<tr>
<th>Time</th>
<th>135 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td></td>
</tr>
<tr>
<td>1. Lab Part I</td>
<td></td>
</tr>
<tr>
<td>- Students will perform an experiment by measuring their pulse rate.</td>
<td></td>
</tr>
<tr>
<td>- Students will record and collect class data and create a graph.</td>
<td></td>
</tr>
<tr>
<td>- Students will analyze data and use this data as evidence to develop conclusion about their lab.</td>
<td></td>
</tr>
<tr>
<td>2. Lab Part II</td>
<td></td>
</tr>
<tr>
<td>- Students will perform a clothespin experiment.</td>
<td></td>
</tr>
<tr>
<td>- Students will investigate a claim and justify their reasoning by demonstrating data driven evidence.</td>
<td></td>
</tr>
<tr>
<td>- Students will develop their own experiment and identify all experiment components including writing a step-by-step procedure.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NYS Living Environment Curricula Standards</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 2, Key Idea 2.3: Develop and present proposals including formal hypotheses to test explanations; i.e., predict what should be observed under specific conditions if the explanation is true.</td>
<td></td>
</tr>
<tr>
<td>Standard 3, Key Idea 3.3: Assess correspondence between the predicted result contained in the hypothesis and actual result, and reach a conclusion as to whether the explanation on which the prediction was based is supported.</td>
<td></td>
</tr>
<tr>
<td>Standard 3, Key Idea 3.5b Scientists use peer review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations.</td>
<td></td>
</tr>
</tbody>
</table>

| **Instructional Resources** | Information (text [spoken, written, visual], SmartBoard, Chromebooks, Google timer set, and puzzles. |

| **Preparation** | 1. Print lab worksheets |

**LAB Part I:**

1. Engage - 5 minutes:
   - Students will learn how to take their pulse rate and determine what causes pulse rate to change.
2. Read Lab Part 1A Text - 25 minutes:
   - Task 1: Students will read part 1A of lab and record main ideas.
   - Task 2: Students will measure and record their pulse rate three times.
   - Students will calculate their pulse rate
   - Students will collect class data and record average pulse rate.
Students will create a histogram which will be used to indicate experiment results. This data will be used to provide as evidence for answering the lab analysis questions.

3. Exit Ticket - 3 Minutes:
   - Post Assessment
     - Students will explain what they learned today.

### Lab Part II

1. Engage – 10 minutes:
   - Students will watch video and determine how muscles contract.
2. Lab Part A.2: 30 minutes:
   - Students will complete the Fatigue clothespin experiment.
   - Students will answer lab analysis questions
   - Students will investigate a claim and justify their reasoning with evidence.
   - Students will create an experiment identifying all components necessary to perform an experiment.
3. Exit Ticket – 5 minutes:
   - Students will be given a regents practice test question on experiment design.

### Assessment

3. Formal Assessment:
   - Collected student lab work.
   - Post self-assessment.
4. Informal Assessments:
   - Student participation.
   - Student check-ins.

### References

1. NYS Making Connections Lab
2. Regents Question from Living Environment Exam August 2010
3. Idea extracted from

### Images/Videos

2. How to find your pulse rate video:
   - [https://www.youtube.com/watch?v=sfjHNDdV_Z0](https://www.youtube.com/watch?v=sfjHNDdV_Z0)
3. How do muscles contract video:
   - [https://www.youtube.com/watch?v=e3Nq-P1ww5E](https://www.youtube.com/watch?v=e3Nq-P1ww5E)
What Is Your Pulse Rate?  
NYS Making Connections Lab I

Homework due: None

**Habits of Scholarship Checklist (how would you rate yourself 1-4)**

_____ I was on time to class

_____ I have my materials ready for class

_____ I am focused and ready to learn

**Engage Do Now (5 minutes)**

1. Watch this video on [https://www.youtube.com/watch?v=sfjHNDdV_Z0](https://www.youtube.com/watch?v=sfjHNDdV_Z0).
2. Practice finding your pulse!
3. What are three things that cause your pulse rate to change?
   - a. ______________________
   - b. ______________________
   - c. ______________________
   - d. ______________________

**Today’s Learning Targets**

1. I can measure and record my pulse rate.
2. I can record and graph the pulse rate of others.
3. I can analyze data for patterns and connections to use as evidence to develop a conclusion.

**Agenda**

★ Engage - 5 minutes
★ Explore Making Connections Part A.1 - 25 minutes
★ Explain Part A.1- 10 minute
★ Exit Ticket - 5 minutes
Explore: Making Connections Lab A.1
What Is Your Pulse Rate? (25 minutes)

Instructions: Work with a partner and follow the task prompts below. Complete pages 2 & 3 in the Making Connections Packet.

Task 1: Read Part 1A: What is your pulse rate?
Record the main ideas below.

Main Idea 1:

Main Idea 2:

Main Idea 3:

Main Idea 4:

Task 2: Measure and record your pulse rate three times

Task 3: Calculate your pulse rate.

Task 4: Collaborate with the class to record the average pulse rates for yourself and your classmates

Task 5: Graph your data on the histogram
• Record your pulse rates for three trials below:
  Trial 1 (20-second count) _____ \times 3 = _____ per minute
  Trial 2 (20-second count) _____ \times 3 = _____ per minute
  Trial 3 (20-second count) _____ \times 3 = _____ per minute

• Calculate and record your average pulse rate per minute: _______
• Record your average pulse rate on the board or on a transparency provided by your teacher so that everyone can see the pulse-rate data for the entire class.

**Complete a Data Table**

Use the average pulse rate for each student in the class to complete the data table below.

**Class Results: Average Pulse Rates**

<table>
<thead>
<tr>
<th>Pulse rate per minute (range of averages)</th>
<th>&lt; 51</th>
<th>51-60</th>
<th>61-70</th>
<th>71-80</th>
<th>81-90</th>
<th>&gt; 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students in this range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prepare a Histogram**

Use the information in the data table to prepare a histogram of the class results. Use the grid below.

• Provide a title for the histogram.
• Label the vertical axis and mark an appropriate scale on the vertical axis.
• When you have determined the height of each column, shade in the vertical bars.

Histogram Title: ________________________________

Explain & Elaborate: Analysis Questions (10 minutes)

Answer the activity follow up questions on page 4 of the Making Connections Packet.

Answer the Following Questions

Do you see a pattern to the class data? ______ If so, what is it? If not, explain why you think a pattern does not exist.

A question that someone might ask about pulse rate is, “Is there a connection between height and pulse rate?” Based on the information obtained from this activity, can you tell if there is a connection between a person’s height and the person’s average pulse rate? ______ If so, explain the relationship and how you can tell it exists. If not, what additional data would you need to collect to find out if there is a connection?

State another question that someone might ask about pulse rate that could be answered by doing an experiment.

Some people have suggested that someone’s pulse rate will increase if he or she becomes more active. Try this: Once you have found your resting pulse rate, run in place for one minute. As an alternative, you can dance or do knee bends, jumping jacks, or push-ups.

Did your pulse rate increase? ______ Ask four classmates if they got similar results. Did their pulse rates increase after exercise? ______

Pulse rates increase for most people after exercise. Explain why this connection between pulse rate and activity makes sense.

Exit Ticket  (5 minutes)

Explain in 2-3 sentences what you learned today?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
# How Does Fatigue Affect Muscle Performance?

**NYS Making Connections Lab Day II**

**Homework due:** None

## Habits of Scholarship Checklist (how would you rate yourself 1-4)

- [ ] I was on time to class
- [ ] I have my materials ready for class
- [ ] I am focused and ready to learn

## Engage Do Now (10 minutes)

1. Watch this video on [https://www.youtube.com/watch?v=e3Nq-P1ww5E](https://www.youtube.com/watch?v=e3Nq-P1ww5E).

2. In your own words, write the gist of how muscles contract?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

## Today’s Learning Targets

- I can determine how muscles contract.
- I can investigate a claim.
- I can design my own experiment.

## Agenda

1) Engage - 10 minutes
2) Lab Part A.2 - 30 minutes
3) Lab Part B - Investigate Claims - 15 minutes
4) Design an Experiment - 30 minutes
5) Exit Ticket - 5 minutes
Lab Part A.2: How Does Fatigue Affect Muscle Performance? (30 minutes)

Instructions: Work with a partner and follow the task prompts below. Go to page 5 in the Making Connections Packet.

Task 1: Hold a spring-type clothespin between your thumb and index finger and record how many times you can squeeze the clothespin in 1 minute.

Do the Following Activity

Hold a spring-type clothespin between your thumb and index finger. Pinch the ends together completely (until the two ends touch) and release them. Do this as rapidly as possible for one minute. Record the number of times you could squeeze the clothespin in one minute: ________

Try the activity again, doing it the same way and using the same two fingers as before.

Record the number of times you could squeeze the clothespin the second time: ________


Task 2: Record the number you got above and organize them in the data table.

<table>
<thead>
<tr>
<th>Time</th>
<th>Number of squeezes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td></td>
</tr>
<tr>
<td>2 minute</td>
<td></td>
</tr>
</tbody>
</table>

Task 3: Answer the Following Questions on page 5 & 6 of lab packet.
Some people are able to squeeze the clothespin more times in a minute than others. Suggest a possible explanation for this.

________________________________________________________

________________________________________________________

Could you do as many in a minute the second time as you could do the first time? _________
Provide a biological explanation for these results.

________________________________________________________

________________________________________________________

What does an increased pulse rate indicate about the heart rate and flow of blood in someone’s body?

________________________________________________________

________________________________________________________

When muscles are active, cells use nutrients and oxygen at a higher rate and produce waste chemicals and heat more rapidly. Describe how the interaction of two or more body systems helps to maintain homeostasis during periods of high muscle activity. (Be sure to identify the two systems you refer to in your answer.)

________________________________________________________

________________________________________________________

A student in your class suggests that when most people watch exciting sporting events on television, their pulse rates increase. What is a reliable way to find out if this statement is correct?

________________________________________________________

________________________________________________________
What specific evidence would you need in order to determine if what the student suggests in question #3 can be supported?

If you wanted to increase your clothespin-squeezing rate, would you suggest exercising or resting before you did it? Explain why you think your choice is the correct one.


Lab Part B: Investigating Claims (15 minutes)

Task 1: Read and complete questions on page 7 of lab packet.

Part B. Investigating Claims

You hear many claims made every day. Advertisers make claims about the usefulness or effectiveness of their products. Your friend may claim to be able to do something that you do not think he or she can really do. Do you believe all the claims that people make? Have you ever bought a product based on a claim made in an advertisement, only to find that the product did not work as you expected it to?

When does a claim become a fact? Scientists look for evidence to support or refute a claim. Evidence can help you determine which claims are facts and which are opinions or even misrepresentations. For example, if one of your classmates claims to be the fastest runner in the class, you could gather evidence by holding a series of races. If your classmate’s claim is true, that person should win all of the races. If another individual wins the races, your classmate’s claim was simply an opinion not supported by the evidence.

In this part of the laboratory activity, you will conduct an investigation to determine which of two opposing claims can be supported with evidence. First read the section below. It describes two opposing claims. Then investigate to see which claim (if either) is supported.
Conflicting Claims About the Effect of Exercise on the Rate of Clothespin Squeezing

Student A claims that a person will be able to squeeze a clothespin more times in a minute if the person exercises first. Student A suggests that exercising produces a faster pulse rate, which indicates that the blood is getting to the muscles faster.

Student B claims that a person will be able to squeeze the clothespin more times in a minute if the person does not exercise first. Student B suggests that exercise takes energy away from the muscles, and a person who has been resting will have more energy.

Which of the two students do you agree with? ______. How could you find out for sure which claim is correct?

__________________________________________________________________________________________________

__________________________________________________________________________________________________

__________________________________________________________________________________________________

Design an Experiment  (30 minutes)

Instructions: See bottom of page 7 in lab packet.

You must now design and conduct a controlled experiment to gather evidence that will determine which of the two claims is correct. Use the information on the next page to help you design your controlled experiment. Be sure your experimental methods will provide enough data upon which to base a valid conclusion. You will have to conduct several trials.

- What is the question you were trying to answer? (The inquiry)

- What is your Hypothesis that you will test?

- A title for your experiment:

  The Effect of ________________ on _____________________

- Plan the experiment:
  - Dependent Variable: ________________________________
  - Independent Variable: ________________________________
  - Variables to control and keep constant: ________________________________
  - How many individuals will be tested? ________________
  - How many trials will each person do? ________________
  - What will each person have to do? ________________

- Design your data table

```
• Write out the step-by-step procedure for conducting your experiment.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________


Exit Ticket (5 minutes)

1. An experiment was carried out to determine whether drinking caffeinated soda increases pulse rate. The pulse rate of two groups of people at rest were measured. Group A was then given caffeinated soda and group B was given caffeine-free soda. One hour after drinking the soda, the pulse rates were measured. The participants in the experiment were all the same age, and they were all given the same amount of soda.

The dependent variable in this experiment is the....

I. Type of soda given to each group
II. amount of soda given to each group
III. pulse rate of each group

2. What are 3 characteristics of a good experiment?

________________________________________________________________
________________________________________________________________
________________________________________________________________

Unit 2: Characteristics of Living Systems

Rationale:

The unit introduces and builds upon student understanding on what it means to be alive. Students will learn the 8 characteristics of life and apply this knowledge to determine if various items are living or nonliving. To deepen student understanding the students will engage in a 5 day case study on fungi. The students will recall the 8 characteristics of life and determine how mushrooms, the white-nose fungus, and yeast live. The lessons in this unit focus on engagement, each beginning with a video to build background knowledge, and slowly progress toward activities that demand higher level thinking protocols and authentic learning experiences. At the end of this unit, students will have created a mushroom aquarium and apply what they’ve learned in review session to determine if the Ebola virus is alive. After this unit, the students will understand that all living things carry out the 8 characteristics of life, but do so, through varying methods. They will also have developed strong vocabulary for important science terms related to the 8 characteristics of life.

Outline of Lesson Plans

<table>
<thead>
<tr>
<th>Day 11</th>
<th>What makes something living?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Introduction of the 8 characteristics of life</td>
</tr>
<tr>
<td>Day 12</td>
<td>What makes something living?</td>
</tr>
<tr>
<td></td>
<td>- Living vs. non-living</td>
</tr>
<tr>
<td>Day 13</td>
<td>How are living organisms similar or different?</td>
</tr>
<tr>
<td></td>
<td>- Compare humans, bacteria, and fungus</td>
</tr>
<tr>
<td>Day 14</td>
<td>What is living in the courtyard?</td>
</tr>
<tr>
<td></td>
<td>- Bioblitz; Living vs. non-living practice</td>
</tr>
<tr>
<td>Day 15</td>
<td>Case Study: Are Fungi Alive?</td>
</tr>
<tr>
<td></td>
<td>- Mushroom dissection; is it alive?</td>
</tr>
<tr>
<td>Day 16</td>
<td>Case Study: Are Fungi Alive?</td>
</tr>
<tr>
<td></td>
<td>- Jigsaw activity</td>
</tr>
<tr>
<td>Day 17</td>
<td>Case Study: Are Fungi Alive?</td>
</tr>
<tr>
<td></td>
<td>- Investigate the White Nose Fungus Syndrome and determine if it is living or non-living.</td>
</tr>
<tr>
<td>Day 18</td>
<td>Case Study: Are Fungi Alive?</td>
</tr>
<tr>
<td></td>
<td>- Making bread, Is yeast alive?</td>
</tr>
<tr>
<td>Day 19</td>
<td>Create a fungus aquarium.</td>
</tr>
<tr>
<td></td>
<td>- Students create a mushroom aquarium.</td>
</tr>
<tr>
<td>Day 20</td>
<td>Is Ebola living or nonliving?</td>
</tr>
</tbody>
</table>
**Teacher Notes Lesson 11: What Makes Something Living?**

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will identify the 8 characteristics of life. Students will apply their understanding of the 8 characteristics of life to determine if something is living or nonliving.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 3, Key Idea 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, &amp; google timer.</td>
</tr>
<tr>
<td><strong>Preparation</strong></td>
<td>1. Print worksheets.</td>
</tr>
</tbody>
</table>
| **Lesson outline**<br>(Refer to lesson plan for instructions and details) | 1. Engage - 10 Minute:  
   o Students will watch video and will attempt to recall all 8 characteristics.  
2. Explore poem - 5 minutes:  
   o Task 1: Students will read the poem and circle the 8 characteristics of life.  
3. Explain the text - 15 minutes:  
   o Task 1: Students will read and annotate the text on the 8 characteristics of life.  
   o Task 2: Students will use the information from the text to complete the connection chart to better understand the 8 characteristics of life.  
   o Task 3: Students will turn and talk to a neighbor to develop a main idea of the text.  
4. Elaborate Practice Questions - 10 minutes:  
   o Students will apply their understanding of the vocabulary terms to determine examples of each term.  
   o Students will state whether 9 items are living or nonliving.  
5. Exit Ticket - 5 minutes:  
   o Post Assessment  
     o Students will explain what they learned in today’s class. |
| **Assessment** | 1. Formal Assessment:  
   a. Collected student work.  
   b. Post self-assessment  
2. Informal Assessments: |
| References | 1. 8 Characteristics of life poem; idea extracted from:
  2. Text from Regents Review Book
  3. Idea extracted from
| Images/ Videos | 1. Introduction to characteristics to life video
  - [https://vimeo.com/15407847](https://vimeo.com/15407847) |
## What Makes Something Living?

**Homework due:** None

**Habits of Scholarship Checklist** (how would you rate yourself 1-4)

- [ ] I was on time to class
- [ ] I have my materials ready for class
- [ ] I am focused and ready to learn

### Engage Do Now (10 minutes)

1. **Watch this video:** [https://vimeo.com/15407847](https://vimeo.com/15407847)

2. **How do you know if you are alive?** (Try to list 8 ways)

   - ________________________________
   - ________________________________
   - ________________________________
   - ________________________________
   - ________________________________

### Today’s Learning Targets

- ★ I can read a poem and identify the 8 characteristics of life.
- ★ I can determine the central idea of a text.
- ★ I can apply my understanding of the 8 characteristic of life to answer questions.

### Agenda

1. Engage - 10 minutes
2. Explore - 5 minutes
3. Explain - 15 minutes
4. Elaborate - 10 minutes
5. Exit Ticket - 5 minutes
Explore: Identify The 8 Characteristics Of Life (5 minutes)

Instructions: Circle the 8 essential life processes of living organisms.

Living things respire; living things grow
Living things reproduce. Don’t you know?

Living things obtain nutrients
Living things respond to stimuli
Who wouldn’t want to buy a french fry?

Living things transport materials
Living things synthesize
Now build your confidence and visualize.

There’s one more thing that
Living things yearn
Often people know
It can do with urine.
Talk like a scientist
And try to remember

It rhymes with reason
And boom
The word is excretion.

If none of that happens, it’s just a thing.
It’s not alive; it’s non-living.
Earth’s living environment is made up of millions of diverse organisms, from towering redwood trees, sleek antelope, and mushrooms that grow in huge circles, to microscopic bacteria, one celled-organisms that turn the tides red, and to the multi-celled students in your class.

These living organisms are both similar to and different from each other. Although there is no simple definition of life, most scientists agree that living things share certain characteristics that distinguish them from nonliving things.

All living things are organized structures made of one or more cells. Living things use energy to maintain life and to grow and develop. These activities require that cells carry out various chemical reactions. The combination of all the chemical reactions that occur in an organisms is called metabolism.

Living things maintain a stable internal environment even when their external environment changes dramatically. The maintenance of this internal stability is known as homeostasis. To maintain homeostasis, organisms must respond and adapt to both their internal and external environments.

Living things also pass hereditary information to new organisms of the same type in the process of reproduction.

Only living things share the characteristics of life. Nonliving things have no functioning cells and no metabolic activity; they do not maintain homeostasis, nor do they reproduce.

**Task 1: List 3 things you made a connection with, that surprised you, and that you wonder from the text.**

<table>
<thead>
<tr>
<th>What did you connect to?</th>
<th>What surprised you?</th>
<th>What do you wonder?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Task 2: Turn and talk to a neighbor. Share your connection to the text, what surprised you about the text, and what you wonder about the text.

Task 3: What is the main idea of the text?
(Record your notes and thoughts here)
Elaborate: Practice Questions (10 minutes)

Instructions: Use the information learned today to answer the questions below.

Task 1: List the 8 essential processes of living organisms.

<table>
<thead>
<tr>
<th>1.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>6.</td>
</tr>
<tr>
<td>3.</td>
<td>7.</td>
</tr>
<tr>
<td>4.</td>
<td>8.</td>
</tr>
</tbody>
</table>

Task 2: a. List the 8 essential processes of living organisms again.
b. Describe a real life example of how a person completes the following essential life processes

1. __________________ ex. ____________________________________________
2. __________________ ex. ____________________________________________
3. __________________ ex. ____________________________________________
4. __________________ ex. ____________________________________________
5. __________________ ex. ____________________________________________
6. __________________ ex. ____________________________________________
7. __________________ ex. ____________________________________________
8. __________________ ex. ____________________________________________

Task 3: Use the 8 essential life processes to determine if the things below are living or non-living.
<table>
<thead>
<tr>
<th>Banana</th>
<th>Cow</th>
<th>Seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>River water</td>
<td>Winter Icicle</td>
</tr>
<tr>
<td>Sock</td>
<td>Virus</td>
<td>Bubbles</td>
</tr>
</tbody>
</table>

**Exit Ticket** (5 minutes)

Write 3 sentences explaining what you learned in today’s class.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
# Teacher Notes Lesson 12: What Makes Something Living?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will identify the 8 characteristics of life. Students will justify why an image on the smartboard is living or nonliving. Students will make a poster on the 8 characteristics of life and present it to the class in a gallery walk.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 3, Key Idea 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, &amp; google timer.</td>
</tr>
</tbody>
</table>
| Preparation   | 1. Print worksheets.  
2. Choose 20 images to display for the visual image challenge  
3. Poster Paper for poster project and gallery walk |
| Lesson outline (refer to lesson plan for instructions and details) | 1. Engage - 15 minute:  
   - Students will watch a movie and add any new interesting information learned.  
   - Students will complete a matching exercise.  
2. Explore & Explain A visual Image - 15 minutes:  
   - Students will compete in around the world challenge to determine if the image on the board is living or nonliving.  
3. Elaborate Poster Project - 40 minutes:  
   - Task 1: Students will create a T-Chart poster.  
   - Task 2: Students will pick out pictures from the magazines and paste them under the appropriate.  
   - Task 3: Students will pick 3 pictures on each side (living and nonliving) that were difficult to identify and explain it to the class.  
4. Exit Ticket - 20 minutes:  
   - Post Assessment  
     - Each group will get 3-4 minutes to present and explain their poster in a gallery walk. |
| Assessment    | 1. Formal Assessment:  
   a. Collected student work.  
   b. Post self-assessment  
2. Informal Assessments: |
| References                      | 1. Vocabulary definitions for matching from Regents Review Book  
|                                |   o [http://iapps.pvcsd.org/PVIWEB/jzupan/Site/Living_Environment_Assignments/Entries/2014/1/2_Midterm_REview_w_2_files/SimilaritiesandDifferences1.pdf](http://iapps.pvcsd.org/PVIWEB/jzupan/Site/Living_Environment_Assignments/Entries/2014/1/2_Midterm_REview_w_2_files/SimilaritiesandDifferences1.pdf) |
| Images/ Videos                 | 1. 8 Characteristics of life video  
|                                |   o [https://www.youtube.com/watch?v=FHTkIwVvr9A](https://www.youtube.com/watch?v=FHTkIwVvr9A) |
What Makes Something Living?

Homework due: None

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

Engage Do Now (15 minutes)

1) Watch this video: [https://www.youtube.com/watch?v=FHTklwVvr9A](https://www.youtube.com/watch?v=FHTklwVvr9A)

2) Interesting information from video

3) Match the 8 characteristics that all organisms possess on the next page.

4) Use the video to help you come up with an example for each characteristic.

Today’s Learning Targets

- ★ I can identify the 8 characteristics of life.
- ★ I can justify why the image on the smartboard is living or nonliving.
- ★ I can create a poster and present it to my class to explain the 8 characteristics of life.

Agenda

1. Engage - 15 minutes
2. Explore/Explain: Visual Image Challenge - 15 minutes
3. Elaborate:
   - Poster Project - 40 minutes
4. Exit Ticket - 20 minutes
<table>
<thead>
<tr>
<th>Matching: The 8 Characteristics That All Organisms Possess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Nutrition</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Synthesis</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Cellular Respiration</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Excretion</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Transport materials</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Response to Stimuli</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
<tr>
<td>Reproduction</td>
</tr>
<tr>
<td>example: ______________</td>
</tr>
</tbody>
</table>
Explore & Explain: Read a Visual Image Challenge (15 minutes)

Instructions: We will play a game! Mr. Krebs will post an image on the smartboard and two students will race to justify why it is living. The student who wins continues to the next student. Only two students will go at a time. The student who makes it furthest around the room wins.

Elaborate: Poster Project (40 minutes)

Instructions: Students will get in groups of 3-4. Each group will get poster paper, glue, and 5 magazines. Students will flip through magazines, cut out pictures of items, and sort them based on whether they are living or nonliving. Follow the tasks below for guidance.

Task 1: Create a T Chart on the poster with the titles: Living and Nonliving.

Task 2: Cut pictures from magazines and paste them under the appropriate title.

Task 3: Next to each picture, justify why it is living or nonliving.

Task 4: When finished pick 3 pictures on each side (living and nonliving) that were difficult to identify and prepare to explain to the class.

Exit Ticket (20 minutes)

1. Each Group will get 3-4 minutes to present and explain their poster in a gallery walk.
Teacher Notes Lesson 13: How are living organisms similar or different?

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will identify the 8 characteristics of life. Students will interpret information on a chart to compare and contrast how they are similar and different to fungus and bacteria. Students will take a quiz to determine how well they understand the 8 characteristics of life vocabulary terms.</td>
</tr>
</tbody>
</table>
| NYS Living Environment Curricula Standards | Standard 3, Key Idea 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.  
Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things. |
| Instructional Resources | Information (text [spoken, written, visual], SmartBoard, Chromebooks, & google timer. |
| Preparation | 1. Print worksheets. |
| Lesson outline (refer to lesson plan for instructions and details) | 1. Engage - 15 minute:  
   o Students will watch a movie and record any new interesting information learned.  
   o Students will identify vocabulary terms in a matching exercise.  
  2. Explore & Explain similarities and differences among living organisms- 15 minutes:  
   o Task 1: Students will read the comparison chart.  
   o Task 2: Students will complete the Venn Diagram  
   o Task 3: Students will answer follow up questions.  
  3. Elaborate Characteristics of Life Quiz- 10 minutes:  
   o Task 1: Students will take the quiz and record the questions that are incorrect.  
   o Task 2: Students will determine what vocabulary terms they find difficult to understand.  
  4. Exit Ticket - 20 minutes:  
   o Post Assessment  
     o Each group will get 3-4 minutes to present and explain their poster in a gallery walk. |
| Assessment | 1. Formal Assessment:  
             -Collected student work. |
<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
</table>
| 1. **Informal Assessments:** | - Post self-assessment  
- Student participation  
- Student check-ins |

**References**

1. Vocabulary definitions for matching from Regents Review Book  
   - [http://iapps.pvcsd.org/PVIWEB/jzupan/Site/Living_Environment_Assignments/Entries/2014/1/2_Midterm_REview_2_files/SimilaritiesandDifferences1.pdf](http://iapps.pvcsd.org/PVIWEB/jzupan/Site/Living_Environment_Assignments/Entries/2014/1/2_Midterm_REview_2_files/SimilaritiesandDifferences1.pdf)

Exit Ticket Regents Question from:  

**Images/Videos**

1. Characteristics of life video:  
   - [https://www.youtube.com/watch?v=uM_CgOgJGG0](https://www.youtube.com/watch?v=uM_CgOgJGG0)

2. Characteristics of life quiz:  
   - [http://www.sciencequiz.net/jcscience/jcbiology/characteristic/mcq/char1a.htm](http://www.sciencequiz.net/jcscience/jcbiology/characteristic/mcq/char1a.htm)
How Are Living Organisms Similar or Different?

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (10 minutes)

1) What do I know about the characteristics of life?

2) Watch this video: https://www.youtube.com/watch?v=uM_CgOgJGG0
   - After watching the video, record 3 new things that you learned and 3 things that you now wonder?

<table>
<thead>
<tr>
<th>New information learned</th>
<th>Wonder/ Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Today’s Learning Target

★ I can identify the 8 characteristics of life.
★ I can interpret information on a chart to determine how I am similar and different than fungus and bacteria.
★ I can take a quiz online to determine how well I understand the characteristics of living organisms.

Agenda

1. Engage - 10 minutes
2. Explore: Similarities and Differences - 15 minutes
3. Elaborate: 10 minutes
4. Exit Ticket - 5 minutes
Explore:
Similarities and Differences Among Living Organisms (15 minutes)

Instructions: Use the comparison chart on the next page to complete the Venn Diagram. List each organism’s characteristics, put all similar characteristics in the middle where the circles overlap.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Humans</th>
<th>Bacteria</th>
<th>Fungus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproduction</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Function</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Heart Beat</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiration</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Excretion</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>See</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respond to stimuli (Environment)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Touch</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport materials</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nutrition: Obtain nutrients from environment</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Synthesis (combine simple and make complex)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Growth (in size or number)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Speaking</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Task 1: Fill out the Venn Diagram with the comparison chart information. Label the circles: Bacteria, Human, and Fungus.

Task 2: What qualities do they have in common?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: What do all these qualities have in common?

Elaborate: Quiz (10 minutes)

Instructions: Follow the link and take the quiz online. [http://www.sciencequiz.net/jcscience/jcbiology/characteristic/mcq/char1a.htm](http://www.sciencequiz.net/jcscience/jcbiology/characteristic/mcq/char1a.htm)

Task 1: Place your score here: ________________

Task 2: Rewrite the questions that were marked incorrect with the right answer.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: What do you find hard to understand so far in this unit?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exit Ticket (5 minutes)

1. An organism’s metabolism is defined as: ______________.
   
a. The sum/total of all the food and individual eats  
b. The sum/total of the energy required to perform ALL life processes  
c. The total number of chemical reactions that occur in an organism  
d. How quickly an individual grows during puberty

2. In a sentence, explain why sight and heart beat are **not** 1 of the 8 characteristics of all living organisms?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
# Teacher Notes Lesson 14: What is living in the courtyard?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will apply their understanding of the 8 characteristics of life to classify what is living and nonliving in the courtyard. Students will collect data using a T-Chart and present their findings to the class.</td>
</tr>
</tbody>
</table>
| NYS Living Environment Curricula Standards | Standard 2, Key Idea 2.3: Develop and present proposals including formal hypotheses to test explanations; i.e., predict what should be observed under specific conditions if the explanation is true.  
Standard 3, Key Idea 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.  
Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things. |
| Instructional Resources | Information (text [spoken, written, visual], SmartBoard, Chromebooks, & google timer. |
| Preparation   | 1. Print worksheets.  
2. Containers for both living and nonliving organisms.  
3. Camera to document student T-Chart made. |
| Lesson outline (refer to lesson plan for instructions and details) | 1. Engage - 10 minutes:  
   o Students will first record 10 living organisms that they might find outside in the courtyard.  
   o Students will watch, The Soil is Alive, video and add 3 more living organisms to their list.  
2. Bioblitz Introduction - 10 minutes:  
   o Task 1: Teacher will introduce the activity to the students.  
   o Task 2: Students will predict the amount of species they will find in the courtyard.  
   o Task 3: Students will organize themselves into groups of 4-5 individuals.  
3. Explore the Courtyard - 35 minutes:  
   o Task 1: Students will make a T-Chart, 1 column for “living” and 2nd column for “nonliving”.  
   o Task 2: Students will record all living organisms on worksheet table.  
   o Task 3: Students will use the data collected to determine a conclusion for how many living things live in the courtyard.  
   o Task 4: Respond to the presentation talking point questions and prepare for your presentation.  
4. Presentations - 30 minutes |
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students will present their findings in 3-5 minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Exit Ticket - 5 minutes:</td>
</tr>
<tr>
<td></td>
<td>o Post Assessment</td>
</tr>
<tr>
<td></td>
<td>o Students will describe in their own words how living things differ from non living things.</td>
</tr>
<tr>
<td>Assessment</td>
<td>1. Formal Assessment:</td>
</tr>
<tr>
<td></td>
<td>a. Collected student work.</td>
</tr>
<tr>
<td></td>
<td>b. Post self-assessment</td>
</tr>
<tr>
<td></td>
<td>2. Informal Assessments:</td>
</tr>
<tr>
<td></td>
<td>-Student participation</td>
</tr>
<tr>
<td></td>
<td>-Student check-ins</td>
</tr>
<tr>
<td>References</td>
<td>1. Bioblitz idea extracted from:</td>
</tr>
<tr>
<td></td>
<td>o <a href="http://www.nationalgeographic.com/explorers/projects/bioblitz/">http://www.nationalgeographic.com/explorers/projects/bioblitz/</a></td>
</tr>
<tr>
<td></td>
<td>2. Ideas extracted from:</td>
</tr>
<tr>
<td></td>
<td>o Christopher Widmaier, Rochester City School District, New York State, Science Teacher.</td>
</tr>
<tr>
<td>Images/Videos</td>
<td>1. The soil is alive video:</td>
</tr>
<tr>
<td></td>
<td>o <a href="https://www.youtube.com/watch?v=9PcPG8Hnggw">https://www.youtube.com/watch?v=9PcPG8Hnggw</a></td>
</tr>
</tbody>
</table>
# What Is Living In The Courtyard?

**Homework due: None**

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

**Engage Do Now (10 minutes)**

1) **List 10 different living organisms that you might find outside.**

   _________________________________

   _________________________________

   _________________________________

2) **Turn & Talk with a neighbor compare and contrast each other’s lists.**

3) **Watch this video:** [https://www.youtube.com/watch?v=9PcPG8Hnggw](https://www.youtube.com/watch?v=9PcPG8Hnggw)
   - Add 3 more living organisms to your list above.

**Today’s Learning Target**

- ★ I can use my understanding of the 8 characteristics of life to determine what is living and what is not in the courtyard.
- ★ I can collect data about biodiversity
- ★ I can analyze my data and present my findings to the class.

**Agenda**

1. Engage: 10 minutes
2. Lab Introduction: 10 minutes
3. Explore: 45 minutes
4. Elaborate/Explain:
   - Presentations: 20 minutes
5. Exit Ticket - 5 minutes
Introduction to the Bioblitz (10 minutes)

Instructions: Today we will go into the courtyard to investigate what it means to be alive. In groups of 4-5 students we will use our knowledge of the 8 characteristics of life to collect as many living and nonliving items in the courtyard as we can. We will analyze our data and present our findings to the class.

Information: A bioblitz is a fun way to count how many different things live in a particular area. Biodiversity means a diversity of life or all of the different things living in an area.

Bio = Life
Diversity = Many different things

Task 1: How many different kinds of living organisms do you think live in the courtyard? (Circle one)

5 10 20 30 40 50 100 200 300 400 500 1000

Task 2: Form groups and materials

Explore: Courtyard Biodiversity Blitz (45 minutes)

Courtyard Biodiversity Blitz!

Question: How many different kinds of living things live in the courtyard?

Goal of a Biodiversity Blitz = To find and catalog as many different species as possible in a specific period of time.

Method = Spread out and look for living and nonliving things in the courtyard. When you find something new bring it back to your group’s poster. Make sure it has not already been cataloged. If it is new, add it to the poster.

Task 1: Make a T-Chart. Label one side “Living Organism” and the other “Nonliving Organisms”.

Task 2: Record all living organisms that you find in the data table below.
<table>
<thead>
<tr>
<th>Biodiversity</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals</td>
<td></td>
</tr>
<tr>
<td>Plants</td>
<td></td>
</tr>
<tr>
<td>Fungus</td>
<td></td>
</tr>
<tr>
<td>All living things</td>
<td></td>
</tr>
</tbody>
</table>

Task 3: How many different types of living things did your group find in the courtyard?

________ we found ________________________________________________
______________________________________________________________

Task 4: Presentation talking points.

1. Describe what you found and what your data revealed.

______________________________________________________________
______________________________________________________________

2. What are the 3 most interesting living organisms that you found?

______________________________________________________________
______________________________________________________________

3. What were you surprised by? Why or Why not?

______________________________________________________________
______________________________________________________________

4. Describe why 3 of your nonliving organisms are nonliving.

______________________________________________________________
Exit Ticket  (5 minutes)

1. In your own words, describe how living organisms differ from non-living things in the courtyard.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
**Teacher Notes Lesson 15: Are Fungi Alive? Case Study Day 1**

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will read and annotate a text that introduces how fungi live. Students will dissect a mushroom and apply their science inquiry skills and understanding of the 8 characteristics to identify how the mushroom undergoes each one of the 8 characteristics of life to prove whether it is living or nonliving.</td>
</tr>
</tbody>
</table>
| **NYS Living Environment Curricula Standards** | Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources.  
Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.  
Appendix A, Laboratory or technical skills:  
- Dissects plant and/or animal specimens to expose and identify internal structures |
| **Instructional Resources** | Information (text [spoken, written, visual], SmartBoard, Chromebooks, google timer, dissection kits, gloves, and mushrooms to dissect. |
| **Preparation** | 1. Print worksheets.  
2. Set up lab tables for mushroom dissection. |
| **Lesson outline (Refer to lesson plan for instructions and details)** | 1. Engage - 10 minutes:  
   - Students will watch the video and record three observations and wonderings.  
2. Introduction to Fungi Reading - 15 minutes:  
   - Task 1: Students will read and annotate the fungi text.  
   - Task 2: Students will answer the task prompt questions to determine fungi’s role in the environment.  
3. Dissect a Mushroom - 20 minutes:  
   - Task 1: Students write down noticings and wonderings before dissect the specimen.  
   - Task 2: Students will dissect a specimen and will add one new noticing and wonder to the chart.  
   - Task 3: Students will answer the task prompt questions to determine the anatomy of a mushroom and how a mushroom carries out the 8 characteristics of life. Students are expected to use the text in the lesson and google to help them complete their worksheet.  
4. Exit Ticket - 5 minutes:  
   - Formal Assessment.  
     - Students will complete a 3-2-1 exercise. Students will need to include 3 questions that have, include two things that
they have learned, and 1 new thing that surprised them.

| Assessment          | 1. Formal Assessment:  
|                    | - Collected student work.  
|                    | - Post self-assessment  
|                    | 2. Informal Assessments:  
|                    | - Student participation  
|                    | - Student check-ins  |

| References         | 1. Introduction to Fungi text:  
|                    |   - [http://www.ucmp.berkeley.edu/fungi/fungi.html](http://www.ucmp.berkeley.edu/fungi/fungi.html)  
|                    | 2. Idea extracted from Mushroom Dissection Lab - Chatt:  
|                    |   - [https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8&q=lab%20dissect%20mushroom](https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8&q=lab%20dissect%20mushroom)  |

| Images/Videos      | 3. The Fastest Living Thing On The Planet Video:  
|                    |   - [https://www.youtube.com/watch?v=Z4gK5Kuy1bE](https://www.youtube.com/watch?v=Z4gK5Kuy1bE)  |
Are Fungi Alive?  
Case Study Day 1

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (10 minutes)

1) Watch this video: https://www.youtube.com/watch?v=Z4gK5Kuy1bE
2) List 3 observations and 3 wonderings below.

<table>
<thead>
<tr>
<th>Observations</th>
<th>Wonderings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Today’s Learning Target

★ I can read a text to my background knowledge on Fungi.
★ I can apply my background knowledge to answer questions about fungus.
★ I can dissect and analyze a fungus to determine if it is living or nonliving.

Agenda

1. Engage: 5 minutes
2. Explore Fungi: 15 minutes
3. Elaborate: Dissect a Mushroom: 20 minutes
4. Exit Ticket - 5 minutes
Introduction to the Fungi  (15 minutes)

Instructions: Read & annotate the text using the text coding strategies:
N = new information
? = anything confusing

The Kingdom Fungi includes some of the most important organisms, both in terms of their ecological and economic roles. By breaking down dead organic material, they continue the cycle of nutrients through ecosystems. In addition, most vascular plants could not grow without the symbiotic fungi, or mycorrhizae, that inhabit their roots and supply essential nutrients.

Other fungi provide numerous drugs (such as penicillin and other antibiotics), foods like mushrooms, truffles and morels, and the bubbles in bread, champagne, and beer. Fungi also cause a number of plant and animal diseases: in humans, ringworm, athlete's foot, and several more serious diseases are caused by fungi. Because fungi are more chemically and genetically similar to animals than other organisms, this makes fungal diseases very difficult to treat. Plant diseases caused by fungi include rusts, smuts, and leaf, root, and stem rots, and may cause severe damage to crops. However, a number of fungi, in particular the yeasts, are important "model organisms" for studying problems in genetics and molecular biology.

Task 1: What role does Fungi have in the living environment?
Task 2: How are Fungi used to help humans?

Task 3: How are Fungi detrimental to humans and their living environment?

Task 4: Write information that you found to be most interesting and any questions that you may have below.

<table>
<thead>
<tr>
<th>New Interesting Information</th>
<th>Questions</th>
</tr>
</thead>
</table>

**Elaborate: Dissect A Mushroom** (20 minutes)

Is This Fungus Living or Nonliving?

Instructions: Students will work in groups of 4 and follow the task prompts to
**complete the lab. Do not eat or taste the specimen.**

Task 1: Observe the specimen. What do you notice and wonder?

<table>
<thead>
<tr>
<th>Notice</th>
<th>Wonder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _______________</td>
<td>1. _______________</td>
</tr>
<tr>
<td>2. _______________</td>
<td>2. _______________</td>
</tr>
<tr>
<td>3. _______________</td>
<td>3. _______________</td>
</tr>
</tbody>
</table>

Task 2: Dissect the specimen. Add one new notice and wonder to the chart above.

- Does it feel different? Does it smell? What do you see?

<table>
<thead>
<tr>
<th>Notice</th>
<th>Wonder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: Draw an illustration of your specimen. Label the parts of the specimen that you recognize (Stem, Gills, Cap etc.) Google the anatomy of a mushroom to help.
Task 4: Why does the specimen have these parts? What of the 8 essential life processes do they serve? Use the text above and The Internet to answer the questions below.

1. The ____________ helps the specimen ____________________________.

2. The ____________ helps the specimen ____________________________.

3. The ____________ helps the specimen ____________________________.

4. The ____________ helps the specimen ____________________________.

5. The ____________ helps the specimen ____________________________.

6. The ____________ helps the specimen ________________

7.  The ____________ helps the specimen ____________________________.

8.  The ____________ helps the specimen ____________________________.
Task 5: Is this specimen living or nonliving?

This specimen is _______ because ___________________________
__________________________________________________________________.

Exit Ticket (5 minutes)

Instructions: Complete the 3-2-1 below.

1. List 3 questions you have

2. List 2 things that you learned

3. List 1 thing that surprises you
# Teacher Notes Lesson 16: Are Fungi Alive? Case Study Day 2

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Each students will read an expert text and share with their group how fungi exhibit the 8 characteristics of life. Students will create a graphic organizer to demonstrate their understanding and then view each other's products in a gallery walk.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, google timer, and poster paper.</td>
</tr>
</tbody>
</table>
| Preparation | 1. Print worksheets.  
2. Poster Paper.  
3. Make a 6 block graphic organizer and have it posted on the smartboard. 1 block will be for background information, followed by 4 blocks for the expert texts, and the last remaining block reserved for any questions to record. There should be a picture of a mushroom in the middle of the poster as well. |
| Lesson outline (Refer to lesson plan for instructions and details) | 1. Engage - 10 minutes:  
o Students will watch the video and define 5 new vocabulary words that they learned.  
2. Explore Jigsaw Activity - 35 minutes:  
o Task 1: Students will get into groups of 4.  
o Task 2: Students will make a graphic organizer as shown on the board with 6 blocks and a picture in the middle.  
o Task 3: Each student will choose 1 expert text to read. All students should read and annotate their text and complete their note catcher.  
3. Elaborate: Graphic Organizer- 40 minutes:  
o Task 1: Each student will be given 3 minutes to share their notes and expert text to the group. Each student listening should record notes on the space provided on the worksheet.  
o Task 2: Complete your graphic organizer as a group.  
o Task 3: Gallery Walk to see everybody's graphic organizer.  
4. Exit Ticket - 5 minutes:  
o Formal Assessment.  
o Students will determine if fungi are alive using at least 3 of the 8 characteristics of life to support their response. |
| Assessment | 1. Formal Assessment:  
| | 1. Collected student work.  
| | 2. Post self-assessment  
| | 2. Informal Assessments:  
| | 1. Student participation  
| | 2. Student check-ins  
| References | 1. Fungi Expert Texts:  
| | o http://www.ucmp.berkeley.edu/fungi/fungilh.html  
| | 2. Jigsaw activity idea extracted from:  
| | o https://www.jigsaw.org/  
| Images/ Videos | 3. What is a fungus video:  
| | o https://www.youtube.com/watch?v=b5rluxtABGA |
Are Fungi Alive?  
Case Study Day 2

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (10 minutes)

1) Watch this video: [https://www.youtube.com/watch?v=b5rluxtABGA](https://www.youtube.com/watch?v=b5rluxtABGA)

2) List 5 new vocabulary words that you learned about Fungi and define them in your own words.

<table>
<thead>
<tr>
<th>New Vocabulary Terms</th>
<th>What is your definition of them?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Today’s Learning Target

★ I can read a text to increase my background knowledge on Fungi.
★ I can become an expert of a text.
★ I can collaborate with my classmates to make a Fungi graphic organizer.

Agenda

1. Engage: 10 minutes
2. Explore Jigsaw: 35 minutes
3. Elaborate: Graphic Organizer-40 minutes
4. Exit Ticket - 5 minutes
Explore: Jigsaw Activity (35 minutes)

Instructions: Get into groups of 4. Create a graphic organizer that looks like the one on the smartboard. Take up the whole paper.

Task 1: Record your background knowledge with your group. (10 minutes)
1. Discuss with your group what you know about the top
2. Record all of the things you know in box #1 (use yesterday’s work)
3. Make sure your group’s name is on the graphic organizer

Task 2: Look over the 4 expert texts. (10 minutes)
1. Each student should pick one expert text to read individually.
2. Each student will text code the article
   a. Use “N” for any new information
   b. Use “?” for anything that was confusing

Task 3: Each student should record their notes below. (5 minutes)

<table>
<thead>
<tr>
<th>Note prompt</th>
<th>Record notes below</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the text about?</td>
<td></td>
</tr>
<tr>
<td>Which of the 8 characteristics of life did the text discuss?</td>
<td></td>
</tr>
<tr>
<td>List all intriguing information learned</td>
<td></td>
</tr>
<tr>
<td>List all of your questions that remain.</td>
<td></td>
</tr>
</tbody>
</table>
Elaborate: Complete Graphic Organizer
(40 minutes)

Task 1: Discuss and Record new information
1. Each student will have 3 minutes to share their notes verbally with their group.
2. Each student should take notes on the “expert’s” presentation.

<table>
<thead>
<tr>
<th>Expert #1 Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
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</table>

<table>
<thead>
<tr>
<th>Expert #2 Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Expert #3 Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Task 2: As a group complete your graphic organizer. Follow the template on the smartboard.
- Add more background information in box #1.
- Add all important information for each expert box as determined by the group.
- Add all questions in the last box #6.

Task 3: Make sure your poster has color and is appealing. Draw a Fungi!

Task 4: Gallery walk.
Exit Ticket (5 minutes)

Are fungi alive? (Hint: describe how fungi perform at least 3 of the 8 characteristics of life).

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Expert Text # 1: Fungi exist primarily as filamentous dikaryotic organisms.
Resource: http://www.ucmp.berkeley.edu/fungi/fungilh.html

As part of their life cycle, fungi produce spores. In this electron micrograph of a mushroom gill, the four spores produced by meiosis (seen in the center of this picture) are carried on a clublike sporangium (visible to the left and right). From these spores, haploid hyphae grow and ramify, and may give rise to asexual sporangia, special hyphae which produce spores without meiosis.

The sexual phase is begun when haploid hyphae from two different fungal organisms meet and fuse. When this occurs, the cytoplasm from the two cells fuses, but the nuclei remain separate and distinct. The single hypha produced by fusion typically has two nuclei per "cell", and is known as a dikaryon, meaning "two nuclei". The dikaryon may live and grow for years, and some are thought to be many centuries old. Eventually, the dikaryon forms sexual sporangia in which the nuclei fuse into one, which then undergoes meiosis to form haploid spores, and the cycle is repeated.

Some fungi, especially the chytrids and zygomycetes, have a life cycle more like that found in many protists. The organism is haploid, and has no diploid phase, except for the sexual sporangium. A number of fungi have lost the capacity for sexual reproduction, and reproduce by asexual spores or by vegetative growth only. These fungi are referred to as Fungi Imperfecti, and include, among other members, the athlete's foot and the fungus in bleu cheese. Other fungi, such as the yeasts, primarily reproduce through asexual fission, or by fragmentation -- breaking apart, with each of the pieces growing into a new organism.

Expert Text # 2: Fungi are heterotrophic.
Resource: http://www.ucmp.berkeley.edu/fungi/fungilh.html

Fungi are not able to ingest their food like animals do, nor can they manufacture their own food the way plants do. Instead, fungi feed by absorption of nutrients from the environment around them. They accomplish this by growing through and within the substrate on which they are feeding. Numerous hyphae network through the wood,
cheese, soil, or flesh from which they are growing. The hyphae secrete digestive enzymes which break down the substrate, making it easier for the fungus to absorb the nutrients which the substrate contains.

This filamentous growth means that the fungus is in intimate contact with its surroundings; it has a very large surface area compared to its volume. While this makes diffusion of nutrients into the hyphae easier, it also makes the fungus susceptible to dessication and ion imbalance. But usually this is not a problem, since the fungus is growing within a moist substrate.

Most fungi are saprophytes, feeding on dead or decaying material. This helps to remove leaf litter and other debris that would otherwise accumulate on the ground. Nutrients absorbed by the fungus then become available for other organisms which may eat fungi. A very few fungi actively capture prey, such as Arthrobotrys which snares nematodes on which it feeds. Many fungi are parasitic, feeding on living organisms without killing them. Ergot, corn smut, Dutch elm disease, and ringworm are all diseases caused by parasitic fungi. Resource: http://www.ucmp.berkeley.edu/fungi/fungilh.html

**Expert Text # 3: Mycorrhizae are a symbiotic relationship between fungi and plants.** Resource: http://www.ucmp.berkeley.edu/fungi/fungilh.html

Most plants rely on a symbiotic fungus to aid them in acquiring water and nutrients from the soil. The specialized roots which the plants grow and the fungus which inhabits them are together known as *asmycorrhizae*, or "fungal roots". The fungus, with its large surface area, is able to soak up water and nutrients over a large area and provide them to the plant. In return, the plant provides energy-rich sugars manufactured through photosynthesis. Examples of mycorrhizal fungi include truffles and *Auricularia*, the mushroom which flavors sweet-and-sour soup.

In some cases, such as the vanilla orchid and many other orchids, the young plant cannot establish itself at all without the aid of its fungal partner. In liverworts, mosses, lycophytes, ferns, conifers, and flowering plants, fungi form a symbiotic relationship with the plant. Because mycorrhizal associations are found in so many
Like plants and animals, fungi are eukaryotic multicellular organisms. Unlike these other groups, however, fungi are composed of filaments called hyphae; their cells are long and thread-like and connected end-to-end, as you can see in the picture below. Because of this diffuse association of their cells, the body of the organism is given the special name mycelium, a term which is applied to the whole body of any fungus. When reproductive hyphae are produced, they form a large organized structure called asporocarp, or mushroom. This is produced solely for the release of spores, and is not the living, growing portion of the fungus.

In addition to being filamentous, fungal cells often have multiple nuclei. In the chytrids and zygomycetes, the cells are coenocytic, with no distinction between individual cells. Rather, the filaments are long and tubular, with a cytoplasm lining and large vacuole in the center. By contrast, the ascomycetes and basidiomycetes are septate; their filaments are partitioned by cellular cross-walls called septa. The structure of these septa varies, and is taxonomically useful.

Another feature of fungi is the presence of chitin in their cell walls. This is a long carbohydrate polymer that also occurs in the exoskeletons of insects, spiders, and other arthropods. The chitin adds rigidity and structural support to the thin cells of the fungus, and makes fresh mushrooms crisp.

Most members of the kingdom Fungi lack flagella; the structures are completely absent in all stages of their life cycle. The only exception are the chytrids, which produce flagellated gametes. The absence of flagella then, is a synapomorphy which unites all the remaining groups of fungi. This has had a tremendous impact on fungal biology, because it means that no fungus can produce motile gametes, and two organisms must therefore come into direct physical contact to effect sexual reproduction.
Teacher Notes Lesson 17: Are Fungi Alive? Case Study Day 3: White Nose Syndrome

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will be able to read and record information connecting the white nose syndrome to the 8 characteristics of life from a text to the table on their worksheet. Students will develop a 2-minute speech on how the white nose syndrome carries out some of the characteristics of life. Students will determine if the white nose syndrome is alive and infer how scientists might be able to stop the spread of the fungus.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, and google timer.</td>
</tr>
</tbody>
</table>
| Preparation | 1. Print worksheets.  
2. Print 5 copies of each text. Leave one set of the same text at each lab table. |
| Lesson outline (Refer to lesson plan for instructions and details) | 1. Engage - 10 minutes:  
o Students will watch the video on the white nose syndrome to build background knowledge on today’s topic.  
2. Explore White nose fungus group reading - 25 minutes:  
o Task 1: Students will get into groups of 5-6.  
o Task 2: Students will read and annotate their text.  
o Task 3: Students will complete the 8 characteristics table to their best ability together.  
o Task 4: Students will prepare their text presentation by following the task prompts.  
o Task 5: Students will give a quick 2 minute drill presentation on the text that they had read. Students listening to the group,will add new information to their 8 characteristics table.  
3. Elaborate: 2 minute drill presentations- 10 minutes: |
<table>
<thead>
<tr>
<th>Task 1: Groups will have 2 minutes each to present their key points from their learnings. Students listening to their presentation are supposed to take notes and record blank spaces on the 8 characteristics of life table.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Exit Ticket - 5 minutes:</td>
</tr>
<tr>
<td>o Formal Assessment.</td>
</tr>
<tr>
<td>o Students’ will self assess and communicate to the teacher how they feel about learning the characteristics of life. They will also state if the white nose syndrome is alive or not.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Formal Assessment:</td>
</tr>
<tr>
<td>- Collected student work.</td>
</tr>
<tr>
<td>- Post self-assessment</td>
</tr>
<tr>
<td>2. Informal Assessments:</td>
</tr>
<tr>
<td>- Student participation</td>
</tr>
<tr>
<td>- Student check-ins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Texts:</td>
</tr>
<tr>
<td>o Article 1:</td>
</tr>
<tr>
<td><a href="http://bioscience.oxfordjournals.org/content/62/9/819.full">http://bioscience.oxfordjournals.org/content/62/9/819.full</a></td>
</tr>
<tr>
<td>o Article 2:</td>
</tr>
<tr>
<td><a href="http://www.biologicaldiversity.org/campaigns/bat_crisis_white-nose_syndrome/Q_and_A.html">http://www.biologicaldiversity.org/campaigns/bat_crisis_white-nose_syndrome/Q_and_A.html</a></td>
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<td>o Article 3:</td>
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<td><a href="http://www.americanscientist.org/science/pub/-1096">http://www.americanscientist.org/science/pub/-1096</a></td>
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<tr>
<td>o Article 4:</td>
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<tr>
<td><a href="https://www.whitenosesyndrome.org/sites/default/files/files/new_hope_in_the_battle_against_wns_bats_mag_summer_2013_1.pdf">https://www.whitenosesyndrome.org/sites/default/files/files/new_hope_in_the_battle_against_wns_bats_mag_summer_2013_1.pdf</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Images/ Videos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White Nose Syndrome Video:</td>
</tr>
<tr>
<td>o <a href="https://www.youtube.com/watch?v=JAXpz9BjVEQ">https://www.youtube.com/watch?v=JAXpz9BjVEQ</a></td>
</tr>
</tbody>
</table>
Are Fungi Alive?  
Day 3: White Nose Fungus Syndrome

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (5 minutes)

1. Watch this video: https://www.youtube.com/watch?v=JAXpz9BjVEQ

2. What is the problem?

3. Why are bats important to the living environment?

Today’s Learning Target

1) I can read and annotate a text.
2) I can collaborate and problem solve with my peers.
3) I can share my findings with the class in a short presentation.

Agenda

1. Engage: 5 minutes
2. Explore: 25 minutes
3. Elaborate: 10 minutes
4. Exit Ticket: 5 minutes
Explore: White Nose Fungus (WNF)
(25 minutes)

Instructions: Get into groups of 5-6. Choose a table to sit at with your group. Each group will get a different reading and complete the table below to the best of their ability.

Task 1: Read and Annotate the text at your table individually.

“!” = interesting info
“Q” = questions/wonderings

Task 2: As a group, complete the 8 characteristics of life table (refer to notes).

<table>
<thead>
<tr>
<th>8 Characteristics of Life</th>
<th>Your Definition</th>
<th>How does the WNF carry out this characteristic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthesis</td>
<td></td>
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<tr>
<td>Cellular Respiration</td>
<td></td>
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<tr>
<td>Excretion</td>
<td></td>
<td></td>
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<tr>
<td>Transport of Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response to Stimuli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproduction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: Answer the discussion prompt questions below.

★ Summarize what you have read in 2-3 sentences (state interesting information that you learned)
★ Describe how the WNF carries out 2-3 of the characteristics of life.

★ Using your understanding of the 8 characteristics of life and what we have learned from the text, how might we be able to stop the WNF from spreading? (use your inference skills)

Elaborate: Presentation WNS (10 minutes)
Instructions: Each group will have 2 minutes to share their text and findings to the class in a short presentation. The class should be taking notes and filling in any blanks in their 8 characteristics of life chart. The teacher will be taking notes on the smartboard for reference.

Exit Ticket (5 minutes)

1) What is your favorite part of learning about the characteristics of life?

2) What is your least favorite part of learning about learning about the characteristics of life?
3) Is the White nose syndrome alive? Explain.
White-nose syndrome (WNS) is a devastating disease affecting hibernating bats, first documented in winter 2006 in eastern North America. Over 5.5 million bats of several species may have died as a result of this disease...The fungus Geomyces destructans is now considered the causal agent of WNS, and this species may have been recently introduced into North American bat hibernation habitats... Species in this genus are common in the soils of temperate and high-latitude ecosystems and are capable of withstanding and thriving in cold, low-nutrient polar environments. These species are dispersed by wind, groundwater, arthropods, birds, and mammals and are carried by humans, their clothing, and their equipment. These characteristics present significant challenges to biologists, managers, and others charged with controlling the spread of WNS and G. destructans in other parts of North America and the biosphere...

A remarkable diversity of fungal species occur in soils. The vast majority of the approximately 80,000 described fungal species may occur in soils at some time during their life cycle (Bridge and Spooner 2001), and there are undoubtedly many more species of soil fungi to be discovered (Hawksworth 1991, Bridge and Spooner 2001). Kirk and colleagues (2008) listed four species in the genus Geomyces, and the description of G. destructans by Gargas and colleagues (2009) brings the number of known species to five. Members of this genus produce small, unicellular, oval- or pear-shaped spores (arthroconidia) from existing hyphae in branched, tree-like clusters, supported on conidiophores (Sigler and Carmichael 1976, Currah 1985, Sigler et al. 2000, Rice and Currah 2005). Fungi often reproduce using propagules, which are structures that break away from the fungal body, and are dispersed by wind or water or on animals and form new fungal masses. Arthroconidia are asexual propagules that form when the tips of hyphae break apart along the cross-walls separating cells within hyphae (Kendrick 2000, Larone 2002). Conidiophores are specialized hyphal structures on which arthroconidia are formed and supported (Larone 2002).
**Article 2: WNF Question & Answer - Center for Biological Diversity**

**Why are bats dying in North America?**
An estimated 6.7 million bats have died since 2006 because of an outbreak of white-nose syndrome, a fast-moving disease that has wiped out entire colonies and left caves littered with the bones of dead bats. The epidemic is considered the worst wildlife disease outbreak in North American history and shows no signs of slowing down. It threatens to drive some bats extinct and could do real harm to the pest-killing services that bats provide, worth billions of dollars each year, in the United States.

**What is white-nose syndrome, and how does it kill bats?**
White-nose syndrome is the result of a fungus called *Pseudogymnoascus destructans* that invades and ingests the skin of hibernating bats, including the wings. It causes bats to wake up more frequently during the winter, using up their limited fat reserves very rapidly. Massive destruction of wing tissue may lead to disruption of bats' water and electrolyte balance, and it could be the actual cause of death. Some bats may survive a winter with white-nose syndrome only to subsequently succumb in the spring, when their immune systems kick into overdrive, attacking the fungal invader and their own tissues at the same time. Dead or dying bats are frequently observed with a white fuzz around their muzzles, hence the name “white-nose syndrome.”

**Where did the fungus come from?**
The fungus appears to have been introduced to North America from Europe. It has been found on cave bats in 12 countries in Europe, where bats appear to be adapted to, and unaffected by, the fungus. Because bats do not travel between the continents, this strongly suggests the fungus was newly introduced to North America by people — likely cave visitors who transported it on their gear or clothing. This pattern is reminiscent of the spread of diseases that ravaged American Indian people when Europeans first colonized. White-nose syndrome was first discovered in North America in upstate New York in February 2006, in a cave adjoining a commercial cave visited by 200,000 people per year.

**How does this disease spread?**
It is passed from one bat to another, or from the cave environment to bats, but it also likely spreads when people inadvertently carry it from one cave to another on their shoes, clothes or equipment.

**Are there ways to stem its spread?**
Yes. One of the most important is to close caves and abandoned mines to all but essential human travel.

**Article 3: Scientists Find Drugs That Might Fight Bat Disease**
Resource: http://www.americanscientist.org/science/pub/-1096

BOSTON — Scientists may have found some ways to help the nation's bats, which are being wiped out by a novel fungal disease.

Lab tests show that several drugs can fight the germ and that some antiseptics might help decontaminate areas where bats live or the shoes and hands of people who visit them, researchers reported at an infectious-diseases conference Sunday. Scientists tested six strains of the novel fungus against drugs already used to treat people and animals such as cats and dogs for ailments ranging from athlete's foot to life-threatening infections.

"We found that two major classes of antifungal drugs have very good activity" against the bat germ, Vishnu Chaturvedi (microbiologist) reported Sunday in Boston at a meeting of the American Society for Microbiology.

The drugs include fluconazole, the most widely used antifungal drug, which is sold as Diflucan by Pfizer Inc. and in generic form. Four other drugs also seem highly effective, Chaturvedi said.

Researchers also screened more than 2,000 compounds and found five antiseptics that greatly inhibit the fungus.

Now comes the difficult part: how to use these tools in a safe and practical way. No one has ever tried anything quite like this before to treat a large wildlife die-off or to decontaminate areas where the animals live. Treatments can backfire, too: Drugs used a few years ago to try to help frogs being decimated by a fungal disease in many parts of the world turned out to harm tadpoles, Chaturvedi said.

Trying to handle surviving bats for treatment may stress them more than the disease does. And bats' habitats have other important plant and animal life that could be harmed by spraying antiseptics, Coleman said.
Article 4: The enemy of my Enemy is my Friend: A NEW HOPE IN THE BATTLE AGAINST White-Nose Syndrome?

...While some chemical fungicides will kill the fungus, their use would likely devastate complex cave ecosystems and could contaminate water supplies.

Several teams, including ours, are exploring another, potentially safe, option: ...a natural bacterium that in the lab is able to inhibit the fungus without actually touching the bats or the cave...My microbiology colleagues and I decided to tackle this problem... We gave significant attention to developing biological and chemical control options. We soon noticed some intriguing activities exhibited by the bacterium Rhodococcus rhodochrous strain DAP 96253.

Our initial investigation found that the bacterium, when cultivated under very specific conditions (U.S.P. 7,943,549), could inhibit the growth of two Geomyces species that are closely related to G. destructans...

The initial test results were astonishing. The cold-loving fungus attacks by sending out branching structures called hyphae that invade the bats' tissue, especially the wings. Geomyces destructans grows best at about 41 to 50 degrees Fahrenheit and essentially stops growing, becoming dormant, at 68º F. We demonstrated that R. rhodochrous bacteria completely blocked germination of Geomyces destructans spores at 59º F and strongly inhibited growth and reproduction at 39º F... Since previous studies have shown the spores to be the primary infectious agent of Geomyces destructans. These results suggest that Rhodococcus can prevent the initial colonization of healthy bats, and also slow advancement of the disease in already-infected bats – and increase their chance of survival...

The simplicity and efficacy of this microbial antagonism are not really surprising. The co-evolution of soil-associated fungi, such as Geomyces, and bacteria, such as Rhodococcus, lends itself to these natural antagonisms: these organisms have been waging war in a complex environment for billions of years. Humans are unlikely to devise a more effective weapon than what the natural competitors of Geomyces have evolved over eons of open-hostilities...

Early results are promising and provide optimism that the Rhodococcus control agent will give wildlife-management agencies a potent new tool to prevent the spread of White-Nose Syndrome and begin the re-colonization of bats that have been devastated by this disease.
Teacher Notes Lesson 18: Are Fungi Alive? Case Study Day 4 Yeast Lab

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will identify the 8 characteristics of life. The students will make bread and learn that yeast is alive. Students will apply their knowledge of the 8 characteristics of life to specifically justify their reasoning.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, wax baking sheets, yeast, flour, sugar, baking powder, salt and google timer.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print lab worksheets. 2. Prepare stations with wax baking sheets, yeast, baking powder, flour, salt, and sugar. 3. Heat four 500 ml beakers of water for activating the yeast. 4. Organize to use 3 ovens in the home and careers kitchen for after class.</td>
</tr>
<tr>
<td>Lesson outline (Refer to lesson plan for instructions and details)</td>
<td>1. Engage - 10 minutes:  o Students will watch the video on the how yeast works to help make bread. 2. Yeast Lab - 65 minutes:  o Task 1: Students will get into groups of 4.  o Task 2: Students will identify the 8 characteristics of life.  o Task 3: Students will look over lab materials to record initial observations and to deduce inferences for what will happen in today’s lab.  o Task 4: Students will test the yeast for life by mixing warm water, sugar, and yeast together.  o Task 5: Students will determine if their yeast is living or nonliving. They will justify their response with evidence from their recorded observations.  o Task 6: Students will bake bread.  o Task 7: Students will spend the last 10 minutes of class cleaning up their work station. 3. Exit Ticket - 5 minutes:  o Formal Assessment.</td>
</tr>
</tbody>
</table>
Students will self assess and communicate to the teacher how well they understand the 8 characteristics of life. They will also write 3 new things that they learned from lab.

| Assessment | 1. Formal Assessment:  
| | a. Collected student work.  
| | b. Post self-assessment  
| | 2. Informal Assessments:  
| | - Student participation  
| | - Student check-ins |

| References | 1. What is yeast text:  
| | 2. Task 4 Yeast text:  

| Images/ Videos | 1. How yeast works in bread:  
| | o [https://www.youtube.com/watch?v=ZXYZYKfjNBg](https://www.youtube.com/watch?v=ZXYZYKfjNBg) |
Are Fungi Alive?
Case Study Day 4: Yeast Lab

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (10 minutes)

1. Watch this video: https://www.youtube.com/watch?v=ZXYZYKfjNBg

2. Describe how yeast works to help make bread.

Today's Learning Target

1. I can understand that yeast is alive and actively eats sugar to make bread.
2. I can follow a complex multistep procedure, take measurements, and perform technical tasks to determine if yeast is living or nonliving.
3. I can make bread.

Agenda

★ Engage: 10 minutes
★ Yeast Lab: 65 minutes
★ Clean up: 10 minutes
★ Exit Ticket - 5 minutes
LAB # 6: Is This Fungus Living? (65 minutes)

Instructions: Get into groups of 4. Follow the task prompts below.

What is Yeast?

Yeast are single-celled fungi. They are related to the other fungi that people are more familiar with, including: edible mushrooms available at the supermarket, common baker's yeast used to leaven bread, molds that ripen blue cheese, and the molds that produce antibiotics for medical and veterinary use.

Humans use yeast everyday. You can buy yeast to make bread in the grocery store. This yeast consists of little brown grains.

Is this yeast alive?

Task 1: What does it mean to be alive? Identify the 8 characteristics of living organisms.

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<tbody>
<tr>
<td>2.</td>
<td>6.</td>
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<tr>
<td>3.</td>
<td>7.</td>
</tr>
<tr>
<td>4.</td>
<td>8.</td>
</tr>
</tbody>
</table>

Task 2: Look over lab materials. Make observations and an inference.

2.1 Write what you notice about the Yeast in the box below. (Is it alive?)

List Observations:

2.2 Write what predictions you can make about what will happen in the box below.

Inference:
Task 3: Test Yeast for life.
1. Mix 1 spoon of sugar and 1 cup of warm water (H₂O) with a spoon.
2. Add yeast to mixture.
3. What do you notice?
   Observations:
4. Let sit for 10 minutes. Do not touch.

Task 4: Read text below.

We are carrying out an indirect test for metabolism. In other words, we will be indirectly testing whether yeast can use energy, which is one of the characteristics of living organisms.

Yeast cells digest food to obtain energy for growth. Their favorite food is sugar in its various forms: sucrose (beet or cane sugar), fructose and glucose (found in honey, molasses, maple syrup and fruit), and maltose (derived from starch in flour).

As yeast cells digest sugar, they produce carbon dioxide gas (CO₂) and ethyl alcohol. In bread baking, these end products are released by the yeast cells into the surrounding liquid in the dough. When yeast ferments the sugars available, the carbon dioxide gas cannot escape because the dough is elastic and stretchable. As a result of this expanding gas, the dough inflates, or rises. Thus, the term "yeast-leavened breads" was added to the vocabulary of the world of baking.

Task 6: What is metabolism?

Task 5: According to this article, how should we be able to tell if the yeast is alive?
Task 6: Look at the yeast test again. Record your observations below.

Observations:

Task 7: What of the 8 characteristics of living organisms did you observe?

Task 8: Is the yeast alive?
I conclude that the yeast is __________ because ______________________
___________________________________________________________________.

Task 9: Let’s make bread!
Mix w/ hands or spoon:
1. 2 cup flour
2. ½ spoon baking powder
3. ½ spoon salt
4. ½ spoon sugar
5. Add the Yeast test from task #3.

Exit Ticket (5 minutes)

How well do you understand the 8 characteristics of life?

1  2  3  4  5

List 3 new things that you learned today

1. ________________________________________________________________
2. ________________________________________________________________
3. ________________________________________________________________
### Teacher Notes Lesson 19: How do fungi live? Case Study Day 5

**Mushroom Aquarium**

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will create a oyster mushroom aquarium to demonstrate how fungi live. Students will identify how mushrooms grow, reproduce, obtain nutrients, respire, excrete wastes, transport materials, respond to stimuli, and reproduce using prior knowledge and google to locate accurate responses.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, sterilized straw or coffee beans, clear plastic bags, mushroom spawn, skewer, and google timer.</td>
</tr>
</tbody>
</table>
| **Preparation** | 1. Print lab worksheets.  
2. Prepare stations. Each station will need a big handful of recently boiled/sterilized straw or coffee beans, clear plastic bags, mushroom spawn, and skewer to poke holes.  
3. Reserve space to store them outside of direct sunlight. |
| **Lesson outline (Refer to lesson plan for instructions and details)** | 1. Engage - 10 minutes:  
   - Students will watch the video on the how to grow mushrooms. Students will have to record the steps required to grow mushrooms in the space provided.  
2. Set up the Oyster Mushroom Bag - 15 minutes:  
   - Task 1: Students will get into groups of 4.  
   - Task 2: Students infer how each item on the table will be used.  
   - Task 3: Students will read through the directions for creating a mushroom aquarium. They will be expected to correct any misunderstanding from task 2.  
3. Elaborate: Mushroom Scavenger Hunt  
   - Task 1: Students will follow the task prompt questions.  
   - Students will answer questions using their knowledge on the 8 characteristics of life, past class materials, and chromebooks.  
4. Exit Ticket - 5 minutes:  
   - Formal Assessment.  
   - Students will be assessed by two multiple choice exam questions |
| Assessment                  | 1. Formal Assessment:  
|                            | - Collected student work.  
|                            | - Post self-assessment  
|                            | 2. Informal Assessments:  
|                            | - Student participation  
|                            | - Student check-ins  |
| References                 | 1. Instructions for creating mushroom aquarium  
|                            |   - [http://permaculturenews.org/2013/01/30/how-to-grow-your-own-oyster-mushrooms-on-straw/](http://permaculturenews.org/2013/01/30/how-to-grow-your-own-oyster-mushrooms-on-straw/)  
|                            | 2. Exit ticket questions from:  
| Images/Videos              | 1. How to grow mushrooms video:  
|                            |   - [https://www.youtube.com/watch?v=irjwX3qgtTg](https://www.youtube.com/watch?v=irjwX3qgtTg)  |
### How do fungi live?
#### Case Study Day 5: Mushroom Aquarium

**Homework due:** None

**Habits of Scholarship Checklist** (how would you rate yourself 1-4)

- [ ] I was on time to class
- [ ] I have my materials ready for class
- [ ] I am focused and ready to learn

**Engage Do Now (5 minutes)**

1. Watch this video: [https://www.youtube.com/watch?v=irjwX3qqtTg](https://www.youtube.com/watch?v=irjwX3qqtTg)

2. Write out the steps needed in order to grow mushrooms.

### Today's Learning Target

1. I can create a mushroom bag aquarium to show how oyster mushrooms demonstrate the 8 characteristics of life.
2. I can use the Internet and my notes to complete the mushroom scavenger hunt.

### Agenda

1. Engage: 5 minutes
2. Explore: 15 minutes
3. Elaborate: 20 minutes
4. Exit Ticket: 5 minutes
Explore: Oyster Mushroom Bag
(15 minutes)

Instructions: Get into groups of 4. Choose a table to sit at with your group.

Task 1: Look over the materials at your desk. Make an inference to how each item will be used.

Task 2: Read over the instructions. Correct any misunderstandings above.

1) Before you begin, wash your hands and clean all your surfaces well. It’s very important to be hygienic when cultivating mushrooms, as you do not want to grow the wrong types of fungi!
2) Boil substrate, straw or coffee beans, to sterilize it (teacher will do this with class).
3) Let substrate cool down until it is not hot to the touch. (teacher will have this prepared ahead of time)
4) Pack your robust plastic bags with the substrate quite tightly, and then distribute some of the mushroom spawn throughout the substrate. I put about three or four pieces of spawn-covered dowel in each bag, but perhaps one would have been fine (further experimenting required). The substrate should not be dripping wet, but it should still be damp.
5) At this stage, use a sterilized skewer and poke holes in the bag every 3 inches or so. This lets some air in, but not too much.
6) You now have to find a home for your mushrooms. Keep them out of direct sunlight. They like some indirect light and I am told they like it best at around 15-20 degrees Celsius.

Task 3: Make your Oyster Mushroom bag. We will be doing this together step by step.
Elaborate: Mushroom Scavenger Hunt
(20 minutes)
Instructions: Answer the questions below using your book or the Internet.

1. How do mushrooms grow?

2. How do mushrooms obtain their nutrients?

3. How do mushrooms perform cellular respiration?

4. How do mushrooms excrete wastes?

5. How are materials transported in mushroom?

6. How do mushrooms respond to stimuli?

7. How do mushrooms reproduce?
Exit Ticket (5 minutes)

★ Mushrooms decompose rotting wood to obtain the molecules it needs to stay alive. What is this an example of?
  ○ Nutrition
  ○ Reproduction
  ○ Growth
  ○ Transport

★ A student prepared a test tube containing yeast, glucose, and water. After 24 hours, the test tube was analyzed for the presence of several substances. What substance would the student expect to find if respiration occurred in the test tube?
  ○ A hormone
  ○ Starch
  ○ Nitrogen
  ○ Carbon Dioxide
# Teacher Notes Lesson 20: Is Ebola Alive?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will read and annotate a text to determine whether Ebola virus is living or nonliving. Students will review the 8 characteristics of life in a comprehensive matching exercise and define them stating examples in a review game.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 1, Key Idea 1.2a: Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. Standard 4, Key Idea 1: Living things are both similar and different from each other and from nonliving things.</td>
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<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, post it notes, and google timer.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print lab worksheets.</td>
</tr>
</tbody>
</table>
| Lesson outline (Refer to lesson plan for instructions and details) | 1. Engage - 10 minutes:  
   - Students will watch the video to build background knowledge on the Ebola Virus. Students will then determine if Ebola Virus is alive or not in a pre-assessment.  
2. Explore Ebola Virus Text - 15 minutes:  
   - Task 1: Students will read and annotate Ebola text.  
3. Explain The Ebola Virus - 15 minutes  
   - Task 1: Students will explain if the Ebola Virus is alive.  
   - Task 2: Students will record 3 interesting things that they learned and wonder about the Ebola text.  
   - Task 3: Students will turn to talk with a neighbor to share their interesting things. The students will work together with their partners to determine 3 top most interesting things learned and 3 top question they have. They will also verify if the Ebola virus is alive and how it is spread.  
4. Elaborate Living vs Nonliving Review - 15 minutes:  
   - Task 1: Students will match living thing descriptions with a list of statements.  
   - Task 2: Verify your answers with a partner  
   - Partners with the best-combined score will receive a prize.  
5. Characteristics of Life Review Game- 30 minutes  
   - Task 1: Students will get in groups of 4.  
   - Task 2: Each group gets post it notes  
   - Task 3: Teacher will call out 1 of the 8 characteristics of life. Each student group will have to come up with their own definition  
   - Teacher will collect all post it notes at the same time and read them out loud. Students will snaps for the best definition. |
Students are expected to complete the definition table with definitions as we go over them together.

6. Exit Ticket - 5 minutes:
   - Formal Assessment
     - Students will have to apply their comprehensive understanding of the 8 characteristics of life to determine if Ebola, Salmonella, Sickle Cell Anemia, Influenza, Strep Throat, Diabetes, Athlete's foot, and the White Nose Fungus are living or nonliving.

| Assessment          | 1. Formal Assessment:  
|                    | a. Collected student work.  
|                    | b. Post assessment  
|                    | 2. Informal Assessments:  
|                    | - Student participation  
|                    | - Student check-ins  

| References         | 1. Ebola Text:  
|                    | 2. Elaborate living vs. nonliving exercise from:  

| Images/ Videos      | 1. What is Ebola and how does it spread video:  

## Is It Living or Nonliving?

**Homework due:** None

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

**Engage Do Now (10 minutes)**

1) **Watch this video:** [http://khon2.com/2014/10/01/what-is-ebola-and-how-does-the-virus-spread/](http://khon2.com/2014/10/01/what-is-ebola-and-how-does-the-virus-spread/)

2) Read the statement below and decide if you agree or disagree with the statement. Support your statement with reasons why you agree or disagree.

**Statement =** Ebola is not alive.

**Do you…**

- ★ strongly agree
- ★ somewhat agree
- ★ strongly disagree
- ★ somewhat disagree

**Why do you agree or disagree?**

________________________________________________________________________

________________________________________________________________________

---

**Today’s Learning Target**

**Agenda**
Explore: 6 Things You Might Not Know About Ebola (15 minutes)

Instructions: Read the Ebola text and circle notes using the text codes:

“I” = Interesting Information
“?” = Wondering

More than 3300 people have died of an Ebola outbreak in Africa, and now, the virus has made the jump to United States: In Dallas, Texas, 100 people who came in contact with a Liberian national who has the disease have been quarantined. Here are some things you might not have known about the haemorrhagic fever.

1. IT’S NOT EVEN ALIVE.

The criteria to be considered a living organism includes being able to eat and to reproduce on your own. Ebola can reproduce aggressively inside an infected host, but it needs to insert itself into the host cells to do it—no host cell, no more new viruses. (Just don’t call it a prion: bits of protein that influence other proteins to adopt their misshapen forms, causing diseases. Ebola has genetic material held inside a protective protein coat, while prions don’t.) Ebola doesn’t metabolize anything on its own, either, making it not dead but not really alive. Ebola is something like a zombie—a bundle of genetic programming with replication skills and bad intentions.

2. THIS IS NOT THE FIRST U.S. OUTBREAK.

There’s a whole family tree of Ebola. There are 5 species that have been identified, each named after the place they sprung up: Zaire, Bundibugyo, Sudan, Reston and Taï Forest. The current outbreak is the Zaire strain—which is creepy because the crisis is not in Zaire. The Reston subtype is named after a town in Virginia, where an outbreak occurred in 1989, followed by incidents in Texas and Pennsylvania. These
all had one thing in common: infected monkeys exported by a single facility in the Philippines. These outbreaks are different than the current patient in Dallas for one big reason: No humans suffered illness in any of the previous cases.

3. IT HAS A MILITARY MINDSET FOR INVASION.

Researchers are finding out just how clever Ebola is as they reveal some of the virus' murderous Modus Operandi. One key to its lethal success is the stealth way it shuts down immune system defenses, the same way an air force will disable air defenses before sending in the bombers. Ebola obstructs parts of an immune system that are activated by molecules called interferons. These interferons have a vital role in fighting Ebola, usually with scorched earth tactics. “It makes a variety of responses to viral infection possible, including the self-destruction of infected cells,” says Christopher Basler, professor of microbiology at Mount Sinai and co-author of recent studies done by a consortium of Ebola researchers. That group also said, in a paper published in the August 13 edition of the journal *Cell Host & Microbe*, that they figured out exactly how Ebola craftily disables signals the cells use to defend against attack: An Ebola protein called VP24 binds to a specific protein that takes signaling molecules in and out a cell’s nucleus. Without communication, the cell can’t call for help or kill itself. The virus then hijacks the cell, uses it to make more viruses, and spreads them to more cells. Next thing you know, the infected victim is bleeding from every orifice.

4. NO ONE KNOWS HOW IT CAME TO INFECT PEOPLE.

There is a lot we think we know about Ebola’s origins. For starters, human beings are not its natural host, what epidemiologists charmingly call a “reservoir.” Scientists believe that Ebola’s reservoirs are fruit bats. Infected bats can pass the virus to a bunch of other mammals, like rats, primates, and other bats. No one is sure how people became exposed to Ebola, but the best guess is that the monkeys were the conduit. Local hunters in Africa likely became infected while butchering the animals. Anyone who became sick likely infected their family and, if hospitalized in an unsanitary facility, other patients.

5. GUMSHOE DETECTIVE WORK IS THE ONLY WAY TO STOP AN OUTBREAK.

For all the biotech and medical savvy, it takes the investigative skill of a homicide detective to stop an outbreak. Professionals call it “contact tracing,” but it’s really man
hunting. Here’s how it works: Ebola victim A is isolated and interviewed. Anyone who had close contact with A is put into isolation for 21 days. (In Texas, there are emergency medical technicians in this quarantine limbo right now.) If they exhibit no symptoms, they’re free to go. If they come down with Ebola, they become victim B, and another contact trace begins. If the investigators miss anyone, the outbreak will continue. The CDC even put out a cool poster of the process.

6. YOU CAN ORDER IT FROM A CATALOG.

The home page of BEI Resources has an interesting tab that reads “Ebola reagents available.” With a couple of clicks of the mouse, you reach a catalog of infectious disease materials available for order. Just what is going on here?

The National Institute of Allergy and Infectious Diseases (NIAID) has set up BEI to make sure research facilities have access to microbiological materials that can help them develop diagnostics and vaccines for emerging diseases. Scientists must be registered with BEI to request materials. The real key here is the word “reagent,” which means the virus is not an active threat. For example, they have Gamma-irradiated Sudan Ebola virus that has been spun in a centrifuge to separate out cell fragments. Reagents won’t spread, but they can serve as stand-ins during the development of tests. (On the Biosafety Level, or BSL, scale—which ranks the severity of infectious disease and sets baselines of which safety protocols need to be enforced to work with them in a lab—reagents are treated at Biosafety level 1; Ebola is a BSL-4, the top of the scale for risky bugs.) The best part of the catalogue is the disclaimer: “BEI Resources products are intended for laboratory research purposes only. They are not intended for use in humans.”

October 2, 2014 - 2:00pm
http://mentalfloss.com/article/59241/6-things-you-might-not-know-about-ebola
Explain: The Ebola Virus  (15 minutes)


Task 2: Record 3 interesting things that you learned and 3 new wonderings.

<table>
<thead>
<tr>
<th>Interesting Information</th>
<th>Wonderings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: Turn and Talk with a partner. Share the interesting things that you learned and your wonderings. Try to answer each other’s wonderings. Then answer the questions below together.

3.1 What are both of your 3 most interesting things that you learned?

3.2 What 3 questions do you both want to determine the answers to?

3.3 Is the Ebola virus alive?

3.4 How does the Ebola virus spread?
Elaborate: Living Vs Nonliving (15 minutes)

Task 1: Identify which characteristic of living things is being described in each of the statements below. Some may be used more than once!

A. All living things contain cells.  
B. All living things contain DNA.  
C. All living things obtain and use energy.  
D. All living things reproduce.  
E. All living things respond to stimuli.
F. All living things maintain an internal balance.  
G. All living things grow and develop.  
H. All living things evolve as a population.

1. An amoeba is a unicellular organism.  
2. When a human steps out into the cold air, the body begins to shiver in order to keep its temperature at 98.6 degrees Fahrenheit.  
3. Green plants produce their own food through the process of photosynthesis.  
4. An adult hydra is producing its offspring through budding.  
5. The roots of a plant grow towards a source of ground water.  
6. Over three years, Tim’s height has increased from 5’4” to 5’11”.  
7. A pill bug eats a carrot.  
8. A baby songbird hatches from its egg with both parent songbirds watching.  
9. A tulip opens up in the morning at sunrise and closes up in the evening at sunset.  
10. Identical twins have 99.999% of the same genes.  
11. A caterpillar hibernates in a cocoon, and emerges as a butterfly.  
12. It is thought that humans and chimpanzees once shared a common ancestor.  
13. A beaver is an organism composed of many different types of cells.

15. As a sea worm is placed in fresh water, the pulse slows down in order for the worm to conserve energy.

Task 2: Go over your answers with a partner. (5 minutes)

Task 3: Teacher will post answers on board. Group with best score gets a prize.

Characteristics of Life Review Game
(30 minutes)

Follow the instructions below.

1. Students get in groups of 4 and choose a group name.

Our group name is _______________________________ (classroom appropriate)

2. Each group gets pad of sticky notes and writes their group name at the top of each note they use.

3. Each group chooses a scribe/ person who writes for the group.

4. Mr. Krebs will call out 1 of the 8 characteristics of living organisms to the groups.

5. Groups will have 1 minute to provide a definition of the characteristic Mr. Krebs calls out.

6. After one minute, Mr. Krebs will say “Time”; each group will have one member bring their sticky note to Mr. Krebs.

7. Mr. Krebs will read each group’s definition out loud, and the students will vote with snaps to determine the best definition.

8. As students play the game, they will complete the 8 characteristics of living organism chart below.

---

The 8 Characteristics That All Organisms Possess

---
We have learned that disease can be spread by both living organisms and non-living organisms. This is determined by whether the disease exhibits all 8 characteristics of life. Circle and identify the diseases that are living and non-living in the table and state why.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Living/Nonliving</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebola (Virus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonella (Bacteria)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sickle Cell Anemia (Genetics)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Exit Ticket** (5 minutes)

We have learned that disease can be spread by both living organisms and non-living organisms. This is determined by whether the disease exhibits all 8 characteristics of life. Circle and identify the diseases that are living and non-living in the table and state why.
<table>
<thead>
<tr>
<th>Disease</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza (Virus)</td>
<td></td>
</tr>
<tr>
<td>Strep Throat (Bacteria)</td>
<td></td>
</tr>
<tr>
<td>Diabetes (Genetic)</td>
<td></td>
</tr>
<tr>
<td>Athletes foot (Fungal)</td>
<td></td>
</tr>
<tr>
<td>White-noes fungus (Fungal)</td>
<td></td>
</tr>
</tbody>
</table>
Unit 3: Human Structure & Function

Rationale:

The unit introduces the levels of organization of the human body, emphasizing structure and function of organs, organ systems, and how these organ systems work together in order to maintain homeostasis. The lessons in this unit focus on engagement, each beginning with a video to build background knowledge, and slowly progress toward activities that demand higher level thinking protocols. After this unit, students will be expected to understand the 6 levels of organization, be able to identify the 11 human body systems, key organs that contribute to each organ system, and describe how the body systems work together.

Outline of Lesson Plans

<table>
<thead>
<tr>
<th>Day 21</th>
<th>How do our bodies work?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-The 6 levels of organization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 22</th>
<th>How do our bodies work?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Identify human body systems, their major organs, and their functions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 23</th>
<th>How do our bodies work?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Explain how human body systems work together</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 24</th>
<th>How are our bodies similar to other organisms?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Compare and contrast our bodies to a sharks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 25</th>
<th>How do our body systems work together?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Choose a human body system to research and present to the class</td>
</tr>
</tbody>
</table>
### Teacher Notes Lesson 21: How do our bodies work?

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will record the definitions of an organism, organ system, organ, tissue, cells, and organelle. Students will read a brief text and organize a set of images in the correct level of organization envelope. Students will elaborate their knowledge through matching human body organs found in a word bank with their structure and function descriptions on a visual image. Students will sort the 6 levels of organization from least complex to most complex.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 4, Key Idea 1.2a: Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, set of images, envelopes, and google timer.</td>
</tr>
</tbody>
</table>
| **Preparation** | 1. Print lab worksheets.  
2. Prepare a set of 10 images and 6 envelopes per lab table |
| **Lesson outline (Refer to lesson plan for instructions and details)** | 1. Engage - 15 minutes:  
   - Students will watch the video to build background knowledge on the 6 levels of organization. Students will define each of the vocabulary terms.  
2. Explore The 6 Levels of Organization - 15 minutes:  
   - Task 1: Students will read the text and create an analogy for the task described.  
   - Task 2: Students will look over their materials and use scientific inquiry skills to determine what the next task will be.  
   - Task 3: Students will work with a partner to write the 6 levels of organization on each of the envelopes and sort the images to the appropriate envelope.  
3. Elaborate Human Body Organs - 10 minutes  
   - Task 1: Students will match the items in the word bank to the human body organs in the diagram.  
4. Exit Ticket - 5 minutes:  
   - Formal Assessment  
     - Students will arrange the 6 levels of organization from least complex to most complex. |
| **Assessment** | 1. Formal Assessment:  
   - Collected student work.  
   - Post assessment |
| References | 1. 6 Levels of Organization Text from Oakland Schools link:  
| o https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8&q=Oakland+schools+biology+resource+unit+and+composed+of+paragraphs  
| 2. Exit Ticket from Living Environment Regents Exam January 2010:  
| o http://www.syvum.com/cgi/online/mult.cgi/exam/regents/living_environment/regs_jan_2010_living.tdf?0 |

| Images/Videos | 1. Video on the 6 levels of organization  
| o https://www.youtube.com/watch?v=B3DeR7hh41s  
| 2. Human body organ diagram:  
| o http://humananatomybody.info/anatomy-human-body-organs/ |
How Do Our Bodies Work?

Homework due: None

<table>
<thead>
<tr>
<th>Habits of Scholarship Checklist (how would you rate yourself 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ I was on time to class</td>
</tr>
<tr>
<td>_____ I have my materials ready for class</td>
</tr>
<tr>
<td>_____ I am focused and ready to learn</td>
</tr>
</tbody>
</table>

Engage Do Now (15 minutes)

1) Watch this video: https://www.youtube.com/watch?v=B3DeR7hh41s

2) Use the information in the video to answer the questions below.

   a) What is an organism? ____________________________
      i) What are 3 examples? _______________________

   b) What is an organ system? __________________________
      i) What are 3 examples? __________________________

   c) What is a organ? ____________________________
      i) What are 3 examples? __________________________

   d) What is a tissue? ____________________________
      i) What are 3 examples? __________________________

   e) What are cells? ____________________________

   f) What are organelles? ____________________________
Today’s Learning Target

1. I can identify the 6 levels of organization.
2. I can define the 6 levels of organization.
3. I can sort the levels of organization from least complex to most complex.

Agenda

1. Engage: 15 minutes
2. Explore Levels of Organization Activity: 15 minutes
3. Elaborate – 15 minutes
4. Exit Ticket: 5 minutes

Explore: The 6 Levels of Organization
(15 minutes)

Instructions: Students will have 15 minutes to work in pairs. Each group will get a handful of envelopes and pictures. Follow the task prompts below to guide you through the activity.

Task 1: Read the text.

Organisms are composed of varying levels of subunits similar to the way that a book is composed of paragraphs, words and letters. In the text of a book, what are the smallest subunits? (Letters) When the smallest subunits are combined, what do they form? (Words) Work with a neighbor to continue this pattern from the smallest subunit of a book’s text all the way to the full book.” Students should discuss how letters form words, words form sentences, sentences form paragraphs, paragraphs form chapters, and the chapters form the text of the book.

Task 2: What is the analogy in the text above?

Task 3: Look over the materials in front of you.

★ What do you observe? __________________________________________

★ What can you infer you will be doing? ____________________________ __________________________________________
Task 4: Each group will write the 6 levels of organization on their envelopes and describe what each of them mean.

Task 5: Each group will sort the images matching them to their appropriate level of organization.

**Elaborate: Human Body Organs (10 minutes)**

**Instructions:** Match the items in the word bank to the human body organs.


**WORD BANK:**

<table>
<thead>
<tr>
<th>1. Liver</th>
<th>6. Kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Ovaries</td>
<td>7. Small Intestine</td>
</tr>
<tr>
<td>3. Heart</td>
<td>8. Lungs</td>
</tr>
<tr>
<td>5. Large Intestine</td>
<td>10. Brain</td>
</tr>
</tbody>
</table>
Exit Ticket  (5 minutes)

Write the structures listed below in order from least complex to most complex.
organ
cell
organism
organelle
tissue

Least complex: ____________________________

__________________________

__________________________

__________________________

Most complex: ____________________________
# Teacher Notes Lesson 22: How do our bodies work?

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will be able to arrange the organization of human body levels from simplest to most complex. Students will be able to identify how the 11 human body systems function and 3 organs involved in the system. Students will be able to label and explain how the 11 human body systems function describing the role of 3 human body organs for each system.</td>
</tr>
<tr>
<td>NYS Living Environment Curricula Standards</td>
<td>Standard 4, Key Idea 1.2a: Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms. Standard 4, Key Idea 1.2b: Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions.</td>
</tr>
<tr>
<td>Instructional Resources</td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, textbooks, and google timer.</td>
</tr>
<tr>
<td>Preparation</td>
<td>1. Print lab worksheets.</td>
</tr>
</tbody>
</table>
| Lesson outline (Refer to lesson plan for instructions and details) | 1. Engage - 7 minutes:  
   o Task 1: Students will use prior knowledge to infer how their body works.  
   o Task 2: Students will watch a video and describe how to human body systems work.   
2. Stations Lab Activity-  80 minutes   
   o Task 1:Students will have 20 minutes at each station to complete the tasks.  
   o Students will be practice identifying and explaining the 11 human body systems in 4 different ways.   
3. Exit Ticket - 5 minutes:  
   o Students will self assess what they found most interesting today and record one question that they have for the instructor. |
| Assessment | 1. Formal Assessment:  
   o Collected student work.  
   o Post assessment  
2. Informal Assessments:  
   o Student participation  
   o Student check-ins |
<p>| References | 1. Exit Ticket from Living Environment Regents Exam January 2010: |</p>
<table>
<thead>
<tr>
<th>Images/ Videos</th>
<th>Levels of Organization Text from Oakland Schools link:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Human Body 101 Video:</td>
<td></td>
</tr>
<tr>
<td>2. Resource for digestive body system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="http://www.enchantedlearning.com/subjects/anatomy/digestive/lab/easy/">http://www.enchantedlearning.com/subjects/anatomy/digestive/lab/easy/</a></td>
<td></td>
</tr>
<tr>
<td>3. Resource for circulatory system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="http://www.smartdraw.com/circulatory-system-diagram/">http://www.smartdraw.com/circulatory-system-diagram/</a></td>
<td></td>
</tr>
<tr>
<td>4. Resource for respiratory body system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="https://www.pinterest.com/pin/116530709084119632/">https://www.pinterest.com/pin/116530709084119632/</a></td>
<td></td>
</tr>
<tr>
<td>5. Resource for nervous system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="https://en.wikipedia.org/wiki/Central_nervous_system">https://en.wikipedia.org/wiki/Central_nervous_system</a></td>
<td></td>
</tr>
<tr>
<td>6. Resource for human reproductive system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="http://www.britannica.com/science/human-reproductive-system">http://www.britannica.com/science/human-reproductive-system</a></td>
<td></td>
</tr>
<tr>
<td>7. Resource for 6 human body systems image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="http://thegoodistablog.com/2013/10/23/the-human-body-systems/">http://thegoodistablog.com/2013/10/23/the-human-body-systems/</a></td>
<td></td>
</tr>
<tr>
<td>8. Resource for integumentary body system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="https://whs-anatomyphysiology.wikispaces.com/Integumentary+System">https://whs-anatomyphysiology.wikispaces.com/Integumentary+System</a></td>
<td></td>
</tr>
<tr>
<td>9. Resource for the immune body system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="https://whs-anatomyphysiology.wikispaces.com/Integumentary+System">https://whs-anatomyphysiology.wikispaces.com/Integumentary+System</a></td>
<td></td>
</tr>
<tr>
<td>10. Resource for endocrine system image:</td>
<td></td>
</tr>
<tr>
<td>o <a href="https://embryology.med.unsw.edu.au/embryology/index.php/Lecture_-_Endocrine_Development">https://embryology.med.unsw.edu.au/embryology/index.php/Lecture_-_Endocrine_Development</a></td>
<td></td>
</tr>
</tbody>
</table>
How Do Our Bodies Work?

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (7 minutes)

1) How do you think your body works?


3) Describe how 2 human body systems work?

Today’s Learning Target

1) I can arrange the organization of human body levels from simplest to most complex.
2) I can identify the 11 human body systems, their major organs, and their functions.

Agenda

1. Engage: 7 minutes
2. Stations Lab: 80 minutes
3. Exit Ticket: 3 minutes
Lab: How Does The Human Body Work? (80 minutes)

Instructions: We will be exploring our body systems. Each group will have 20 minutes at each station to complete the task. There are 4 stations. When you hear the alarm, move to the next station. There will be reference sheets to help you complete each station task.

**Station 1**

**Task 1:** Write the structures listed below in order from least complex to most complex.

<table>
<thead>
<tr>
<th>Write the structures listed below in order from least complex to most complex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>organ</td>
</tr>
<tr>
<td>cell</td>
</tr>
<tr>
<td>organism</td>
</tr>
<tr>
<td>organelle</td>
</tr>
<tr>
<td>tissue</td>
</tr>
<tr>
<td>Least complex:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Most complex:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Task 2:** What are the 11 Human Body Systems?

<table>
<thead>
<tr>
<th>List the 11 Human Body Systems</th>
<th>What is their function?</th>
<th>Organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Integumentary System</td>
<td>Barrier to invading organisms and chemicals; temperature control</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Movement; heat production</td>
<td>Muscles, tendons</td>
</tr>
<tr>
<td>4.</td>
<td>Coordinates activities of other organ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>systems; response to sensations</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Circulatory System</td>
<td>Processes foods; absorption of nutrients into body</td>
<td></td>
</tr>
<tr>
<td>7. Immune System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Oxygen/carbon dioxide exchange</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Kidneys, bladder,</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Produces eggs and sperm; environment for growth of fetus (women)</td>
<td></td>
</tr>
</tbody>
</table>
Station 2
Instructions: Identify the name of each human body system. Write the systems function and label 3 of the most important organs in the system.

What Human Body System is this? ____________________
(Label 3 important organs)

Using the organs labeled, describe how the system functions.

What Human Body System is this? ____________________
(Label 3 important organs)

Using the organs labeled, describe how the system functions.
What Human Body System is this? ________________________
(Circle 3 important organs)

Brain (CNS)
- Perception and processing of sensory stimuli (somatic/autonomic)
- Execution of voluntary motor responses (somatic)
- Regulation of homeostatic mechanisms (autonomic)

Spinal cord (CNS)
- Initiation of reflexes from ventral horn (somatic) and lateral horn (autonomic) gray matter
- Pathways for sensory and motor functions between periphery and brain (somatic/autonomic)

Nerves (PNS)
- Fibers of sensory and motor neurons (somatic/autonomic)

Ganglia (PNS)
- Reception of sensory stimuli by dorsal root and cranial ganglia (somatic/autonomic)
- Relay of visceral motor responses by autonomic ganglia (autonomic)

Digestive tract (ENS)
- The enteric nervous system (ENS), located in the digestive tract, is responsible for autonomous functions and can operate independently of the brain and spinal cord.
Using the organs circled, describe how the system functions.

Station 3
Instructions: Match the name of the human body system with each picture.

<table>
<thead>
<tr>
<th>A. Nervous System</th>
<th>F. Respiratory System</th>
<th>J. Excretory System</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Excretory System</td>
<td>G. Muscular System</td>
<td>K. Endocrine System</td>
</tr>
<tr>
<td>C. Immune System</td>
<td>H. Reproductive</td>
<td>L. Circulatory System</td>
</tr>
<tr>
<td>D. Reproductive System</td>
<td>I. Skeletal System</td>
<td>M. Digestive System</td>
</tr>
<tr>
<td>E. Integumentary System</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>ADRENAL GLAND</strong></td>
<td><strong>RENAL ARTERY</strong></td>
<td><strong>LEFT KIDNEY</strong></td>
</tr>
<tr>
<td><strong>RENAL VEIN</strong></td>
<td><strong>RIGHT KIDNEY</strong></td>
<td><strong>BLADDER</strong></td>
</tr>
</tbody>
</table>

**Male Reproductive System**
- **prostate gland**
- **vas deferens**
- **testis**
- **seminal vesicle**

**Female Reproductive System**
- **ovary**
- **vagina**
- **uterus**
- **cervix**

**Inside View**

---

**Human Anatomy**
- Cardiovascular System
- Respiratory System
- Digestive System
- Skeletal System
- Muscular System
Resource for Images used:

Resource station 2
Resource for digestive body system image:
Resource for respiratory body system image: https://www.pinterest.com/pin/11653079084119632/

Station 3
Resource for human reproductive system image:
Resource for 6 human body systems image:
Resource for integumentary body system image:
-https://whs-anatomyphysiology.wikispaces.com/Integumentary+System
Resource for the immune body system image:
- https://whs-anatomyphysiology.wikispaces.com/Integumentary+System
Resource for endocrine system image:
Station 4
Instructions: Take the pre-assessment quiz. Assess your knowledge on the human body.

<table>
<thead>
<tr>
<th>★ _______</th>
<th>3. _______</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. _______</td>
<td>4. _______</td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
</tbody>
</table>

Exit Ticket
What did you find most interesting today?

Write one question that you have.
**Teacher Notes Lesson 23: How do our bodies work?**

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
</table>

**Objective**
Students will record notes on the human organ systems and make a newscast to present in class. Students will elaborate on their human organ system knowledge through reading a complex text and explain how human body organ systems are formed and how they work. Students will choose one of the human body systems and infer what might go wrong in their body if one of their organs stops working properly.

**NYS Living Environment Curricula Standards**
Standard 4, Key Idea 1.2a: Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms.

Standard 4, Key Idea 1.2b: Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions.

**Instructional Resources**
Information (text [spoken, written, visual], SmartBoard, Chromebooks, textbooks, and google timer.

**Preparation**
1. Print lab worksheets.

**Lesson outline (Refer to lesson plan for instructions and details)**
1. Engage - 15 minutes:
   - Task 1: Students will watch a video on the human body organ systems and describe the main idea, and record 3 interesting facts.
   - Task 2: Students will write a “did you know” newscast including their three interesting facts that they discovered in the video.
2. Explain - 10 minutes:
   - Students will present their newscast to the class.
3. Elaborate how does human body systems work? - 15 minutes:
   - Task 1: Students will read and annotate the text on human organ systems.
   - Task 2: Students will complete the main idea, interesting information, and questions table.
   - Task 3: The students will list how the body is organized.
   - Task 4: The students will explain how the organ systems are formed.
   - Task 5: Students will explain how the human body systems work.
4. Exit Ticket - 5 minutes:
   - Students will choose a human organ system and infer what might happen to your body if an organ stops working. Students will write 2-3 sentences describing what might go wrong, how it will affect the human body (if it goes wrong), and how modern medicine could help the human body.
continue to live.

| Assessment       | 1. Formal Assessment:  
|                  |   o Collected student work.  
|                  |   o Post assessment  
|                  | 2. Informal Assessments:  
|                  |   o Student participation  
|                  |   o Student check-ins  
| References       | 1. Newscast idea from:  
|                  |   o Christopher Widmaier, Rochester City School District, New York State, Science Teacher  
|                  | 2. Elaborate Human Body System Text:  
| Images/ Videos   | 1. Organ system Video:  

How Do Our Bodies Work?

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (15 minutes)

1. Use the information in the video to answer the questions below.

2. Record the main idea below in the box (after watching the video).

What is the Main Idea?

3. Watch video clip a 2nd time and during the movie record three interesting facts.

1.

2.

3.
4. Task 4: Write a newscast script stating the main idea and three interesting facts that you learned from the video.

5. Task 5: Present newscast to class.

<table>
<thead>
<tr>
<th>Today’s Learning Target</th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>● I can prepare and present a “did you know” human body systems newscast.</td>
<td>★ Engage: Prepare a Newscast 15 minutes</td>
</tr>
<tr>
<td>● I can identify important human body organs.</td>
<td>★ Explain: Present a Newscast 10</td>
</tr>
<tr>
<td>● I can explain how human body systems work together.</td>
<td>★ Elaborate Read a Text: 15</td>
</tr>
<tr>
<td></td>
<td>★ Exit Ticket: 5 minutes</td>
</tr>
</tbody>
</table>

Elaborate How does the human body system work? (15 minutes)

Task # 1: Track the text with a pen or pencil silently while Mr. Krebs reads out loud.

Task # 2: Circle and annotate text with text codes.

“M” – Main Idea
“I” – Interesting Information
“Q” – Questions/inquires

Have you ever wondered about how the human body works? The human
body is like a complex machine, with many little parts that work by themselves or with other parts to perform specific functions. Sometimes, it seems like our body has a mind of its own and it embarrasses you. Have you ever passed gas accidentally when other people were around? In most cases, the things that your body does are normal, but it’s important to know your body so you can recognize what is normal body behavior and what is not. If there is a problem with how your body works, by recognizing that there is a problem, you can take steps to fix it or get help.

To understand how the body works, it helps to understand how the body is organized. The smallest living unit in any organism is a cell and the human body is made up of trillions of them. That is more than 1,000,000,000,000 cells! Cells are important for many reasons. Cells differentiate from each other to perform different, important tasks within the body. For example, some cells might become brain cells while others make bone, and red blood cells carry oxygen throughout the body, while white blood cells fight infection.

When a group of cells work together to perform a specific function, they are called tissue. Nerve tissue carries messages from the brain to the rest of your body by sending electrical impulses. The electrical impulses tell the muscles when to contract and affect everything from the beating of your heart to the wiggling of your toes. Muscle tissue functions in movement because the muscle cells contract, shorten and relax. Muscle cells know when to contract or shorten because they receive electrical signals from nerve tissue. Finally, connective tissue holds the body together, provides support, insulation, and protection. Bones, tendons, and ligaments are all examples of connective tissue.

Organs are two or more types of tissue that work together to perform a specific task. For example, the stomach has all four types of tissue and is responsible for breaking down food. Organ systems are formed when two or more organs work together to perform a larger task. The mouth, throat, stomach, large and small intestines, liver, pancreas, and gallbladder all work together, as the digestive system, to process the food we eat so that our cells can absorb the nutrients and convert it into energy. There are many systems in the body, such as the skeletal, muscular, circulatory, nervous, digestive, immune, respiratory, urinary, and reproductive systems and they all interact with each other every second of our lives. Without these systems, humans
would not be able to grow, maintain life, and reproduce.

Task # 3: Write key annotations and text codes from the text in the box below.

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Interesting Information</th>
<th>Questions/Inquiries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task # 4: List how the body is organized?
1. __________________________________________
2. __________________________________________
3. __________________________________________

Task # 5: How are organ systems formed?
__________________________________________

Task # 6: How does the human body system work?
__________________________________________
__________________________________________
__________________________________________

Exit Ticket (5 minutes)

Choose one human body system (muscular, skeletal, reproductive, endocrine, circulatory, nervous, etc) and infer what might go wrong with your body if one of your organs stops working properly. Write 2-3 sentences describing what might go wrong, how it will affect the human body (if it goes wrong), and how
modern medicine could help the human body continue to live.
**Teacher Notes Lesson 24: How are our bodies similar to other organisms?**

<table>
<thead>
<tr>
<th>Time</th>
<th>90 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Students will compare and contrast the anatomy of a shark to the anatomy of a human. Students will dissect a shark and explain how their body systems are similar and different to the human body organ systems.</td>
</tr>
</tbody>
</table>
| NYS Living Environment Curricula Standards | Standard 4, Key Idea 1: Living things are both similar to and different from each other.  
Standard 4, Key Idea 1.2b: Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions. |
| Instructional Resources | Information (text [spoken, written, visual], SmartBoard, Chromebooks, textbooks, 12 images: 6 of shark body parts and 6 of human body parts, large dissection tray, surgical scissors, scalpel, probe, forceps, 6 dogfish shark specimens, and google timer. |
| Preparation | 1. Print lab worksheets.  
2. Prepare 6 lab tables with dissection kit and dogfish specimen.  
3. Prepare gallery walk. Post 12 images in the hallway. Try to post similar shark and human organs next to each other. |
| Lesson outline (Refer to lesson plan for instructions and details) | 1. Engage - 12 minutes:  
   o Task 1: Students will watch a video on the human body organ systems and describe the main idea, and record 3 interesting facts.  
   o Task 2: Students will write a “did you know” newscast including their three interesting facts that they discovered in the video.  
2. Explore Gallery Walk - 15 minutes:  
   o Task 1: Students will engage in a gallery walk in the hallway. Images of shark and human body organs will be posted. Students will be expected to record their observations and wonderings.  
   o Task 2: Students will return to their seats and predict what they will find when they dissect a shark.  
3. Explain The difference between sharks and humans - 15 minutes:  
   o Task 1: Students will read and annotate the text.  
   o Task 2: Students will determine how sharks and humans are similar. |
<table>
<thead>
<tr>
<th>Task 3: Students will create a shark and human body systems T chart. Labeling similarities and differences.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Shark Dissection Lab - 33 minutes</td>
</tr>
<tr>
<td>o Task 1: Students will read the dissection rules carefully.</td>
</tr>
<tr>
<td>o Task 2: Students will reference page 4 of their packet and try to identify the shark organs listed.</td>
</tr>
<tr>
<td>o Task 3: Students will complete the table on page 4 of their lab packet using the shark text to aid them as needed. Whatever is not finished is assigned for homework.</td>
</tr>
<tr>
<td>5. Exit Ticket - 5 minutes:</td>
</tr>
<tr>
<td>o Students will explain how the shark and human body systems are both similar and different.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Formal Assessment:</td>
</tr>
<tr>
<td>o Collected student work.</td>
</tr>
<tr>
<td>o Post assessment</td>
</tr>
<tr>
<td>2. Informal Assessments:</td>
</tr>
<tr>
<td>o Student participation</td>
</tr>
<tr>
<td>o Student check-ins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gallery walk idea from:</td>
</tr>
<tr>
<td>o <a href="http://serc.carleton.edu/introgeo/gallerywalk/step.html">http://serc.carleton.edu/introgeo/gallerywalk/step.html</a></td>
</tr>
<tr>
<td>2. Shark text:</td>
</tr>
<tr>
<td>o <a href="http://oceanofk.org/sharks/sharkAnatomy.html">http://oceanofk.org/sharks/sharkAnatomy.html</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Images/ Videos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Video on how pigs can produce human organs:</td>
</tr>
<tr>
<td>o <a href="https://www.youtube.com/watch?v=DxVsz2xbJmM">https://www.youtube.com/watch?v=DxVsz2xbJmM</a></td>
</tr>
</tbody>
</table>
# How Are Our Bodies Similar To Other Organisms?

**Homework due: None**

**Habits of Scholarship Checklist (how would you rate yourself 1-4)**

1. I was on time to class
2. I have my materials ready for class
3. I am focused and ready to learn

**Engage Do Now (12 minutes)**

- Use the information in the video to answer the questions below.
  - Watch this video: [https://www.youtube.com/watch?v=DxVsz2xbJmM](https://www.youtube.com/watch?v=DxVsz2xbJmM)

- Record the main idea below in the box (after watching the video).

**What is the Main Idea?**

- Watch video clip a 2nd time and during the movie record three interesting facts.

  1. 
  2. 
  3. 
3.

- Task 4: Write a newscast script stating the main idea and three interesting facts that you learned from the video.

<table>
<thead>
<tr>
<th>Today’s Learning Target</th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I can identify the human body parts.</td>
<td>1) Engage: Prepare a Newscast 12 minutes</td>
</tr>
<tr>
<td>B. I can compare and contrast shark anatomy to human anatomy.</td>
<td>2) Explore: Gallery Walk 15 minutes</td>
</tr>
<tr>
<td>C. I can explain how human body system and the shark body system are both similar and different.</td>
<td>3) Explain Similarities and Differences 15 minutes</td>
</tr>
<tr>
<td></td>
<td>4) Shark Lab: 33 minutes.</td>
</tr>
<tr>
<td></td>
<td>5) Exit Ticket: 5 minutes</td>
</tr>
</tbody>
</table>
Explore: Gallery Walk:  (15 minutes)

Instructions: Mr. Krebs will lead you in a gallery walk. We will observe the images in the hallway, record our data, and then return back to our seats. You will need this worksheet and a pencil/pen.

Task # 1: Pick up this worksheet and a pencil/pen

Task # 2: Walk to the door silently and form a single file line.

Task # 3: Look at the images on the wall in the hallway. Nobody should be talking. It should be silent. Students should be recording their observations and wonderings individually.

Task # 4: Record your notes below.

<table>
<thead>
<tr>
<th>Observations</th>
<th>Wonderings</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do you notice about the pictures:</td>
<td>What do you wonder about the pictures:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task # 5: Return to your seats silently back in the classroom.

Task # 6: Make a prediction. What will we find when we dissect a shark?
Explain: What are the similarities and differences between sharks and humans? (15 minutes)

Task 1: Listen and follow along with a pen while Mr. Krebs reads the shark text below. Resource: http://oceanofk.org/sharks/sharkAnatomy.html

All the creatures living under water have certain characteristics in common. They all need a way to get oxygen. They all need to reproduce to make sure their species continues. They all need to eat to live. But each species also has special features which are unique.

Sharks have highly sensitive senses, a special liver which helps them to float, several rows of teeth, and eyes which aren’t so different from yours. Like rays, shark skeletons are made of cartilage. The shape of a shark is specially designed to help it navigate long distances and maneuver around its prey with ease. Its several pairs of fins help it navigate through the water, kind of like our legs get us humans around, and our arms help us keep our balance.

A shark has several pairs of gills on either side of its head, unlike other fish who only have one gill on each side. You probably breathe through your nose and mouth, but a shark only uses its nostrils for smelling. When people don’t want to be seen by their enemies they sometimes wear fatigue suits. Sharks are born with their own special colors to protect them from predators above and below them in the water.

Task 2: Explain how sharks and humans similar?
Task 3: Use the text above and the anatomy guides on the next page to determine the similarities and differences between sharks and human body parts.

**Shark and Human Body Systems**

| Similarities | Differences |
Shark Dissection Lab (33 minutes)
Resource for lab from: http://oceanofk.org/sharks/sharkAnatomy.html

What are we dissecting?
The spiny dogfish, spurdog, mud shark, or piked dogfish, Squalus acanthias, is one of the best known of the dogfish which are members of the family Squalidae in the order Squaliformes. While these common names may apply to several species, Squalus acanthias is distinguished by having two spines (one anterior to each dorsal fin) and lacks an anal fin. It is found mostly in shallow waters and further offshore in most parts of the world, especially in temperate waters.

Materials
You will be dissecting a dogfish shark: Squalus acanthias. The equipment you will be using includes:

- a large dissection tray
- surgical scissors
- scalpel
- probe
- forceps

Dissection is a learned skill that takes practice and patience. Some general rules to remember are:

1. Do not make deep cuts with scissors or scalpels as you may damage tissue underneath.
2. Know the anatomical terms listed next so you can follow the directions.
3. Read the section you are working on before you start cutting.
4. Try to answer each other’s questions about anatomy before asking your teacher for help. Use the notes from earlier this 6-weeks to help you identify organs.

Task 1: Carefully begin to dissect the shark following the rules above.
Task 2: Flip to page 4 and try to identify the organs and organ systems listed on the table.
- Use the text to help you identify what you see.

Anatomical Terms
1. Cranial- toward the head
2. Caudal- toward the rear
3. Dorsal- toward the spinal cord (back)
4. Ventral- toward the belly
5. Medial- toward the middle
6. Distal- away from
7. Lateral- to the side

**Dogfish Dissection**

The Digestive Tract and Body Cavities

Vertebrates have a coelomic body cavity. This coelomic space is divided anteriorly into a pericardial (heart) cavity and a posterior pleuroperitoneal cavity by the transverse septum, a tough, white membrane. This is the situation in the dogfish and *Necturus*. In mammals, the thoracic cavity is subdivided into a central pericardial cavity and paired lateral pleural cavities around the lungs. The esophagus runs through this cavity, but we will be looking primarily at the posterior cavity, the abdominal cavity in this lab. These cavities are separated by a muscular diaphragm in mammals.

The posterior pleuroperitoneal, visceral or abdominal cavity, houses the liver, digestive tract, and gonads. This body cavity has muscular walls (mesoderm). The visceral cavity is lined on the inside with a transparent parietal (somatic) peritoneum. It is attached to the muscles of the body wall but it also overlies the urogenital system, which is retroperitoneal. The parietal peritoneum from each side meet dorsally and ventrally to form a double walled mesentery. This splits to line the digestive tract and other organs as the splanchnic (visceral) peritoneum. The peritoneum is serous (wet). The fluid serves as a lubricant to allow frictionless movement of the organs.

The primary mesenteries are dorsal and ventral, although the dorsal mesentery is often interrupted and moved to one side or the other with the organs and the ventral mesentery is reduced to the membranes of the liver and bladder. Mesenteries running from organ to organ are usually called ligaments.

**Digestive Organs**

The digestive tract is a tube, with coils and branches, which begins at the mouth and ends either at a cloaca or anus. It processes food, which moves by peristalsis through the process of digestion, absorption and elimination. The general pattern is to have an oral cavity, pharynx, esophagus, stomach and intestine. Accessory organs are the pancreas, liver and gallbladder, which arise as evaginations from the embryonic digestive tract. We will be looking at the variations and similarities in the digestive tracts of the dogfish, salamander and mammal in this lab.

**Dogfish Digestive Tract**

Use scissors to cut through the body wall. Make your longitudinal cut off center from the midventral line and out to the pectoral and pelvic fins, then turn back the flaps. Note the falciform ligament hanging midventrally from the liver in the anterior half of the pleuroperitoneal cavity. You will have to cut this ligament to look into the cavity. Other 5 remnants of the ventral mesentery are the lesser omentum from the liver to the stomach and small intestine and
reproductive mesenteries, which will be looked at later. The dorsal mesentery is seen as the greater omentum holding the esophagus and stomach to the dorsal body wall and dorsal mesentery holding the intestine. From the stomach to the spleen is a gastrosplenic ligament.

The oral cavity contains the tongue and teeth. The pharynx is the portion leading past the spiracle and five gill slits and also contains the tongue in dogfish. Note the taste buds on the tongue. To view this area, cut through the left jaw of the dogfish and perpendicularly through the center of the gills to the pectoral fin. Fold a paper towel over the teeth and use your scissors to open the mouth wide. Make sure you cut all the way through to the pharynx. Cut horizontally across to the other pelvic fin, making sure you are posterior to the transverse septum. You do not want to cut into the pericardial cavity. You will have to cut through the esophagus until you get to the gill slits on the other side. Pull the lower jaw open and clear out any debris. The esophagus extends from the pharynx at the transverse septum and is lined with papillae, which form a tight seal to keep water out. Cut into the esophagus to see the papillae and the stomach with its longitudinal folds called rugae. The "U" shaped stomach, with an anterior cardiac limb and a posterior pyloric limb ends in a constricted pyloric sphincter. The small intestine is composed of, anteriorly, a duodenum, and posteriorly, an ileum, which contains a spiral valve. Cut into the ilium to see the valve, which increases the surface area. The large intestine, rectum or colon, a shorter section than the small intestine has a rectal gland entering it. The rectal gland is for salt excretion for osmoregulation. The rectum, the most posterior portion, ends in the anus which projects into the cloaca, a common opening with the urogenital ducts.

Digestive Organs

Liver, composed of three lobes, and a greenish gall bladder. These extend posteriorly from the transverse septum. Note the bile duct, from the gall bladder, which goes to the duodenum along with two hepatic vessels. Pancreas, consisting of two lobes; a ventral lobe overlying the duodenum, and a dorsal lobe, in the curve between pyloric stomach and duodenum. The pancreatic duct is usually difficult to locate, it runs from the junction of the lobes into the duodenum.

Spleen, an organ of the circulatory system (lymphoid tissue), extends posteriorly from the curvature of the stomach.

*Necturus* Digestive Tract

Use your scissors to make a longitudinal cut off center from the cloaca to the transverse septum. Note the mid-ventral falciform ligament. Cut across the posterior edge of the transverse septum avoiding the pericardial cavity. Like the dogfish, the main digestive tract is in the pleuroperitoneal cavity. The greater omentum extends from the dorsal wall to the stomach and the gastrosplenic
A ligament goes from the stomach to the spleen. The dorsal mesentery holds the intestines to the dorsal wall; it is called the 6 mesocolon at the large intestine. Other ligaments support the lungs and urogenital tract. Be careful not to destroy these delicate membranes when observing the organs.

Use your scissors to cut through the left jaw and ventral to the gills to the pectoral girdle. Cut horizontally through the esophagus to open up the mouth. Be sure to avoid the pericardial area and any blood vessels. In the oral cavity are teeth, two rows in the upper jaw, and one in the lower. The tongue is better developed than that of the shark. The pharynx has two pairs of gill slits. On the posterior floor of the pharynx lies the glottis, a slit that leads into the trachea. From the pharynx to the stomach is a short, poorly defined esophagus. The straight stomach has internal rugae and ends with a muscular pyloric sphincter. The small intestine is the duodenum anteriorly, and then a long coiled portion with internal small folds called plicae, which increase the surface area. There is a short large intestine, which enters the cloaca via the anus.

Digestive Organs

The large liver is not lobed but weakly scalloped posteriorly. The gall bladder is on the liver near the duodenum. The hepatic ducts and bile duct empties into the duodenum as in the shark, but may be difficult to see. The irregular pinkish mass of the pancreas lies on the hepato-duodenal ligament and is fused into one. Two small ducts lead to the duodenum. The pancreas is both an exocrine gland, producing digestive enzymes and an endocrine gland regulating metabolism. The spleen, a lymphatic organ, lies to the left of the stomach.

Mammal Digestive Tract

In mammals, the coelomic cavity is divided into thoracic and abdominal cavities by the diaphragm. The thoracic cavity will be examined in future labs. Make an incision in the midventral line through the abdominal wall muscles of the cat or rat from the sternum to about an inch anterior to the clitoris or penis. Make lateral incisions at the extremities of this first incision and deflect the flaps. Exposed is the abdominal or visceral cavity. Between the diaphragm and the liver are three ligaments, the most prominent of which is the falciform ligament, which connects the right and left liver halves to the abdominal wall. The greater omentum is double layered and filled with fat in cats. It extends from the greater curvature of the stomach to the dorsal body wall and extends to the pelvic region covering and tucking under the intestine. The portion of this mesentery from the stomach to the spleen is the gastroepiploic ligament. From the lesser curvature of the stomach and duodenum to the liver is the lesser omentum. The dorsal mesentery holds the intestines to the dorsal body wall. Other mesenteries hold the urogenital system in place. Try not to tear any of the mesenteries when doing your dissection.

Glands
During the course of your dissection you will remove or view the following glands. For today’s lab, observe the three salivary glands, the submaxillary, sublingual and parotid glands, which are located in the head and neck region.

Digestive System

The digestive tract starts with the mouth and its associated salivary glands. To view the inside of the mouth, cut through the left jaw after prying the mouth open with a folded paper towel over the teeth. Be sure you are not trying to cut through the molars. Bone cutters may need to be used for the cat. To open the lower jaw, cut through the soft palate. In the oral cavity note the differentiated teeth and the mobile tongue. Lift the tongue to see the lingual frenulum. Note the papillae on the surface of the tongue. Feel the roof of the mouth with its anterior hard palate and posterior soft palate. The pharynx extends from the oral cavity to the larynx and allows passage of food and air. The food, when swallowed, travels down the tubular esophagus, which lies dorsal to the larynx. The soft, distensible esophagus penetrates the diaphragm separating the 8 thoracic and abdominal cavities. Food is moved down it by peristalsis. The esophagus ends at the cardiac sphincter. The J-shaped stomach ends at the pyloric sphincter. The convex side is the greater curvature; the concave side is the lesser curvature. The small intestine starts at the pyloric sphincter with the duodenum a long curved piece, then begins looping back and forth, still descending as the jejunum. The ascending, looping portion is the ileum and it ends in a T-junction with the large intestine. The blind end of the T is the caecum or appendix, large in the rat, small in cats and humans. The other end is the ascending portion of the large intestine or colon followed by a short transverse portion and a descending portion, which ends in a muscular rectum hidden under the pelvic girdle. It opens at the anus, controlled by sphincter muscles, at the base of the tail. The enlarged and constricted areas of the colon are due to peristalsis.

Digestive Organs

The dark reddish brown lobes of the liver (five in rat, six in cat) are attached to the diaphragm. The central lobe has a gall bladder in a cat, but it is absent in the rat, although both animals have a bile duct leading to the anterior duodenum. The mesentery called the greater omentum, stretching from the spleen to the duodenum contains the two lobes of the pancreas, which look like pink granular bubble gum. One lobe runs from the pyloric sphincter to the spleen, the other along the edge of the duodenum. They meet anteriorly forming one duct, which enters the duodenum beside or with the bile duct. The dark reddish brown spleen is an elongate lobe on the left side just below the stomach.

Assignment:

Fill in the table with the functions of the digestive tract, comparing the digestive system to your own.
<table>
<thead>
<tr>
<th>Organ</th>
<th>Function in human</th>
<th>Function in Shark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stomach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Intestine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spleen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gall bladder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exit Ticket (5 minutes)

In 3 sentences, explain how shark and human body systems are both similar and different.
# Teacher Notes Lesson 25: How do our body systems work together?

<table>
<thead>
<tr>
<th>Time</th>
<th>45 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Students will research one of the eleven human body systems and prepare a poster and presentation speech for the class explaining the function of the human organ system, the organ system that it works with, and the key organs involved.</td>
</tr>
<tr>
<td><strong>NYS Living Environment Curricula Standards</strong></td>
<td>Standard 4, Key Idea 1.2b: Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions.</td>
</tr>
<tr>
<td><strong>Instructional Resources</strong></td>
<td>Information (text [spoken, written, visual], SmartBoard, Chromebooks, textbooks, poster paper, markers, and google timer.</td>
</tr>
</tbody>
</table>
| **Preparation** | 1. Print lab worksheets.  
2. Poster paper and markers should be made available. |
| **Lesson outline** (Refer to lesson plan for instructions and details) | 1. Engage - 12 minutes:  
   o Task 1: Students will watch a shark dissection video and record three organs that they were able to identify in yesterday’s lab.  
   o Task 2: They will explain the function of each of these organs identified.  
   o Task 3: They will explain how these organs work together in the human body to help us live.  
2. Explore Organ Systems - 15 minutes:  
   o Task 1: Students will get into groups of 2-3 students and will choose an organ system to research at the website provided.  
   o Task 2: The students will determine the function of the organ system, what organ system it works closely with, and what key organs are involved.  
   o Task 3: Students will write a speech using this information that found.  
   o Task 4: Students will make a poster with their speech on it.  
3. Exit Ticket - 5 minutes:  
   o Students will self-assess their understanding of human body systems and key organs involved on a grading rubric. Students will use this rubric to determine what they need to learn for their exam. |
| **Assessment** | 1. Formal Assessment:  
   o Collected student work. |
<table>
<thead>
<tr>
<th>References</th>
<th>1. Research Websites:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o <a href="https://faculty.washington.edu/chudler/organ.html">https://faculty.washington.edu/chudler/organ.html</a></td>
</tr>
<tr>
<td></td>
<td>o <a href="http://www.mansfieldct.org/Schools/MMS/staff/gr6sci/Websites/RespiratorySystembyKelseyF.htm">http://www.mansfieldct.org/Schools/MMS/staff/gr6sci/Websites/RespiratorySystembyKelseyF.htm</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Images/Videos</th>
<th>1. Video recap of shark dissection:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o <a href="https://www.youtube.com/watch?v=57fS30dazV8">https://www.youtube.com/watch?v=57fS30dazV8</a></td>
</tr>
</tbody>
</table>
How Do Our Body Systems Work Together?

Homework due: None

Habits of Scholarship Checklist (how would you rate yourself 1-4)

_____ I was on time to class
_____ I have my materials ready for class
_____ I am focused and ready to learn

Engage Do Now (12 minutes)

1) Use the information in the video to answer the questions below.
   Watch this video: https://www.youtube.com/watch?v=57fS30dazV8

2) Record 3 organs that you were able to identify yesterday in lab.
   1.
   2.
   3.

3) Explain the function of each of these organs you identified.
   1.
2.

3.

4) Describe how these same organs work together in the human body to help us live.

5) Write a question that you have.

<table>
<thead>
<tr>
<th>Today’s Learning Target</th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can determine how two human body systems work together.</td>
<td>1. Engage: 12 minutes</td>
</tr>
<tr>
<td>2. I can explain how two human body systems work together in a presentation.</td>
<td>2. Explore &amp; Explain Body Systems: 28 minutes</td>
</tr>
<tr>
<td></td>
<td>3. Exit Ticket: 5 minutes</td>
</tr>
</tbody>
</table>
**Explore: Organ Systems** (15 minutes)

Instructions: Get into groups of 2-3. Choose an organ system below to learn more about. Follow the task prompts to learn how they work in the human body together.

Task # 1: Circle / Choose one human body organ system that you are least familiar with. Go to the corresponding website.

<table>
<thead>
<tr>
<th>Organ System</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integumentary System</td>
<td><a href="http://sciencenetlinks.com/student-teacher-sheets/integumentary-system/">http://sciencenetlinks.com/student-teacher-sheets/integumentary-system/</a></td>
</tr>
<tr>
<td>Nervous System</td>
<td><a href="https://faculty.washington.edu/chudler/organ.html">https://faculty.washington.edu/chudler/organ.html</a></td>
</tr>
<tr>
<td>Respiratory System</td>
<td><a href="http://www.mansfieldct.org/Schools/MMS/staff/gr6sci/Websites/RespiratorySystembyKelseyF.htm">http://www.mansfieldct.org/Schools/MMS/staff/gr6sci/Websites/RespiratorySystembyKelseyF.htm</a></td>
</tr>
<tr>
<td>Skeletal System</td>
<td><a href="http://www.livestrong.com/article/77827-skeletal-system-works-other-systems/">http://www.livestrong.com/article/77827-skeletal-system-works-other-systems/</a></td>
</tr>
<tr>
<td>Muscular System</td>
<td><a href="http://www.livestrong.com/article/76374-skeletal-system-works-muscular/">http://www.livestrong.com/article/76374-skeletal-system-works-muscular/</a></td>
</tr>
<tr>
<td>Endocrine System</td>
<td><a href="http://www.emedicinehealth.com/anatomy_of_the_endocrine_system/article_em.htm">http://www.emedicinehealth.com/anatomy_of_the_endocrine_system/article_em.htm</a></td>
</tr>
</tbody>
</table>
Task # 2: Explore your body system and how it cooperates with others in the body. Complete the chart below.

<table>
<thead>
<tr>
<th>Chosen Organ System</th>
<th>Organ System it works with</th>
<th>Key Function they perform in human body</th>
<th>Key Organs involved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Task # 3: Using the data table above. Complete the tasks below.

1. Write your presentation speech. Put the information on the data above into words.

2. Use the poster paper to draw an illustration/diagram that demonstrates how the two body systems work together.

3. Rewrite your presentation in words on your poster paper.
Exit Ticket  (5 minutes)

Grade yourself based on the presentation rubric below.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>I totally understand</th>
<th>I need to study a bit more</th>
<th>I need to study way more</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can identify the human body organ systems and key organs involved.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can explain how two human body systems work together in a presentation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can demonstrate my knowledge through drawing a diagram/illustration</td>
<td></td>
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</tr>
</tbody>
</table>

What do I need to study? : __________________________
References


http://doi.org/10.3926/jotse.124

http://doi.org/10.1111/j.1467-8535.2012.01382.x


