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BioCraft: Using Gamification to Stimulate Students' Motivation and Acquisition of  
Scientific Terms in a Bilingual Classroom

A thesis submitted in partial satisfaction of the  
requirements for the degree of Master of Arts

in

Education Studies  
Teaching and Learning: Bilingual Education (ASL-English)

by

Kent Alan Turner

Committee in charge:

Tom Humphries, Chair  
Bobbie Allen  
Carol Padden

2014

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Chair

University of California, San Diego

2014

## DEDICATION

Compiling this thesis would not be possible without my family, friends, and individuals who made an impact during my upbringing. My love, Leila, who had to share my essential being with the University of California, San Diego during my self-professed study hermit routines. My mom, who always made sure I was raised properly with plenty of love. My dad, supplying me with plenty of reasons to love science, information, and life itself. My brother and sister, who gave me the joy of playing games. Bobbie, my first teacher in preschool and my last professor in graduate school. Tom, who gave me the resources to complete my vision.

I was also influenced by the works of various maestros in particular realms of human creative expression: video games, books, and movies. The magic of being human is the ability to manipulate, interpret, and express the world around us.

I would like to especially thank Eugene William Albright III for his commitment toward making my vision come true during the implementation of my operating model for this thesis. Without my best friend, William, I would have either undergone premature male pattern baldness or sported a salt-and-pepper hairdo by now. Thank you, William.

This thesis is dedicated to every one of you who believed in me.

## EPIGRAPH

“Empty your mind, be formless, shapeless - like water. Now you put water into a cup, it becomes the cup, you put water into a bottle, it becomes the bottle, you put it in a teapot, it becomes the teapot. Now water can flow or it can crash. Be water, my friend.”

*Bruce Lee*

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## **ABSTRACT OF THE THESIS**

**BioCraft: Using Gamification to Stimulate Students' Motivation and Acquisition of Scientific Terms in a Bilingual Classroom**

by

Kent Alan Turner

Education Studies

Master of Arts in Teaching and Learning: Bilingual Education (ASL-English)

University of California, San Diego, 2014

Tom Humphries, Chair

Gamification is the act of introducing game elements in any aspect of life. In this case, it is a classroom. The operating model of BioCraft was a role-playing game that reinforced deaf students' use of new vocabulary in a gamified environment. BioCraft addressed the problem of deaf students acquiring scientific terms and using these scientific terms bilingually in academic language. BioCraft also established a student-centered learning atmosphere that promoted intersubjectivity, appropriation, and

self-determination. In BioCraft, students became avatars of new organisms living on a new planet who needed to learn about living systems, adaptations, and genetics in order to survive. The results of the operating model suggested that gamification had an effect on deaf students' motivation and frequency of using new scientific terms with minimal persuasion from the teacher.

## **I. INTRODUCTION AND OVERVIEW**

Why do we continue to promote the use of papers and pencils in the classroom while our students go home and interact with technology like iPads, iPhones, video game systems, and browse the internet? Our students are rapidly adapting to the changing world and schools are scrambling to keep up. Teachers worry more about standardized tests than the individual achievements of the future leaders of our world. At UCSD, I've learned about various approaches to teaching and many of them are innovative. All of these approaches are evidence based and will be effective once implemented properly in the classroom. However, there is one philosophy that rang true with me. This radical new movement can be defined in one word: gamification.

Gamification is the act of introducing game elements in any other aspect of life. In this case, it is a classroom. In later sections of this thesis, you will read several case studies and existing curricula that have implemented the philosophy of gamification in classrooms. There are a variety of research studies that prove students are more motivated about approaching learning tasks and exhibit heightened senses of accomplishment. In my case, I have three objectives to achieve with my attempt to gamify my classroom:

1. Engage students with an imaginative operating model that incorporates key terms from academic content
2. Strengthen knowledge retention by reinforcing the *Episodic Memory* theory through content synthesis
3. Establish a student-centered learning environment that promotes intersubjectivity, appropriation, and self-determination

I believe that deaf students who use ASL and English in a bilingual classroom will benefit from gamification as much as their hearing counterparts who use only English in a classroom. In my classroom, my operating model will be associated with seventh grade science vocabulary and content material. Most of the content will be focused on organisms' exterior and interior systems, along with concepts such as adaptations and genetics. With gamification, I will provide plenty of opportunities for my students to use key scientific terms in interactive dialogues and problem-solving situations. There will be situations where they read academic terms, reproduce these terms in ASL with peers, and apply these terms toward situations that arise in the game's operating model.

BioCraft is the name that I've given to my gamification project. It is a role-playing game that places the students in a lush, alive planet filled with organisms that abide by the laws of nature. These organisms are creative projections of the students themselves who exist within the world. As the organisms, the students play BioCraft

with the ultimate goal of fending off humans who attempt to exploit their planet of its resources. In order to strengthen themselves, the students must complete learning tasks and meet behavioral expectations throughout the curriculum to earn experience points that will work toward gaining special abilities in the classroom. These abilities are rewards for staying on task and double as tools to defeat upcoming tasks.

BioCraft is my first, and surely not the last, foray into the symbiosis between games and education. In the following section, I address the philosophy behind my approach toward bilingual education and how I will manage the curriculum as the moderator of my operating model.

## **II. ADDRESSING THE NEED FOR A BILINGUAL APPROACH TO DEAF EDUCATION**

My ultimate approach to this project is to become a model for my students in a way that they will acquire practices in learning scientific content that parallels the community of practice that I emulate in the classroom. By increasing mutual structuring of participation, my students will develop a sense of belonging and share in the everyday practices of our community (Rogoff, 1990; Wenger, 1998). A community of practice can be a family, a neighborhood, a business, a larger community, and in this case, a classroom (Singleton & Morgan, 2006). In a sense, my students will establish their identity and build on ways of being. By incorporating in-depth ASL elaboration of scientific terms as a team, we will develop mutual understanding of the content as Deaf people. As an “expert” participant, I will share my set of everyday practices and by doing this; I support the increased participation of “novices” (e.g. my students) into the joint enterprise (Singleton & Morgan, 2006).

I want my students to understand that they can own scientific terms in their lexicon by giving the words their own interpretation of the meaning in English. I will support their participation by giving elaborate explanations of the scientific terms in ASL, using classifiers and extended storytelling supported by video footage. As a native signer, I will establish a community of practice where participants discuss scientific content without over-reliance on the English language. I will show my students that science can be

appreciated without the interference of struggling with English. By alleviating the struggle with English, I will kindle my students' interest in the pure content area of science.

In the United States and Canada, the average Deaf child is exposed to at least two languages, English and ASL. For English, there is educational support for formal exposure, whereas ASL must be learned under a range of linguistically impoverished, and sometimes negative, circumstances (Hoffmeister, 2000).

Currently, the only Deaf children who have consistent exposure to ASL or close variants of ASL are those with Deaf parents. In rare cases, some hearing parents learn to use ASL with their young Deaf children and thus supply their Deaf child with the input necessary to acquire ASL in a typical language acquisition situation. Only rarely is ASL learned from parents or adults unless those parents and adults are Deaf (Hoffmeister, 2000).

Therefore, if the majority of deaf children in the country are still picking up on the nuances of ASL in BICS, how is it possible that they will perform well in a CALP scenario with ASL? Often, deaf students are overwhelmed with science because the content requires heavy CALP and if the science teacher's ASL skills are inadequate for converting CALP content into BICS, it will present a problem.

For most deaf children of hearing parents, the best opportunity for learning a natural signed language will take place in their classrooms, with the teacher as their primary linguistic model. The sign language proficiency of these children's parents is

dependent on the parents' existing ability or their motivation to learn sign language. In a classroom, with a highly proficient signing teacher being an important role model in language development, the natural signed language may become the child's primary language (Hoffmeister, 2000). This ensures that a deaf child will have access to a primary language in critical learning environments.

### **III. ASSESSMENT OF NEEDS AND RELEVANT RESEARCH**

We live in a society obsessed with games. Gamification has crept its way into nearly every corner of human culture. We subconsciously play games every day, all day and we do not realize it. We earn airline mileage points by purchasing flights with the same airline on a credit card. This is a game because we ultimately want the rewards that come along after accumulating certain amounts of points. 5,000 points? Here's a free flight for you! 10,000? You may enjoy the airline's executive lounge at select airports across the country! A similar game can be found in the card from your favorite coffee shop with symbols punched into it after purchasing cups of coffee. Punched in all 20 symbols? You have a choice between a free mug or a shirt!

Games are everywhere and if adults love to play them, who says that kids would not, too? Children demand the latest version of a gaming device, whether it be the next Playstation or the newest model of XBox. These are video game consoles designed mainly to play video games but children also find games on their tablets and phones. Back in the day, before video games, children still found games in their backyard, playground, and even the living room. Hopscotch, tag, marbles, baseball, or a game simply to see who could skip a rock the furthest on a glassy pond.

In this age, video games dominate the gaming landscape. 67% of households in the United States play video games. In these households, the average gamer spends 8 hours a week playing video games. 25% of gamers are under 18, 49% are 18-49, and 26% are over

50. This trend is not focused on men and boys since 40% of all gamers are female (Entertainment Software Rating Board, 2010). This shows that the video game industry entices the interest of a wide spectrum of people. The culture of gaming is rooted into our lives, day to day.

The question I have to ask is why are these children so invested in spending hours upon hours playing games without showing the same commitment toward schoolwork? I have had personal accounts of sitting on the couch, playing a video game for nearly 24 hours straight without complaint. However, I cannot bring myself to imagine spending the same amount of time sitting in a classroom. Why is that? The answer lies within the psychological aspects of playing a game.

There are plenty of empirical studies published in peer-reviewed journals that show evidence of the effect games have in the classroom. I took the liberty of digging through resources for meta-analysis research studies and individual research studies that focus on elements of games, including the use of gaming artifacts.

Randel, Morris, Wetzel, & Whitehill (1992) collected sixty-seven studies from 1963 to 1991. They compared traditional classroom instruction with the effect of games on student performance. Based on data analysis, they found that the effects of games on student performance were negligible if no specific content was targeted. However, they found that games were rated as more intriguing than conventional instruction. The most glaring statistic I learned from their research was that only 5 percent of the studies favored conventional instruction over gamified instruction.

Narrowing the focus solely on computer games, a meta-analysis was done by Ke (2009), reviewing eighty-nine research articles with empirical data on using computer-based instructional games in the classroom. Instead of extracting data from quantitative findings, she depended on her analysis of qualitative textual data of the studies for the meta-analysis results. Out of the eighty-nine studies, she found only one that showed conventional instruction being more effective than instruction through computer games.

The learning outcomes of using instructional games showed an improvement in players' higher-order thinking, planning, and reasoning as opposed to an improvement in factual or verbal knowledge. Most importantly, it was evidenced that computer games motivated learners with various skills in different situations. This motivation spilled over to a positive attitude toward learning content material linked with corresponding games.

Motivation exists from the chemical dopamine released inside the brain while we experience pleasure. This pleasure is felt anytime we eat something delicious, possess money, see somebody we care for, and experience anything fun. Once we experience that pleasure, we are motivated to seek more from the same source of that feeling. As teachers, we can use dopamine release as a tool to engage students.

Motivation is a powerful tool if employed properly. Extrinsic rewards may work wonders but it may be means to an end for students and may distract them from the tasks on hand. This is why, as teachers, we balance extrinsic and intrinsic motivation to maintain students' interest in academics with structure and their own personal

investment into the instruction framework. Without extrinsic motivation, students may not find reasons to begin a learning task. Without intrinsic motivation, the same students will not find reasons to continue a learning task. So, in the classroom, intrinsic and extrinsic motivation can coexist.

Traditional forms of instruction often face issues with engaging students in the classroom. For deaf students, I believe that motivation is the key to academic and social achievement inside and outside the classroom. With a correct game design, deaf students will be able to develop social skills bilingually and establish a sense of relatedness in the academic environment with their peers and the teacher. Based on assorted studies and existing curricula, gamification appears to be a plausible approach for deaf students. In the next section, I will introduce you to several case studies of existing curricula done in hearing classrooms. Within these classrooms, there were a range of student needs and performance levels, mentally and physically. Despite the lack of research of gamification in deaf classrooms thus far, I still believe the proven success of gamification in hearing classrooms will translate effectively in a deaf classroom with similar demographics.

#### IV. REVIEW OF EXISTING CURRICULA

Video game developers employ a variety of methods to keep their customers hooked on their products. The *Call of Duty* series uses an intricate system of recording and rewarding player progress in their online multiplayer mode. When you start playing, you begin at level one with minimum weapon options and default special perks. However, once you accumulate online kills and perform certain feats that contribute to the success of your team, you will earn access to more weapons and character upgrades. The reward system is deep enough to reward even the players who perform poorly in most aspects of the game. For example, you may earn 500 experience points (XP) for sprinting for a total of at least one mile during online play. This thread of rewarding XP for sprinting continues when you hit 5 miles (1,000 XP), 10 miles (2,500 XP), and so forth.

After I described my curriculum idea to fellow peers and acquaintances, I was often met with mixed reactions. The general response toward the idea was positive but many questions were directed at the terminology included within the framework. I was not surprised at this since gamification is a new concept and a field of study that is growing as you read this. The type of operating model that I was aiming for in the classroom closely correlated with a popular genre of video game: a role-playing game (RPG). RPGs have a long history in gaming and is widely distributed across several mediums with video games being the primary trendsetter for this genre.

The *Final Fantasy* series, created by Hironobu Sakaguchi and developed by Square Enix, is a popular Japanese role-playing game (JRPG) that presents gameplay features which are often imitated and/or improved upon. A primary example is the *Final Fantasy* system of earning XP to level up and gain abilities and statistical improvements. You may recognize this system as described in the *Call of Duty* franchise's online multiplayer mode. For my curriculum, I felt like I could use a derivation of this popular instant feedback system as a framework for classroom management and an operating model for lesson sequences.

I turned to the internet and an arsenal of newly acquired books on gamification as my guiding light for existing materials and curricula. Fortunately, I did not have to search long for a wealth of case studies on gamification in the classroom.

We begin with Denishia Buchanan (2011), a biology teacher at Marked Tree High School in Marked Tree, Arkansas. 80% of Buchanan's students lived in poverty and usually did not graduate from high school. She recognized this trend of students failing in class and decided to add a new twist in her classroom. Inspired by her own foray into existing curricula, Buchanan decided to profess the marriage between gamification and education inside her classroom.

Beginning in the 2010-2011 school year, three of her sophomore level biology classes began playing "Biology Quest." In this game, students earn XP to reach levels of achievements in a certain amount of time. Buchanan afforded her students open-ended choices between assignments to perform throughout "Biology Quest" to accommodate

varying learning styles. In “Biology Quest”, assignments are called *quests* and rewards for completing quests were primarily XP and Biology Bucks. XP contributed toward the student’s total grade in the class and Biology Bucks was a form of currency used to purchase classroom supplies and hall passes to the library or restroom.

Each quest had a different amount of XP reward, depending on the difficulty of the task. For each level, Buchanan designed a range of quests that appealed to visual learners, auditory learners, and kinesthetic learners. The tasks included but were not limited to: creating websites, making brochures, writing essays, making models, developing analogies, writing rap songs, and producing multimedia projects. Quest information could be accessed in a classroom quest log booklet and at the beginning of each level, all students received a copy of each quest to put in their own quest log folder.

Buchanan started each day with a whole group classroom activity, lecture, or a lab activity. She used this time to present information about the current topic essential to the students’ own inquiry process through individual questing. For questing, the students had access to computers, crafting supplies, and library resources. Buchanan expected her students to follow every detail of instruction on quest guidelines in order to earn credit for the quest. Aside from assignments as quests, Buchanan gave her tests a different label as well: dungeon quest. If students failed a dungeon quest, they had to attempt again until a minimum of 60% on the test was achieved.

Buchanan's evaluation of her curriculum showed a high amount of student satisfaction and motivation. Her students felt that the questing system gave them independent choices in how they wanted to learn the content material. The students knew what to expect in terms of earning XP, setting personal goals to complete quests, and reaping the rewards of completing tasks. In a data analysis, Buchanan calculated that only 3% of her students earned a score of *advanced* in the quarterly End of Course Practice Test in 2009. After incorporating "Biology Quest", 55% of her students scored *advanced*. In December of 2009, 62% of her students passed with a D or higher. In December 2010, 98% of her students passed with a D or higher (Buchanan, 2011).

The level of success among students in Buchanan's classroom was evident from the data I read in this case study. It showed that a little creativity in the operating model of a classroom is capable of going a long way in terms of students' motivation and performance. Students were given a certain amount of independence and responsibility for their own actions and Buchanan's gambit proved to be a positive experience for all parties involved within "Biology Quest."

Since I was going to implement my curriculum in a seventh grade classroom, I wanted an age-appropriate example of gamification in the classroom. I found that model in a general math classroom at Robert Louis Stevenson Middle School in Honolulu, Oahu, Hawaii. This classroom is an inclusion type class that consists of five special education students along with ELL (English language learners). Matthew Baylor and

Charles Souza are the team teachers who devised of *Knowledge Quest*, a game set in medieval times as an operating model (Baylor & Souza, 2011).

After reading this case study, I was inspired by many of the elements that Baylor and Souza installed within their role playing game. These elements would later find their way into my final iteration of BioCraft. What I liked the most about *Knowledge Quest* was how the teachers appealed to the students' sense of self worth. In *Knowledge Quest*, students chose and named their own avatar, an imaginary representation of their actual self inside the classroom. The students were grouped into guilds and formed their own Guild Crest, kingdom shape, and seating arrangements.

Baylor and Souza (2011) predetermined the demographic of the guilds based on skill levels and personality types to evenly balance the groups. To track progress in the class, the teachers set up a Google site to display earned XP, status updates, and achievement badges for individual students. Staying true to the abiding formula of leveling in RPGs, each student started from level one and worked their way up to level ten. However, what set this class differently from Buchanan's biology class was the relationship between XP and grades. In Buchanan's class, XP directly influenced the grade you received in class. In this general math class, the grade you received on homework and tests influenced the amount of XP you earned.

As an example, if a student received a 4 (0-4 scale) on a quiz, s/he would receive 300 XP. A 3 on the same quiz would earn 200 XP. A 2 earned you 100 XP. The incentive for earning XP to level up was the prospect of accumulating gold. With each level,

students earned a certain amount of gold to spend on various options given by the teachers. The options included: snacks, pencils, 500 bonus XP, free homework passes, and 20 minutes of recreational time in the classroom.

Baylor and Souza made an interesting discovery through data analysis of their students' gold spending trends. 64% of their students purchased the 500 XP bonus, 14% traded in gold for a free homework pass, the other 14% bought recreational time, and 8% bought snacks. The elephant in the room was the amount of students that bought items that would directly improve their grade in the classroom. Exactly zero percent of students bought grade-altering items while an overwhelming majority bought items that contributed to leveling up. This caught my attention since I felt this was a common trend among children and even adults. We are willing to spend a ridiculous amount of time on games without complaint but if we are forced to spend the same amount of time on the goal of improving grades, there is a noticeable dip in motivation.

In Baylor and Souza's class, the results of *Knowledge Quest* were shown explicitly by students coming to class on time, working together assertively, and an improved quality in completed assignments. The teachers contributed to the operating model of the curriculum by using certain gaming vocabulary throughout the class. The phrase, "Weapons check!", was used to check on the status of students' supplies in their possession. Pencils were swords, dry erase markers were wands, red pens were torches, whiteboards and erasers were shields.

I was skeptical about how this operating model would fare for the motivation of girls in the classroom but as I read on, Baylor and Souza experienced increased participation from girls in their class. Ultimately, the student with the highest XP at the end of the year was a girl. For struggling students, *Knowledge Quest* proved to be the secret weapon for success. Baylor and Souza mentioned that one formerly struggling student in particular exhibited high levels of engagement, teamwork, and completion of assignments and even went as far as claiming that math was now their favorite subject.

In their closing statement at the end of this case study, Baylor and Souza emphasized that the unifying factor in their framework was the experience bar. This experience bar was shown online for each individual student and tracked the progress of the XP that each student earned. The bar would fill up with XP for each level and returned to empty once the student leveled up. This was a powerful visual indicator of individual progress and served as an instant feedback for performance in the classroom (Baylor & Souza, 2011).

Upon reading about the importance of the experience bar, I told myself that I would find a way to incorporate that into my curriculum somehow. I liked the relationship between grades and XP in Buchanan's *Biology Quest* and her approach toward multiple intelligences in students. I also especially liked how Baylor and Souza developed camaraderie among their students in the form of avatars, guilds, and gaming terminology. What I did not like was the model of a classroom market as the primary reward system. It would not be wise for me to spend money on classroom supplies,

snacks, and various resources since I would only be a MA student without income at the time of my implementation. Plus it has been shown that extrinsic motivators only work for the short term, not the long term. I also was still looking for a way to empower my students in a different form of motivation. I soon found the holy grail in Shawn Young's *Classcraft* (2013).

Young is a grade 11 physics teacher at Sherbrooke, Quebec. He is also a web developer who has worked on various web projects and mobile applications. Young was, too, inspired to use video game elements in the classroom. He received his inspiration from the massively multiplayer online role playing game, *World of Warcraft*. His curriculum started off as a joke. During a class session, Young told a student that he should have earned XP for answering a question right and soon enough, that remark snowballed into a collective effort to establish an operating model in the classroom. A couple of Young's students helped him design the game and Young built the game engine in a web application over the course of a weekend (Young, 2013).

Classcraft is an educational augmented-reality multiplayer role-playing game. Played in the classroom, students play as one of three classes, gaining awesome powers, while risking a terrible death. Students gain experience points for good actions and take damage for bad actions. As they gain experience points, students level up and gain powers that can be used in the classroom (Young, 2013).

What I liked most about *Classcraft* was the player classes and their respective powers. Drawing parallels from Baylor and Souza's division of the class into guilds,

Young divided his class into teams of 8. Inside these teams, students were given the choice between three classes: *Mage*, *Warrior*, and *Healer*. Each class had an unique skill tree that would grow as they leveled up in class by earning XP. These powers were the main form of extrinsic motivation in place instead of the classroom market approach that I was not fond of. For example, the mage class had the ability to *teleport*, leaving the classroom for up to 2 minutes at a time.

Adding depth in the role-playing aspect of the game, Young implemented a HP and AP system. HP measured the player's health in the game and AP measured the amount of energy the player was capable of spending on powers. I drew inspiration from this intricate system of risk and reward that would promote unity between members of a team. The depth of Young's curriculum drew me to contact him by e-mail and I managed to set up a brief Skype meeting with him, communicating through text (Young, 2013).

Young admitted that the hardest part of his curriculum was the tedious task of tracking XP, HP, and AP on paper. This was the main reason he developed a web application to assist tracking of student progress. Even with the web application, Young felt that managing the game ate up a lot of time. Since his students did not have access to electronics, Young had to use a system of projectors and computer screens to display student progress and updates to the class agenda. On the other hand, the easiest part about *Classcraft* was getting his students hooked on the game. Young confirmed that there was a noticeable increase in engagement and motivation but felt that there was no

official way to measure a before/after effect since he did not set up a control for data analysis.

After investigating these three case studies, I continued to read through several more instances of gamification in the classroom. All of them shared similar themes and a underlying purpose: to increase students' motivation to learn in the classroom. I was confident that the examples and ideas that I have had accumulated would transfer into a curriculum that would be compatible for an age-appropriate bilingual ASL-English classroom. Buchanan's operating model was interwoven with content in biology. Baylor and Souza's *Knowledge Quest* attributed to the variety in skill levels and special needs among their students. *Classcraft* added a deep layer in the classroom with a role-playing element to student collaboration and motivation.

Gamification lies on a bed of learning theories that bolster the scope of this radical new movement in the marriage between pop culture and education. Upon further investigation, I was able to pinpoint several key learning theories that would double as the mortar layered between the building blocks of my curriculum.

## V. KEY LEARNING THEORIES AND RELEVANT RESEARCH

The primary intention of gamifying my classroom is to increase the motivation level of my students to the point where they can maintain their own engagement in class activities. There are many theories that verify the importance of keeping your students engaged while learning content material. I decided upon five learning theories to base my curriculum on. Several of the theories overlap with each other in terms of similar trains of thought and research.

Keller's (1987) *ARCS Theory of Motivation* is modeled with four factors: *Attention, Relevance, Confidence, and Satisfaction*. Keller's model is popular in the development of e-learning materials and coursework. Keller intended for this theory to be applied toward designing instruction but many elements in this theory are relevant to gamifying a classroom.

Naturally, you have to grab the attention of your students before you begin anything else. Without your students' attention, it is absurd to think that they will learn anything from you so the first step in the ARCS model is to draw their interest into the lesson sequence. As teachers, there are many methods to gain your students' attention: raising a question, associating with personal experiences, and using visual aids. Not only that, we can employ role-playing situations or a hands-on experience. Ultimately, to maintain interest through a long period of time, we can mix up our method of delivery.

The second step in the ARCS model is to make the material relevant to your students. A popular method of doing this is to activate your students' prior knowledge on the content material. Another way of making learning relevant is to match the motives of your students with the goal of the learning task. Making the goals explicit to your students will fuel their engagement into the task, whether it be for personal achievement, taking risks, or increased affiliation among peers.

Moreover, your students must feel confident with their performance in the classroom. A comfortable and inviting atmosphere should be set in the room if you want your students to learn freely. If your students feel that they can achieve learning, then they will invest energy into doing learning tasks implemented by the teacher. The requirements and expectations of the curriculum should be made obvious to your students at the very beginning of implementation. For example, in *Super Mario Bros*, a Nintendo video game, you are required to save a princess from a castle. That is a very simple premise to lay out for a game but it gave players a clear goal to work towards. For the duration of the game, players moved across a landscape of obstacles willingly, with the knowledge that there will be a castle at the end of the level.

Confidence is built upon success, so students must be given opportunities to overcome small milestones on the way to the primary goal. Learners build confidence when they believe in themselves and their control over their own success. When success is reached, satisfaction is experienced. This is the final step in the ARCS model and will lead to a continued effort from students. Satisfaction is achieved through successful

learning experiences and may only be achieved if the students are engaged, feel the content is relevant, and sense confidence in their ability to accomplish tasks.

Providing your students with small milestones to meet is a major component in gamifying the classroom. Most successful games employ the same instant feedback system that I previously mentioned with *Call of Duty*. The primary goal of the online multiplayer mode was to win matches and improve your overall player level. However, these goals took a while to achieve and players would lose interest if they failed to win matches consistently. So, small milestones were added to maintain interest and to keep players engaged within the game. These milestones were not necessarily relevant to the main goal. Nevertheless, they kept players working toward the goal.

Most people would agree that the original idea behind an instant feedback system were the experiments done by Pavlov (1927) and improved upon by B.F. Skinner (1938). Pavlov's classical conditioning experiments proved a correlation between two events in a cause/effect relationship such as a dog salivating at the sound of a tuning fork since it knew it would be fed. Skinner took conditioning one step further with operant conditioning. Skinner believed he could change an individual's behavioral tendencies by reinforcing a specific behavior to achieve a desired outcome.

This resulted in the famous "Skinner's Box" experiment where Skinner achieved in making a rat receive its own food pellets by pressing a button after hearing a tuning fork. However, the experiment did not spawn linear results like a direct cause and effect relationship. Skinner came up with the terms: *variable ratio reinforcement*, *fixed ratio*

*schedule* and *unpredictable intervals* (Skinner, 1938). Many game developers adopt the reasoning behind these terms to build addictive games. While Skinner and Pavlov's work is recognized – we have to remember that students are not animals. Yes, they will respond, which is considered a conditioned response. We want students to think for themselves and this can be done without conditioned response techniques.

With *variable ratio reinforcement*, a player is rewarded in *unpredictable intervals*. A great example of this being used is in the *Mario Kart* franchise series by Nintendo. The goal of the game is to win a race by being the first kart across the finish line. However, along the way you have to battle other karts by using weapons that you pick up along the way. These weapons are accessed by driving through brightly colored boxes positioned strategically along the track. Upon hitting a box, a roulette-type randomizer appears onscreen before settling on a weapon.

Sometimes the weapon is extremely helpful but sometimes you end up with something that is not what you need at the moment. This *variable ratio* motivates the player to keep using weapons and hitting boxes to successfully navigate the course before reaching the finish line. This is an example of placing small milestones before a main objective. In other games, a *fixed ratio* is preferred for operant conditioning. In the *Call of Duty* franchise, a *fixed ratio* is placed upon small milestones. For instance, if you get 10 kills with a weapon, you are rewarded with a special add-on to that weapon to enhance its performance in future matches.

A successful curriculum does not depend only on extrinsic motivation. Rather, a balance between extrinsic and intrinsic motivation must be reached to elicit the best response from students. Malone and Lepper (1988) were a pair of researchers who put their cumulative work into the “Taxonomy of Intrinsic Motivation”. This theory divided intrinsic motivation into two sections: internal motivation and interpersonal motivation.

Internal motivation dealt with circumstances surrounding:

- Challenge in terms of goals, uncertain outcomes, performance feedback, and self-esteem.
- Curiosity in terms of sensory and cognitive inquisitiveness.
- Control in terms of contingency, choice, and power.
- Fantasy in terms of the emotional and cognitive aspects of fantasy as well as the interweaving of the fantasy and the skills to be learned within the game is important.

Interpersonal motivation stemmed from an individual's:

- Cooperation in terms of players working together to achieve a goal within the game.
- Competition in terms of competing against another player to achieve a goal.
- Recognition in terms of making achievements available for others to see so the hard work needed to achieve a level of mastery in a game is recognized (Malone & Lepper, 1988).

To build upon the concept of intrinsic motivation, we must look to the Self-Determination Theory (Ryan & Deci, 2000). Self-determination is a very human trait that we all share. We like to sense autonomy over our actions and the competence to

perform these actions. The propelling force behind our need for self-determination is the importance we place on relatedness. We crave for a connection with other people and the ability to share experiences (Ryan & Deci, 2000). In a game, the feat of accomplishing tasks by relying on the competence of teammates working together is a very rewarding experience. To use this in a classroom, a student should feel that they are making decisions independently and find confidence in their ability to contribute as a member of the class.

To conclude this collection of learning theories, I had to find one final cog to fit into the great machine of turning my classroom into an authentic game. A truly immersive game succeeds in its immersion by making you forget you are playing a game. Furthermore, I wanted my students to link memories from playing the game with the content they learned along the way. This is called Episodic Memory, the theory that information stored in a person's head is easily recalled when they have a particular meaning. Typically, such memories are recalled through association with a particular time or place and tend to be vivid as they are recalled (Gredler, 1997).

While playing a game in the classroom, my students will be able to draw from the schema formed during that experience and remember the relevant content they learned during that period of time. This type of association is important in the retention of information that we discuss in the classroom. If there is no memory linked to the content material I present in class then it is possible that my students will not recall the

material at a later time. Episodic memory plays a big part in the reason why people are able to remember the birthday of a loved one but not the pythagorean theorem.

Feeling empowered by the insight behind these theories, I visualized a curriculum that would attribute to the needs of my deaf students. I saw a framework where I could add components of both ASL and English into a game world that rewarded players' micro and macro progress. I wanted to promote self-determination among my students and condition their learning by using extrinsic and intrinsic motivation. I would add structure and clearly defined goals by using operant conditioning to give my students autonomy and confidence in their ability to succeed in my classroom.

## **VI. SITE OF IMPLEMENTATION AND CURRICULUM FRAMEWORK**

I am at a residential school for the deaf in Texas. The school enrolls students who range from an early childhood education program all the way up to seniors graduating from high school. For my specific placement, I am in the middle school department composing of students in sixth, seventh, and eighth grade. The department is in one three-floor building that is conjoined with the high school department in another wing.

At this school, ASL/English bilingual education is the prime force behind empowering students to be engaged, life-long learners. The mission of this school is to ensure that students excel in an environment where they learn, grow, and belong. In the eyes of the school, education is a responsibility shared by the students, family, school, and community.

In the seventh grade life science class that will experience my curriculum, the students are on grade level for literacy skills. There are four boys and six girls. One Hispanic student and nine Caucasian students. None of them have special behavioral or learning modification needs.

The teaching approach established by the cooperating teacher is based off the philosophy of adjusting to the students' needs. A common observation tells us that students in this day do not use pen and paper at home. Rather, they use technology such as computers, iPads, iPhones, and other electronic devices. Therefore, we must accommodate

to their interests and comfort zone of approaching tasks with technological resources. The majority of the learning tasks in class require access to computers.

We spend approximately half of our time in the computer lab mainly for exploring games related to content being learned in the classroom. As an example, the website- [www.brainpop.com](http://www.brainpop.com) is used extensively. The school has a paid account that is used by all students to access material like vocabulary practice, short educational videos, review quizzes, and graded quizzes.

In the time since I've gotten here, I've made modifications to my curriculum with the goal of making ideas less abstract and more concrete. For example, I devised of a method to put most aspects of the game on an actual, working game board. This game board will reflect the students' progress throughout the curriculum. They can track the population of their created species and the amount of energy they possess in order to perform adaptations in the classroom.

Based on personal observations, this twist to the curriculum seems to be quite effective. I am glad that I decided to go in this direction since my ideas did not come entirely together until I met my students and got an idea of what was already being done at the school.

Building this curriculum from the ground up was no easy task. It took longer than I expected to cultivate my curriculum into a working model. The primary reason for my struggle can be found in the lack of a solid relationship between gamification and education. Fortunately, I wrote this thesis during a radical change in the public's

culture of education and the acceptance of gamifying the classroom. Only recently we've seen an influx of case studies showing evidence that gamification works wonders for student performance in the classroom. After absorbing other educators' ideas from the case studies that I read, along with a rich and personal history of gaming since my earliest childhood memory, I now present my curriculum framework to you.

The first step in establishing the vision of gamifying my classroom was the decision of making my game a role-playing game (RPG). As evidenced in the case studies described in Section IV, a RPG is the most logical and compatible approach to unifying content material and game elements. I wanted to give my students the chance to hurdle small milestones on the way toward achieving a big milestone. However, I would not be able to hook the students into playing along with my idea without a solid operating model. I needed to appeal to the students' episodic memory and keep the game relevant with content material in the classroom.

In one of my favorite game worlds that I've ever had the chance to immerse myself into, Final Fantasy VII (FF7), what drew you into the game was its plot. FF7 introduced you to a main character who, at the beginning of the game, seemed to be an insignificant person in the great scope of events. This character, Cloud Strife, soon found out that he played a key part in defending his world from an evil opponent. On my journey through the game, I encountered characters and situations that would define how I felt about the game world. Even though I knew the main reason for playing this game was to help Cloud defeat his adversary and save the world, I was fascinated with

the game's operating model. I felt like I was in control of how Cloud and his friends progressed through the game since I was responsible for equipping them with certain items, weapons, and armor along with determining their actions during game situations.

I wanted the same type of autonomy for my students during the curriculum implementation. I would be responsible for introducing them to the game world, the rules that they must play by, and the expectations for winning the game. After that, I would give them the keys to pilot their way through the weeks spent playing the game. However, my game world would be incomplete without investigating the content material scheduled to be taught in my classroom during my time there.

Upon collaboration with my cooperating teacher at the site of implementation, I learned that the school adopted a curriculum called CSCAPE (Constructive, Socialistic, Curriculum of Progressive Education). The purpose of CSCAPE was to replace textbooks in classrooms and provide a comprehensive lesson sequence for teachers throughout the academic year in nearly every subject. CSCAPE was strictly guided by the Texas state standards, Texas Essential Knowledge and Skills (TEKS). In other words, CSCAPE gave teachers a clear path in completing the required learning tasks to meet TEKS expectations. Each teacher at the school had their own online account to access CSCAPE materials, lesson plans, and TEKS documents.

In my 7th grade science class, from August 2012 to April 2013, my cooperating teacher covered seven units from CSCAPE:

- Unit 01: Science Safety and Procedures
- Unit 02: Flow of Energy
- Unit 03: Force and Motion
- Unit 04: Factors Impacting Earth Systems
- Unit 05: Life in Our Solar System
- Unit 06: Organisms and the Environment
- Unit 07: Structure and Function of Cells

During my time at the site as a student teacher, I was expected to finish off the year's five remaining units in seven weeks. These five units focused mostly on living systems and genetics:

- Unit 08: Structure and Function of Living Systems
- Unit 09: Physical, Chemical, and Energy Changes in Digestion
- Unit 10: Homeostasis
- Unit 11: Genetics
- Unit 12: Genetic Variations and Adaptations

Inside these units, there was an average of three to five learning tasks with their corresponding TEKS listed for each activity. I acclimated myself with the expected content material and devised of an operating model that would merge the two curriculums and give birth to a game world. Since we'd be learning about the internal

and external operation of living systems, their variations and adaptations, and the genes that act as blueprints for living systems- I decided that my students should become unique organisms themselves.

These organisms become avatars, creative projections of students' actual selves in the classroom. These avatars live on a planet far, far away from Earth. There are three classes of organisms on this distant planet: Carnivores, Omnivores, and Herbivores. The planet is split up in three continents with at least one organism class on each continent. So, in a sense, the planet is our classroom. The continents, called ecosystems, are the teams that the class is divided among and the avatars are the players who co-exist as teammates.

Merely stopping the process of world building at this point would prove to be moot since the purpose of placing these students in their imaginary existence has yet to be determined. The students need to get a sense of relatedness so I decided to pit them against a common adversary. This adversary is an invading space fleet from off-world. This fleet turns out to be humans from Earth, exploring other worlds for resources and valuables. The students' avatars battle the humans in a unique quiz bowl style challenge.

The quiz bowls are called "boss battles" and represent a robot sent by the human fleet to collect specimen from the planet and consume natural resources. During a quiz bowl, the students use their content material knowledge learned from learning tasks to defeat the boss. The teams rely not only on their knowledge but the camaraderie among teammates and how they use special powers. These powers are called adaptations.

Each avatar has three statistics to keep track of: PP, AP, and XP. You can refer to in-depth explanations in the Appendix. For now, keep in mind that PP tracks the amount of organisms that each student is in control of in the game world. AP represents the amount of energy that the student has to spend on performing adaptations in the classroom. XP refers to their cumulative progress throughout the curriculum. The more tasks the student completes in class, the more XP they earn. With more XP, the student gains more adaptations and increased ceilings of both PP and AP.

In the classroom, there is a game board representing the planet and its three continents. Each student places their PP, which are colored thumbtacks, on their region in their continent. For their AP, pinto beans are stored in covered plastic cups with their avatar name on it. In order to regulate a steady population on the planet, the students must spend AP to reproduce and increase the amount of PP they have on the game world. On the other hand, they can lose PP by making questionable choices in the classroom such as being off task, arriving late, or not completing homework.

Starting with zero XP at level one, the students begin with minimal adaptations like “reproduce” and do not wield any desirable abilities. However, as they complete learning tasks and earn XP, they will level up and earn adaptations. Between the three classes (Carnivores, Omnivores, and Herbivores), adaptations are varied. Students who are carnivores will gain adaptations that are different from omnivores and herbivores. This promotes an understanding among teammates that they must depend on each other to effectively defeat daily quests and boss battles.

If a student's organism population deteriorates to the point where they reach zero PP, they experience extinction. During an extinction event, other species in the ecosystem lose half the amount of their total PP and the student facing extinction must roll a special *Extinction Roll*. This is a six-sided die and each number refers to a consequence the student must face. For example, if the die lands with the number 6 facing up, the student must give a five minute presentation on a topic to be specified.

In summary, there are three distinct sections to this curriculum. The first unit is the world building phase, where the students develop the world they live on, assign names to their avatars and ecosystems, and establish their presence as a player in the classroom. In the second unit, the students build the strength of their avatars through various quests given to them by the Game Master (yours truly), developing a sense of belonging and teamwork among other peers. In the final unit, the students will have the opportunity to defend their planet against a boss during a quiz bowl. Through all phases, the students will recognize their process and evaluate whether they succeeded in their autonomy and strategy.

Throughout the entire implementation process, I will feature an idea inspired by Baylor and Souza's *Knowledge Quest* (2011) and Young's *Classcraft* (2013), an online tracking system. The students will be able to independently check on their progress during class, from home, or on their mobile devices. On this website, the students see their total XP and current PP/AP. In addition to individual metrics, they see completed quests, upcoming quests, and their XP values. The students are able to determine their

approach to the next task and prepare accordingly. After the first unit, world building, is complete, we will cycle between the second and third units throughout the curriculum after each unit in the CSCAPE framework.

Establishing this operating model within an existing curriculum is my ultimate objective since it is essential to the philosophy of gamifying the classroom, rather than making the educational setting entirely into a game. For detailed explanations of the terminology behind my framework, I remind you to refer to the provided glossary. Furthermore, to delve into the details of my operating model, you may flip to the Appendix. For now, I will share the implementation process and its results in the next section.

## VII. CURRICULUM IMPLEMENTATION

### Pre-implementation

The name I gave to my curriculum, BioCraft, drew upon several sources of inspiration. First, there were already existing games on the market with names that ended with “\_\_craft” and followed a similar formula to my curriculum. *World of Warcraft* was already modified into Young’s *Classcraft* (2013). A variant of *World of Warcraft*, under the same publishing company, *Blizzard*, was called *Starcraft* and was thematic in the sense of conquering worlds. Furthermore, there was something vital I learned about my students once I got to know them more during my first weeks at my placement. At the school, one of the main things that the students often talked about was a game called *Minecraft*. If the students were given any iota of free time in the computer lab, they would endlessly ask for permission to play *Minecraft*.

*Minecraft* is a game that has no definite goal. To explain the game in the simplest possible layman’s terms: *Minecraft* is a computer game that resembles the joy of playing with LEGOs. Players are placed in an open world with colored blocks that double as trees, water, rocks, and minerals. You may craft tools of your choice to mine for resources and use these resources to build structures.

Teachers at the school usually felt comfortable allowing students to play *Minecraft* during spare time in class since the game had educational undertones. I made my first connection with my students through *Minecraft* after I had a conversation with several of

them. I shared that I played *Minecraft* back in my college days and after that day, nearly everybody in the school knew I had some experience with the game. Out of amusement and with permission from my cooperating teacher, I decided to play *Minecraft* with one of the class blocks by using my laptop while the students used computers in the lab. They were absolutely thrilled at the experience and I showed them several things that they could do during the game. It was a fulfilling experience that contributed to a sense of bonding.

In the ARCS model of motivation, the first step is to grab learners' attention and maintain it by making content relevant to them. I wanted to seize the opportunity to make my curriculum relevant to my students by adding a familiar element to the operating model's title. In 8th block, all of my students were, at the least degree, familiar with *Minecraft* and video game elements. Since the content we were learning in class were mostly on the subject of biology, I decided to merge the two words into one: BioCraft.

Now, I needed a Learning Management System (LMS) to update and track students' progress in BioCraft. My cooperating teacher had already been introducing the other class blocks to Edmodo, a commercial LMS that was free for teachers and students to use on the internet. This LMS was, to use the best possible analogy, a Facebook clone. Edmodo provides students with an interface to communicate with peers by sharing links, pictures, and status updates. Teachers can upload files and documents, assignment updates, and grades. Edmodo is a high security LMS that gives

teachers full control of the content students can see online. Comments can be approved or deleted by teachers along with anything else uploaded by students.

During my first several weeks at the school, I received preliminary training for Edmodo from my cooperating teacher and picked up on the details through exploration. I could see that Edmodo was extremely effective in managing the workflow of classes. My cooperating teacher would post the day's agenda on Edmodo along with attached files of assignments before each class and once content material was pre-taught, we would move down to the computer lab and have students open their Edmodo accounts online to see what they had to do for the day.

I was thankful that this approach was already being done in blocks through the day but it was not implemented in 8th block, yet. My cooperating teacher decided to allow me the honor of introducing my students to Edmodo along with BioCraft. I had some time to consider the possibility of combining the tools of Edmodo along with the LMS I was already going to build for BioCraft. Since Edmodo did not have the specific resources to deal with leveling up, PP, AP, and XP, I decided to go ahead with the BioCraft LMS. To build the LMS, I had to turn to William Albright, an aspiring programmer and web developer.

Albright was actually the person who came up with the specific term, BioCraft, while posting an early draft of the LMS online. We hosted the LMS on [biocraft.herokuapp.com](http://biocraft.herokuapp.com) and Albright improved the interface through several weeks. The LMS was not ready until the sixth day of curriculum implementation due to some

technical difficulties and aesthetic formatting. Building the LMS was an experience that both Albright and I benefited from since it helped me visualize the data in a neat, user-friendly format. For Albright, it was an enriching task for him since he had to deal with certain aspects of programming that he never faced before.

While Albright was working on the LMS, I had to lay out the schedule for covering specific state standards and units from CSCOPE. My cooperating teacher assisted me in the decision process of eliminating focus on content that we felt were not critical and would hinder the acquisition of content that had applications toward further learning. There was also a major learning task that was not on CSCOPE, a frog dissection activity. We wanted to make time for that vital experience since it touched on most of the units we were supposed to cover.

We ended up eliminating Unit 09: Physical, Chemical, and Energy Changes in Digestion and most parts of Unit 10: Homeostasis. We combined Unit 11: Genetics with Unit 12: Genetic Variations and Adaptations with three major learning tasks that covered most of the content material in both units. The first unit to be covered, Unit 08: Structure and Function of Living Systems had the most information to cover so that was the most difficult unit to measure in terms of budgeting classroom time. I decided to squeeze the content into individual student presentations and scaffold the content further once we arrived at the point of frog dissections.

Before I proceed with the details of my implementation, I will introduce you to the 8th block players of BioCraft via brief individual profiles. I will use their avatar

names throughout this section for the purpose of confidentiality. In addition, I will refer to my cooperating teacher as CT for the sake of brevity.

### Individual Player Profiles

**Convenant** is a class insinuator. He often escalates the discussion material into critical thinking sessions and contributes with comments that validate his peers' understanding of the content. However, Convenant is an intelligent young man who challenges authority and chooses to converse with peers rather than focus on tasks. Convenant is a native signer and has grade level skills in English. Convenant uses ASL primarily at school and home with his deaf parents. He is proficient in video game terminology and logic since he is an avid gamer with daily hours logged playing games at home. Convenant has an above average knowledge of content area in science. Convenant picked his avatar name as a homage to one of his favorite alien species from the blockbuster game series, Halo.

**Dumbo** is a solid rock. She gives balance to the classroom, leading by example. Dumbo is almost always the first to follow instructions and urges others to do the same. Like Convenant and the rest of her classmates, she is on grade level for linguistic skills in English. Dumbo is from a large deaf family and is proficient in ASL. She is a newcomer to role-playing games such as BioCraft but showed a desire to learn and manipulate the playing field. Science is often interesting for Dumbo, but she is content

with learning within the limits of the content material. Dumbo imagined her avatar as an animal with big ears like the Disney character.

**Elmo** is an energetic girl who is confident with her presence in the classroom. She is a native ASL user with a steady command of the English language. She is able to modify her signing from casual to professional and back to casual in the correct situations. Elmo is a perfectionist in her craft and likes to put artistic touches to her work. She is easily distracted by another player, Wonder Woman, but shows maturity in the class. Elmo is also new to role-playing games and throughout the curriculum, she did not show increased interest towards BioCraft. As her avatar, Elmo represents an animal that is jovial and sociable.

**Frankenstein** goes to school because she has to. She enjoys being around people, but likes her own space. She likes to sit with Elmo and Dumbo, listening more than signing. Frankenstein is a native signer who is comfortable with English. She rarely shows an interest in science and only does what is necessary for the learning task. BioCraft is not appealing to Frankenstein and she often struggles with the concepts that come with the game. She enjoys class noticeably more when she works with others in group projects. Frankenstein selected her avatar name because it rhymed with her actual last name.

**Kenkei** has a natural passion for knowledge. She enjoys reading for leisure and uses academic terms voluntarily in class. Kenkei shows evidence of further exploring information, relevant to what is being taught in class, on her own time at home. She

enjoys writing as well and often submits assignments with word counts that go beyond the minimum amount. Kenkeei is not a native signer and does not sign at home.

However, she is able to hear and speak English well. Kenkeei is a casual gamer who has played a variety of game genres and BioCraft came naturally for her. Kenkeei is her avatar with no prior associations, just a completely fictional creature.

**Lionkingful** is a silent calculator. He often asks questions that are challenging to answer and makes comments that are on point. He prefers to work alone and will avoid opportunities to work with his peers. Lionkingful is a native signer but he is not confident with signing in front of other people. His English skills are on par with others in his class and he possesses a large lexicon. He enjoys science immensely and eagerly tackles each assignment with passion. Lionkingful does not miss assignment deadlines and is often the first to complete his work. He is well versed in gaming and tries to beat the operating model of BioCraft in unique methods. As his avatar, Lionkingful is a play on words derived from *The Lion King*.

**Lumi** is a native signer with an older deaf brother. His parents are not fluent signers, but he has been enrolled at the school since his earliest days. Lumi shows the highest interest in science compared to his classmates and is often deep in thought before making surprising connections to content material. Lumi's English skills are on grade level, with a better grasp on reading than writing. Lumi often forgets assignment deadlines, but makes up work with effort. Along with his passion for science, Lumi is the leading expert in video game knowledge compared to his classmates. Lumi is

always fascinated with the curriculum and eager to play BioCraft. Lumi is an avatar name with no prior associations.

**Nymeria** is a girl who loves creative expression. You will usually find Nymeria in the back of the classroom, sitting alone and drawing pictures. Nymeria has a love and hate relationship with science, engaged while on topic of animals, but checks out whenever anything else is discussed. Nymeria is a signer who is able to express herself, but has yet to grasp the full spectrum of ASL. Instructions need to be clear for Nymeria or she will find ways to avoid work and focus on her drawings. BioCraft was appealing for Nymeria but only with certain assignments that promoted expression in art. Nymeria derives her avatar name from a dragon species in the book series, *Game of Thrones*.

**Rica Blast** is a girl who takes school very seriously. Many of her questions often concern assignment expectations and deadlines. She communicates well with teachers and establishes a natural leadership presence in the class. A native signer from a deaf family, Rica Blast is a balanced bilingual who does not struggle with expressing herself in both ASL and English. She enjoys learning science and acquires academic terms efficiently. Although she does not play video games often, she adapts to teaching styles well and seizes control of BioCraft within her limits. Rica Blast is a fictional animal species and serves purely as a name for her avatar.

**Wonder Woman** is an enigma. He is a gifted boy who shows signs of not being challenged enough in school. He hails from a deaf family and signs natively with an above average command of English. Often fingerspells advanced words while

conversing with teachers and peers. However, he is easily distracted in class and disrupts lesson flow with non-stop side conversations. If he is “cold called” upon to answer questions, he does not falter from pressure and gives the expected answers. Wonder Woman possesses a high level of prior knowledge in science and video gaming, recognizing academic terms and concepts immediately along with terms from BioCraft. Wonder Woman picked his avatar name out of amusement, deriving from the Marvel Comics female superhero.

### Implementation

#### **April 11, 2013 - Day One:**

Today was the first day of taking over 8th block. Let me share a bit of advice with you regarding that fact. If you have a choice, do not take over the class on the same day you implement a new curriculum. I could tell it put the class in shock and the students challenged me plenty of times today. Although I spent time with the class in the two weeks leading up to this day, I had not experienced teaching lessons to them directly. I had a casual rapport and connection with the students, but I did not establish a strictly professional relationship, yet. I was prepared to build that in the next weeks, though.

To add fuel to the fire, my CT was absent today and a substitute teacher was present in his place. I had to pass out a test prepared by my CT at the beginning of the class and I was not briefed on the details of the test so I had to wing it without

preparations. Sure enough, some questions in the test were not clear with their instructions. Both the students and I were confused so I decided to tell the students to skip certain parts of the test and wait for the CT to clarify some requirements.

This set things off on the wrong foot since some students finished the test early and went to play near the windows at the back of the class while others were taking the test. I was helping the test takers and I decided to ignore the rest of the students at the back of the room since they were not causing any problems. I was preoccupied with the notion that I was about to introduce them to my curriculum and I was quite nervous at that point. There was an array of things I realized I had to deal with: establishing my teacher role in the classroom, communicating my expectations for my students, and ensuring that they were introduced to the curriculum seamlessly. Once Lionkingful, the last person to finish the test, was ready I called the students back to their tables to begin my implementation.

I developed a Keynote presentation that consisted of content I pre-selected to review with the class. I laid it out in a format that would display the question first and I'd prompt the students to turn to a partner and discuss the question for a minute or less. Before I started with the slides, I asked the students to share two things about themselves: what they love about science and what they want to learn before the end of the year. I had some surprising answers that attributed toward what I wanted to do in class as well: more games in the classroom, more chemistry, more experiments, organism dissections, and Dumbo expressed interest in the Voyager 1 mission.

I gave the class a brief background lesson on Voyager 1, what it was and what its purpose was in the scope of human space exploration. Afterwards, I told the students that they would be split up in three teams, arranged by table groups that would be permanent until the end of the year.

**Team One:** Covenant, Kenkeei, and Rica Blast

**Team Two:** Dumbo, Lionkingful, Lumi, and Nymeria

**Team Three:** Elmo, Frankenstein, and Wonder Woman

The teams were selected based on my CT's feedback. He has had experience teaching this group of students for almost two years so his input was helpful for balancing out the teams. First of all, he highly recommended splitting up the boys into separate teams since it would be a bad idea to put at least two together due to chatty tendencies. After splitting up the boys, we balanced the teams based on content knowledge and skills. Lastly, we filled in the teams with students who we felt would benefit from co-existing as teammates like Nymeria and Lionkingful.

Once I split the teams up and arranged them into separate table groups facing the white board, I could identify some issues immediately. Nymeria and Lionkingful were already on each other's nerves with Lionkingful bothering Nymeria with a pencil. Lumi was constantly talking with his teammates. Dumbo proved to be a solid rock, waiting for further instructions. Covenant was visibly upset with his group arrangement, slouching over on his table with a bored expression.

We started the Keynote presentation and I modeled how the students would answer the question on the board, “What is an ecosystem?”. I turned to a student, asked him the question, and engaged in a partner talk. After modeling, I told the students to go ahead and engage within their team and discuss the question. I seized their attention again by tapping the shoulders of some students and telling them to tap the others’ shoulders. We discussed the questions one by one and throughout the activity, I noticed that the students had a habit of getting out of their seats once they had a chance to talk. This was distracting for everybody, including myself. I made a mental note to seek ways to prevent this from happening again.

The content I selected to review had a direct relationship to the operating model of BioCraft such as ecosystems, population, species, carnivores, omnivores, and herbivores. I showed a slide with a picture of Carl Sagan’s “Pale Blue Dot” quote. I felt this would have been a little over their comprehension and sure enough, I noticed that they did not fully grasp the scope of Sagan’s words. I expanded upon the quote in ASL and allowed the students to chime in with their own comments and interpretations.

Up to this point, I noticed that the group discussions contributed to their bilingual understanding of the academic terms we reviewed. Since nearly every student had an opportunity to speak within groups, they were able to get peer feedback indirectly in conversation that confirmed the meaning behind these academic terms. I confirmed silently that the terminology I selected to be prominently emphasized during BioCraft was definitely on an appropriate level for this group of students.

Once I moved on to the slide that showed the BioCraft logo for the first time. I got a mixed reception from the students. Wonder Woman remarked, “L-O-L, BioCraft? That’s messed up!” While Lumi was obviously engaged, leaning forward in his seat with wide open eyes. The classroom started to break up into side conversations. I showed the next slide with their first two tasks:

1. Create and name a planet.
2. Design its’ three continents and ecosystems.

Before I started the class that day, I prepared a world map in advance. I used a cardboard base paired with a sheet of cork covered with dark blue poster paper that I crumpled up and re-smoothed to resemble an ocean. I attached the paper to the base by using white pushpins along the edges. I stashed this world map in the corner of the room until I revealed their first two tasks then I brought it out. I also designed a continent to model as an example of what I expected my students to do for Task #2.

I told the students that they needed to come up with a name for their new planet and they may discuss names on the white board near the back of the class. After coming up with names, they shall vote on the final decision. I also clarified that they must give names to their individual continents to reflect their team names. I pointed them to the resources they may use: scissors, paper, markers, and tape from the resource room near the front of the classroom. I wanted them to establish a student-centered feeling to the activity so I provided minimal guidance.

First, the students went over to the white board and came up with names like Eyeth, Sparkly, and Ooh. They got a kick out of the name Ooh and ended up agreeing with the name. I approved the name since it was not offensive and I wanted to empower their decision so I typed down “Planet Ooh” on a word processing document in my laptop. The students continued on to Task #2.

I noticed that there was usually one person in each group doing most of the work, cutting out green paper while the others engaged in side conversations. I decided to check on the groups myself and I asked for an update on their continent names. This prompted the students to refocus the topic of their conversations back to discussing a continent name. I also reminded them that three of their continents needed to fit within the limits of the world map. I recommended that they respect the other teams’ space by comparing the size of their continent with the others and come to an consensus about the general size of each continent.

One by one, the teams completed their continent designs and taped their cut-outs on the world map, arranging them on the map and ensuring sufficient space for the other two continents. Team One decided to call their continent **Derp**. Team Two was **Ohlo**. Team Three gave themselves the humorous name of **Sesame Street**. Time was running out and I passed out a document that prompted them to brainstorm the details of their avatar. In the document, I used the word “organism” to stay relevant within the academic content of the classroom. I also passed out a strategy guide to guide their decision in picking an organism.

I was aware that the strategy guide was loaded with new information and terminology. I wanted to give them a weekend to process the information and once we came together for the next session, they would have a general concept of what I would be explaining. I noticed that the students did not pay attention to the papers as they packed up their things and were excused for the day from school. I wondered what they would say about the papers on the next day.

#### **April 16, 2013 - Day Two:**

On this day, BioCraft had finally ingrained. I managed to pull together an elaborate introduction to pull the students into the game world. In the last class session, I passed out documents to allow the students to digest the aspects of BioCraft. I did not expect the students to completely understand the documents. I wanted to give them a sense of disequilibrium before I weaved the information together in an operating model they would associate with information from the documents.

Today, I asked them if they understood the guide. Naturally, most of them were unsure and needed explanation. So, I told them we would go in details today. They were drawn to the game board I had situated next to the teacher desk and I redirected them to stay with their ecosystems, another word to represent their teams/continents. I fingerspelled E-C-O-S-Y-S-T-E-M-S since I did not want to establish a sign for that word, yet. I had a later task for them to develop a name sign for their team.

To launch the day's presentation, I had them think about the question of why humans are on the top of the food chain. Wonder Woman was the most outspoken during this session. Rica Blast and Elmo were highly engaged as well and conversed among their teammates and wanted to elicit more information out of me. We went through the concepts of checks and balances in the natural world. We covered why humans were outside the circle of balance and how we came to be. Basically, after group and whole class discussions, we came to the consensus that nothing could challenge us except us.

Pollution, overfishing, deforestation, and war. I showed images of all these problems in human nature. The students caught on well and I asked them to deduct what would happen if this trend continued. Before I even showed a picture of a desolate planet, they concluded that if this continued, the world would be an empty shell of itself with no water and life.

I showed them a slide of the desert planet. I asked what one organism could possibly survive after all this? Covenant chimed in and said humans. I showed the slide of human spaceships leaving the planet. I told them the story of humans destroying their own planet and seeking another. Finally, they found another beautiful planet. Now, they planned to land and establish colonies and start the same cycle over again.

I made them guess which planet it was. After group discussions, they realized it was Planet Ooh, their own planet. Now, they were very engaged. I told them to imagine the humans doing this to your planet and the animals living on it. Now, this is BioCraft.

I gave the class the ultimate goal of defending their planet against the humans. With that goal, I established the operating model of the game. The students' episodic memories were tuned to the perspective of being on a different planet every time they walked into this classroom.

I explained the rules, using the Keynote as a visual guide. I diagramed a rough sketch of the class' world map along with model organisms as examples of what their avatars could represent. I emphasized that there could only be one of each species classes in each ecosystem: one carnivore, one omnivore, and one herbivore. I made an exception for Ohlo since there were four ecosystem members.

I explained the structure with PP, AP, and XP. I used situational examples to differentiate between the three statistics. I asked them, "If I grade your assignment, can I change what you wrote on your assignment so I can modify your grade?" The students agreed that I had no right to do that. I confirmed their feelings and told them that XP was something they earned and could never be modified or taken away. For PP, I demonstrated with a handful of colored pushpins. Red pushpins represented carnivores, blue pushpins were omnivores, and green pushpins portrayed herbivores on each ecosystem's land mass.

"Suppose Dumbo has five PP in Ohlo and today she arrived to class late. How much PP does she lose?" I asked my students. I got a majority of my students replying with "Two PP!" Next, I had a cup of pinto beans to represent AP. "Suppose Dumbo feels that she is dangerously close to rolling the Extinction Roll with only three PP, and

decides to use the Reproduce adaptation. How much AP does she need to spend in order to use Reproduce?” I laid out the beans in my hand and showed it to them. I got the correct responses with “Two AP are needed to Reproduce.”

I skimmed on the structure of boss battles since I felt the students were absorbing quite a lot of information today. I assured them that they will have a practice boss battle to get the feel of everything before facing their first boss. On the last slide, it showed the date for their first boss battle (April 23) and the boss’ weakness, which was the students’ knowledge of the human body systems. One of the rewards of beating this boss, which I called “Armored Hunter”, was waiving the students from taking a written test.

For the last five minutes of class, I announced that we would finally be using Edmodo, the website that the students had already been hearing a lot about from their peers in the other classes. I already had their group in Edmodo set up with a group code. They were to create an account on Edmodo and use the group code to join my group. This was necessary to move along with the curriculum and their first big project of BioCraft.

I passed out the first week’s assignments at the computer lab and explained that they needed to read the sheet at home and come prepared with questions at the next class meeting. Once class was excused from the computer lab, I had to pick up Lumi’s papers that he forgot at the computer lab. I assured myself that this problem would be

solved once everything was submitted electronically on Edmodo and easily accessed online by the students.

**April 18, 2013 - Day Three:**

Today I introduced the students to their first assignment. In BioCraft, assignments are called quests. The quests are split up in three categories: main, side, and bonus. The main quest is the primary assignment to complete for the highest percentage of possible XP to be earned. Side quests are small tasks to complete along the way up to the due date of the main quest. Bonus quests are assignments that the student may choose to complete or not. Bonus quests reward minimum XP points but are vital toward a satisfactory grade in class. Anyway, for their first main quest, the students were to create a presentation of their assigned individual human body system.

I pre-selected certain assigned topics since my CT felt some were not mature enough to handle some topics like for example, the reproductive system. That topic was assigned to Elmo since my CT was confident with her maturity level to research and present information on the reproductive system to her audience. For the rest of the students, I mostly randomized their assigned topics since each of the ten systems in the human body were equally as important and informative as the others.

Originally, I planned for the first half of class time to have the students research, create, and finish their presentations then in the 2nd half of class time, some students would start presenting. Unfortunately, the students did not take the deadline seriously

and only Lionkingful met the implemented deadline. Lionkingful was disappointed that he was the only one who finished on time and was expressive about further quests, especially the boss battle.

I took this opportunity to discuss the bonus quest sheet with him and to clarify some questions he had about PP and AP. After reviewing the possible bonus quests on the list, he immediately created his name sign for Lionkingful. That was one bonus quest crossed off from the list and he seemed proud of his accomplishment.

I had no choice but to stay in the computer lab for the whole period since it was unreasonable to go back to the classroom and have Lionkingful present by himself and I'd have to come up with something to do for the rest of the class time. So, I kept a mental note to reduce the maximum XP earned for these who did not finish on time down to SILVER. I wanted to set an example for my students to understand that deadlines are very important and there were consequences for failing to meet them.

Some of the students like Covenant and Wonder Woman finished their presentations before class was up. I told them to go ahead and pick any bonus quest to work on during the remainder of class time. I emphasized that the bonus quests were available to perform any time during future free time in class. Covenant ended up playing with the webcam on his computer but claimed he was trying to practice his ASL poem for one of the bonus quests. I mentally doubted his honesty but kept an eye on him. Wonder Woman kept bending over and talking with Covenant and both of them were off task several times.

I decided to take this opportunity to take away the first two PPs in BioCraft, one for each of them due to being off task. This had a surprising effect since they immediately went back on task for the last few minutes of class. Everybody finished their presentations except for Frankenstein, Elmo, and Nymeria. I warned them that they had to finish the presentations from home and be prepared to present when I called their name in class.

I passed out some more documents before class but before leaving, Wonder Woman left his papers on the computer desk and left class without them. I told myself that passing out papers before reviewing them verbally with the class was a bad idea and I needed to stop doing this since it was irrelevant, some students would read but some would not read them.

I realized that my time table for the curriculum was severely impeded since we would not have enough time to have everybody present before the next main quest so I hoped that it would not affect the whole time table in a major way. But, at the same time, it would be a good learning experience for my students to realize that deadlines are important. I noticed that they had a bad habit of submitting work late before I took over as a student teacher so BioCraft should steer them in the direction of maintaining their own responsibility over their work.

**April 19, 2013 - Day Four:**

Before beginning the implementation, I did not intend to have manipulatives to represent adaptations. However, several days into playing BioCraft, I realized that there had to be something concrete for the students to account for the adaptations that they collected. We already had the pinto beans to represent their AP, the colored thumbtacks that doubled as their PP, but nothing to show for adaptations. So, I spent hours making adaptation cards. These adaptation cards were a throwback and personal nod to the cultural significance of Pokemon cards. Back during my childhood, Pokemon cards were popular as collectibles and represented the strength of your card collection. I tailored the adaptation cards after the design of Pokemon cards.

At the beginning of the class, I passed out the new adaptation cards for the students and clarified any questions they had about the new items in their possession. Dumbo asked, “When will we get more cards?” and I replied with an explanation of earning new cards whenever they leveled up to a level that would allow access to more adaptations. The students already had a strategy guide that listed adaptations that corresponded with the level where you achieve these adaptations. I took this opportunity to warn Covenant and Wonder Woman that their PP levels were dangerously low and they could use their “Reproduce” adaptation to increase their PP back to a safe amount.

The boys chose to heed my advice and spent 2 AP to “Reproduce” by adding more PP from their PP cups onto the world map. This was our first time updating the

world map and I felt the whole thing was a bit disorganized and I made a mental note to improve the flow at the beginning of each class. So far, I was making notes on index cards quickly while keeping an eye on students. This time around, they were busy organizing their BioCraft folders. As one of the bonus quests, I decided to establish BioCraft folders for all students to organize all documents that I passed out so they would be easily accessible whenever the students needed to look up specific information. Nearly twenty minutes passed before we started Lionkingful's presentation on the respiratory system.

I laid out the ground rules for etiquette during presentations. We made it clear that questions should wait until the end of each presentation and the students were to fill out the human body systems chart with information given by the presenter. I also reminded them that the charts were their primary study guide to prepare for the boss battle with Armored Hunter. In addition, we established etiquette for the presenter such as waiting for several seconds to make sure everybody was finished writing down information after each slide.

During Lionkingful's presentation, there were instances when Covenant and Wonder Woman interrupted the presenter to clarify points and I had to warn them to wait until the end of the presentation. I gave them a little slack since this was the first out of ten presentations. However, I noticed that the process was taking too long. I decided to see how the day played out with Dumbo and Covenant's presentations.

I filled out the rubric I had for the main quest during the presentations and I converted the information into a grade that I posted on Edmodo privately after class for individual students to check on their own time with some comments and feedback about their presentations. Lionkingful was the only student who got the Gold amount of XP since he met the deadline on time. Even though Dumbo turned in a more impressive presentation, she did not meet all the necessary expectations so she earned a Silver.

After class, I conferred with my CT and he advised timing all the students with a time limit for their presentations. I wholly agreed with him but discussed that it would be too late to add that into the project requirements since three students already presented without a time limit and it would not be fair to require the rest of the students to meet a time limit. The whole process certainly took much more time than I calculated and it was turning out to be a major issue since we had extracurricular conflicts coming up in several of the next class meetings.

#### **April 23, 2013 - Day Five:**

One of the extracurricular conflicts were the State of Texas Assessments of Academic Readiness (STAAR) standardized tests that were school-wide and took up most of class time during the day that continued for nearly two weeks. During this period of time, classes were abbreviated into 30-minute sessions. This had an impact on our schedule since only Wonder Woman and Lumi gave their presentations today. I took away two PP from Wonder Woman and Covenant for delaying the beginning of class

with constant side conversations. So far, they were the only two students losing PP while the rest had nearly no problems being on task.

Lumi's presentation did not go smoothly since he used Pages to type his information and display pictures. It was not reader-friendly to be shown on a projector and white board and everybody had a hard time reading what was on the board. I told Lumi that he had to be mindful of his audience and interpret what it said on the board and present the information in a way that would be easier for his audience to record information in their human body systems chart. Lumi obliged and managed to adjust his game plan.

I noticed that the students saw how I would follow up on my warnings to remove PP from the world map. I felt like I gave out too much warnings rather than straight up pulling out PP from the board since it was the first few days of BioCraft. Even with my slight inconsistency, I could tell that the students knew that losing PP had its consequences and did their best to stay on task. However, I felt that the students were not confident with the use of adaptations and AP since they did not assertively use adaptations at the beginning of class. I attributed this to a lack of a variety of adaptations to use due to their general state of being at low levels. I hoped that once they leveled up and gained more adaptations, they would begin to develop their own approach to BioCraft.

As for the scientific content material, the students showed evidence of gathering information that were optimal and relevant toward the required material to fill out the

human body systems chart. Since I did not lead a rigid teacher-centered learning environment, it was up to the students to teach each other the material. I could see some frustration caused by not being able to ask questions during the presentation. However, self-professed strategies were evident with some students' notes during presentations. For example, Lionkingful and Elmo wrote down a note to remind themselves of what to ask at the end of a presentation.

**April 25, 2013 - Day Six:**

Today, Kenkeei and Nymeria gave their presentations. Nymeria did not give correct information on some slides and I took the time to support students' learning by supplementing Nymeria's answers to students' questions after her presentation. The cardiovascular system has another name for the system, the circulatory system and Nymeria did not make this clear, choosing to explain the two terms as different systems. So, I did not want the students to be confused any further.

After relieving the confusion, I had to rush into the trial boss battle match. In the previous class meeting, I notified the students that they would be doing a practice boss battle to familiarize themselves with the format they would face during the Armored Hunter match. At the same time, this was good practice for me to run the Armored Hunter match smoothly and reduce stress on the students. Since we were in the middle of the class session, I had to instruct the students to arrange their ecosystems into table

groups separate from each other and leave enough space in the middle of the room for students to use the Eggspert buzzers.

For the questions in the game, I used information extrapolated from the students' presentations, but mostly not something that the students would have written in their human body systems chart. This turned out to be a mistake since the questions were too hard and the students felt frustrated by the fact that they did not know the answer to most of the questions. My demeanor did not assist the process since I was racing against the clock and tried my best to complete the practice boss battle before class time was up. Again, today we did not have a full class meeting since we were to attend a school-wide assembly for Earth Day.

I had a printed sheet of paper to record the process of all three rounds in the boss battle but during the game, I did not record the process fully and chose to ignore the updating of PP on the game board. I told myself that all of this was just a practice run to get all of our "feet wet" with the entire process. At the end of the class, I felt like it was not a good day due to rushing the entire thing and I felt responsible for the students' frustration. However, a bright spot out of everything that happened came from Lionkingful.

At the beginning of the class, he assertively called out that he wanted to use an adaptation and handed in the correct amount of AP to trade for the ability to "Reproduce" and add more PP to the world map since he leveled up with XP earned from completing his main quest. This was a good model for students to recognize what

to do with their resources. BioCraft was slowly taking its grip within the operating model of the class and the students continued with the mentality of defeating the boss. This was a sign that their episodic memory were working by associating the information they learned from each other's presentations with the fact that they needed the information to defeat the invading humans.

During the last few minutes of class, we wrapped up the practice boss battle and the students organized their folder, cleaned up the class, and arranged their tables to their original positions before leaving for the Earth Day assembly.

#### **April 30, 2013 - Day Seven:**

We had no class meeting on April 26 due to Earth Day activities so five days passed since our last session. Even so, today was a short class meeting as well due to another school-wide assembly. Fortunately, through the weekend the BioCraft website was completed and went online so I used this time to introduce the students to their new resource. The BioCraft website had everything they needed to keep up with process mainly within the BioCraft operating model.

There was a leaderboard of students' ranking by total XP earned on the main page. At this point, Lionkingful was in the lead due to his completion of several bonus quests in addition to a Gold medal earned during his main quest. The students at the bottom of the leaderboard were these who did not complete their presentations yet like Frankenstein and Elmo. I took this opportunity to elaborate on the students' status in

class so far and what they should expect in the next few days. I passed out the students' passwords via paper cut outs with user names so they could access the website any time.

The website's general reception from the students showed that they liked how the website laid out their process in a visual way with progress bars and links to descriptions of adaptations and a list of completed quests along with upcoming quests. After several minutes of discussion, we went to the school-wide assembly. The assembly unexpectedly ended early so when we came back to class, we only had approximately ten minutes to kill so I instructed the students to complete quests from their list of bonus quests. Most of the students chose to invent their name signs for their avatars before the day was over. I reminded them that the boss battle with Armored Hunter was in two days and they needed to study by reviewing their human body systems chart and browsing the resources on Edmodo.

### **May 2, 2013 - Day Eight:**

At this point, we had spent exactly two weeks on a single main quest. The boss battle I had originally scheduled was delayed by more than a week. A series of assemblies, STAAR test schedules, and extracurricular activities had a serious impact on our schedule and it was evident that the BioCraft schedule had to be adjusted accordingly. Nevertheless, I was glad that today was the last day for student presentations before we moved on to the final phase of the operating model, the boss battle.

The major difference in the curriculum, starting today, was a “Good Afternoon, Planet Ooh!” slide that I had projected on the white board before the students came in. This was something I learned from a prior placement during a previous internship. The slide had an order of instructions for students to follow at the beginning of class to prepare for the rest of the session. I explicitly noted the consequences for not following all steps by the time limit would be the loss of two PP. The expectations were clear but I had to redirect Lumi, Nymeria, and Dumbo to read the instructions carefully.

Frankenstein and Elmo gave their presentations today to complete the ten human body systems assigned to the class. I was impressed with Elmo’s presentation since the content was about the reproductive system. I took extra time to prepare the students before Elmo’s presentation with increased vigilance. I emphasized that the content being given by Elmo may be awkward for the students but it was a testament to their maturity level of being able to handle sensitive information. Thankfully, Elmo kept her composure while explaining details about the female and male reproductive system and did not falter when there were a couple sniggers from the audience.

I gave supplemental information to Elmo’s presentation by explaining how males and females are differentiated by XX and XY designations in our DNA. This brief discussion was a good prelude for our next topic: structures, functions, and adaptations. I also took the time to touch on some interesting information I wanted to mention about the rest of the other systems we covered in the human body. I gave the

ecosystems ten minutes to compare their study guides and get each other up to speed before the boss battle with Armored Hunter.

Using the experience I gained from running the practice boss battle, I prearranged the classroom before the students arrived today. The tables were already arranged by ecosystems with folded markers on top of each table to identify the ecosystem and player seating arrangements. I organized it so the boys did not sit next to each other, thus reducing the odds of them disturbing the class with side conversations. I used the ten minutes of the students' study time to go through the boss battle slideshow privately to ensure everything was in order. I noticed that most of the students did not use their study time wisely. I chose not to intervene because it was their responsibility to prepare accordingly.

When time was up, I reviewed the rules and expectations of the battle against Armored Hunter and clarified any questions from the students. I had Armored Hunter's Health Points (HP) up on the other white board behind the students and my CT assisted in the scoring process. The ecosystems' names were also up on the board and we proceeded with tallying points under the team names throughout the battle.

The first round started off without any issues. We had plenty of time so I paced the process with ease and my calmness rubbed off on the students this time. I noted that the students chose not to use their adaptations aggressively even though using them would have contributed to winning the battle. Naturally, if you are playing a game for the first time you are not accustomed to manipulating the rules of the game to your

advantage and this was evident during BioCraft's first boss battle. I expected this from the beginning and hoped that the students would learn from their errors and adjust for the next iteration.

During round two, I noticed a flaw in my system because some students were repeatedly called up to answer questions since the Eggspert buzzer randomizer selected their assigned color more than once. Even though the gains and losses were distributed across the ecosystems during round two, I did not feel it was appropriate for some students having a reduced opportunity to answer questions.

For round three, I decided to adjust the requirement for a correct answer to ignore any misspellings since content knowledge was more vital to beating the boss rather than specific spelling of academic terms. Even with the adjustment, all three of the ecosystems failed to defeat Armored Hunter. At the end of the boss battle, Armored Hunter had only four HP left. This was a matter of answering one more question correctly or spending AP to use an adaptation such as "Bite" to take away more HP during a single answer.

I gave the students this feedback and my observations of how they could have prepared better for the boss battle. I reminded them that since they did not beat Armored Hunter, they will need to take individual written tests to prove their knowledge of the systems in the human body. In addition to that, three students were absent today (Dumbo, Rica Blast, and Lumi). So, I told them to review their study materials again

and prepare for the test tomorrow. The class cleaned up and rearranged the tables before being dismissed for the day.

**May 3, 2013 - Day Nine:**

I continued my classroom management strategy by posting the “Good Morning, Planet Ooh!” slide on the board before the students came in. They recognized that they had until 1:55pm to study for the written test and followed instructions by sitting in separate locations to study and prepare. I passed out the tests and monitored their demeanor during the test. Most of them recognized the questions to be exactly the same questions from the boss battle with Armored Hunter.

After the students finished the test, I instructed them to continue doing more bonus quests until class was dismissed. Some of them started working on their BioCraft folder covers.

**May 7, 2013 - Day Ten:**

The opening slide proved to be a very helpful addition to the curriculum. I usually have the “Good Afternoon, Planet Ooh!” slide on one side of the screen and the leaderboard from the BioCraft website on the other side. Upon arriving, the students immediately knew what to do and cooperated easily. However, I had to take away PP from three students (Wonder Woman, Elmo, and Covenant) for not following the steps

on the board. Elmo left her PP/AP cup on the world map and the two boys were having a side conversation again.

Kenkeei went ahead and wrote on a separate piece of paper and thought she was following instructions but I redirected her to rephrase what the board said back to me. Upon redirection, she realized she was supposed to ask me for the worksheet instead. This had a ripple effect on the rest of the class and they came up to me to pick up their worksheet for the day's quest.

When it was time to start the class, I did not explain the three terms for the day (structures, functions, and adaptations) because I wanted the students to develop their own understanding of the terms through the interactive group activity that day. I instructed them to split up into their ecosystems and move over to the three stations that I set up at the back of the classroom. There were three different organisms to be examined and discussed within 5 to 7 minutes each station.

I sent them off to their assigned stations and approached each ecosystem to monitor their process. I asked them questions to check for comprehension and asked some students to expand on concepts. I made sure that each ecosystem had a common understanding of what structures, functions, and adaptations were and the role they played for organisms.

After the three ecosystems visited each of the three stations, I called them back to the front of the class and instructed each ecosystem to present their answers to their audience. I established this in the order of whichever ecosystem visited their respective

station first. Through the students' group discussions and informal presentations, I saw that they understood the difference between the three terms and how the three organisms at the three stations were different or similar to each other.

This learning sequence was done to introduce them to structures, functions, and adaptations: the three academic terms pivotal for the educational documentary that I selected for their next major learning event, "Walking with Cavemen". I announced that the class would be split up into ecosystems and there were three possible XP rewards for answering questions based on content from the movie. The ecosystem that gave the best explanations would earn the highest possible XP.

I could see that this had an immediate impact on the students since they spontaneously set up barriers between themselves by using their BioCraft folders to encircle their ecosystem table groups and block the view of opposing teams. I instructed them to focus on the numbered questions only since they directly corresponded with the movie. I moved on by turning off the lights and using my Netflix account on my laptop to show the movie.

I observed the students' actions during the movie from behind their tables. I noticed that some students like Frankenstein, Rica Blast, and Elmo were concerned about catching every line in the movie, expecting to see the answer to each question at anytime during the movie. I recognized that they had not developed the skills to locate an answer and summarize the concept in writing. I noted to myself that I would sign

some aspects of the movie for them and expand on structures, functions, and adaptations during a supplemental instructional presentation during the next class.

**May 9, 2013 - Day Eleven:**

Since the students were finally in the swing of things and getting used to playing BioCraft in the classroom, I could notice an exponential improvement in how the students approached the curriculum. It took longer than I predicted since a lot of class time were lost to exterior conflicts and the irregular block schedule. Today, I could see a marginal difference in the students' progress since I was prompted to hand out a lot of new adaptation cards for the students.

Along with the new adaptation cards, a total of seven students used the "Reproduce" adaptation and I believed that it was due to my increased discipline to focus on pulling out PP from the world map rather than give warnings. The students recognized the adverse effect that a reduced amount of PP would have on their overall status. Another indicator of their strength as avatars in the classroom was their lack of adaptations against Armored Hunter. Some students did not have the necessary adaptations to reduce more of the boss' HP and defeat him during the test.

I used material that I prepared for another seventh grade class to expand on the academic terms of structures, functions, and adaptations. I used a group discussion approach to my instruction and cold called individuals from each ecosystem after their discussion to explain structures, functions, and adaptations. I noticed a better rhythm to

the class with more of my energy invested in instruction rather than being mostly student centered for a change.

We continued “Walking with Cavemen” but with a twist this time, I sat beside the movie screen and summarized some of the points that the movie. I also used student produced examples made during our recent discussion on structures, functions, and adaptations to connect with prior knowledge. I saw a noticeable improvement in the students’ reception of the movie and eventually I had to cut class short due to another assembly for a school-wide sports awards show.

#### **May 10, 2013 - Day Twelve:**

I felt pressured to speed things up and ignore what I felt was irrelevant at this point. I bypassed the entire PP/AP cup retrieval, world map updating, and adaptation use at the beginning of class today because I felt that was taking up way too much time and we needed to finish the movie as soon as possible. I noticed that I was slowly getting tired of constantly calculating students’ PP/AP/XP and updating them on the BioCraft website. I wanted to focus more on the content material since it was getting very interesting. I made a mental note to add this in my curriculum evaluation.

Only seven students showed up today and in time for a new twist to the curriculum. I wanted to add another level of daily motivation for the students to perform at maximum capacity so I implemented an “Ecosystem of the Day” award. This award went to the ecosystem that lost the least PP and exhibited the highest amount of

teamwork and engagement on that day. After announcing it previously, I noticed that the students exhibited an increased level of camaraderie and cooperation. It diverted from their individualistic mentality and prompted a more collaborative atmosphere. I believed this was the final push toward my original vision and purpose behind BioCraft.

I continued to sign aspects of “Walking with Cavemen” for the class. We did not finish the movie this time so we had to continue during the next class session.

### **May 14, 2013 - Day Thirteen:**

Today we finally had a full class session. I used the time to refresh BioCraft with adjustments due to scheduling and lost time. I also wanted to review everything with the students and perform a minor evaluation plan for everything that happened up to this point in the classroom. I had the ecosystems discuss among themselves to define PP, AP, and XP in their own words. After several minutes, I called upon each ecosystem.

Derp described AP as energy and money to use for adaptations. I checked for agreement from the other two groups and they confirmed Derp’s description of AP. Sesame Street described PP as population, the amount of organisms for each player on each ecosystem. Sesame Street also added that if your population was zero, you would face serious consequences. Ohlo explained that XP was earned as a type of grading for tests and homework. You also could earn XP by going to class and doing tasks during class. This brief review confirmed that the students understood what they were dealing with all this time.

I physically handed 2 AP to each student today instead of preloading the 2 AP in their PP/AP cup before class like I always did for each session until now. What I learned by doing this was that the students did not realize they were earning 2 AP daily all these days. I made a mental note to do away with complex features for my next gamification project such as the relationship between PP and AP.

I had the students go ahead and count their PP, AP, and check their statistics on the BioCraft online leaderboard. I went through the leaderboard and compared their total XP to the chart of XP/grade equivalencies. I asked my students to calculate their current grade in class based on their total XP. Dumbo confirmed that all of them were looking at a “D” grade. I nodded and clarified that there were many conflicts during BioCraft that took a lot of time away from our time in class and they were certainly not stuck with a “D” right now.

To adjust for the lost time, I decided to increase the rewards for completing bonus quests from 5 XP to 200 XP. So, for these who already completed bonus quests, they would be getting total XP re-adjustments and any future bonus quests completed would give 200 XP. This got a positive reaction from the students since I could tell they felt down about their “D” in class.

To continue the curriculum revamping, I showed them a new schedule along with an exciting new main quest, an alien organism dissection on May 31st. The “alien” organisms from Earth was actually frogs but for the sake of their episodic memory, I stayed within the realm of the BioCraft mentality. Along with the frog dissection, I

assured them that there were 8,400 total XP to be earned before the end of BioCraft with a final boss battle and a yet-to-be-announced ASL project.

I established a homework assignment for them to complete the bonus quests of creating name signs, ecosystem name signs, a BioCraft folder cover, and a story describing the structures and functions of their avatar. These were the bonus quests that I felt were integral to the BioCraft curriculum and had to be completed. After everything we discussed, everybody in the class felt confident about what happened up to this point and what to expect for the next few class sessions.

We ended the class by continuing the “Walking with Cavemen” movie.

#### **May 16, 2013 - Day Fourteen:**

Today I collected all the ecosystems’ name signs and Covenant turned in his BioCraft cover with impressive artwork. Seven students used “Reproduce” today and Covenant decided to deplete all of his AP to use his “Pounce” ability. At the beginning of the class, I experienced more chaos with the world map than usual since there were way more adaptations to account for and the students were increasingly excited about their progress in BioCraft. During this, a lightbulb went off in my head and I knew what I would do to solve this.

In the meantime, we finally finished the movie and we settled into a session that had the ecosystems review their answers on the worksheet and make sure they covered everything that was asked of them. I took away PP from Elmo and Covenant for

engaging into side conversations during this time. After the worksheet review, I introduced the class to genetics with my slideshow.

The slideshow prompted the ecosystems to discuss and explain the similarities and differences between a cactus, shark, and rabbit in their own words along with what they learned from “Walking with Cavemen”. I was impressed with how much they learned from the movie and I felt rewarded with witnessing their new way of perceiving how life came to be on this planet through history. This was a perfect introduction to genetics since many concepts were complicated but I felt strongly that the students drew themselves into comprehending the content that they were introduced to so far during BioCraft.

#### **May 21, 2013 - Day Fifteen:**

Today I made adjustments to drastically reduce the chaos at the beginning of class. I called each ecosystem up one by one to perform adaptations, hand in assignments, and check/update their status in BioCraft. I also decided to bypass the “Reproduce” adaptation for everybody since I did not update the world map due to technical difficulties on the BioCraft website. There was a glitch in the system that prevented accurate updating of PP and AP so I would have to adjust them manually and that takes almost a hour to account for the modifications.

To activate their prior knowledge before the alien body dissection, I tasked each student to write down what they knew about the systems in the human body within two

minutes. All of the students ended up just listing ten of the human body systems, which was great since it was weeks since we last covered that topic. Some spelling were off but everybody remembered all ten and that was important since we would be recognizing organs during the dissection.

I prompted each student to share one thing they knew about one system from the body. The students ended up giving a fact from the system they gave their presentation on from their first main quest and that was fine with me, I had this as a review activity in mind.

Since the dissection would potentially be a dangerous activity if the students did not follow instructions carefully, I took extra time to make the expectations explicit and straightforward. I already had the dissection supplies organized in the lab region of the classroom and I covered the expectations, modeling correct and improper behavior. It was also helpful that the students assertively chimed in with proper lab conduct according to prior lab activities they experienced with my CT before I took over as a teacher.

Rica Blast showed the class where to get the aprons, eye guards, and gloves. Covenant confirmed the location of the dissection tray and tools. Lumi repeated some of the expectations back to the class and agreed that if anybody was out of order, they would lose dissection privileges and leave the classroom.

Since I wanted optimal hands-on dissection and exploration experience, I split the classroom up into partners rather than by ecosystems. To prevent any issues, I

instructed them to partner up with somebody who was not the same organism class as them (carnivores could not partner up with other carnivores). This worked almost perfectly since Wonder Woman, Nymeria, Covenant, and Kenkeei were the only ones left without partners and they were stubborn about not pairing up so I forced an union between Wonder Woman and Nymeria, Covenant and Kenkeei.

Before commencing with the dissection, I explained the expectations for the clean up procedure in advance because I knew if I tried to explain during the middle or end of the dissection, I would not receive as much attention as I would before the dissection. After explaining the clean up expectations, I told the students to show me that they are ready to start picking up supplies and lab accessories. Covenant jumped up and immediately gathered things without being excused so I told him that he would go last due to ignoring instructions. He got slightly upset but accepted his consequence.

I used an iPad application that my CT highly recommended for guiding the students through the procedure step by step. I repeated that they would be rewarded 100 XP for each organ they locate on the worksheet. However, I cautioned that it is normal to struggle with locating certain organs if they were not careful with the dissection procedure and if they could not find an organ, they should not stress too much about it.

Everybody was absolutely engaged during the activity. Wonder Woman and Nymeria struggled with their motor skills and the dissection tools. Their sense of manipulating body parts and skin flaps to cut off sections were not mechanically correct and I had to step in and model the easiest method of securing body parts for them.

Dumbo and Rica Blast were very fluid in their teamwork and cooperation of dissecting and locating organs one by one. Frankenstein and Elmo lagged behind in their process since they were very engaged with inspecting each organ individually. Covenant and Kenkeei were in the middle of the pack in terms of procedure. Near the end of the activity, Covenant played around with the frog by cutting off unnecessary body parts and I warned him that if he did that, there would be more of a mess for him to clean up.

Lumi and Kenkeei stayed beyond the class dismissal time for almost ten minutes to help with tidying up the classroom. I was impressed with their enthusiasm to help me make sure the classroom was sanitary and ready for the next day. I made a mental note to give them bonus XP for their increased effort. I also noted that I'd give Rica Blast bonus XP for investing a high amount of effort in one of her bonus quests she handed in today, describing the structures and functions of her organism.

### **May 23, 2013 - Day Sixteen:**

I continued my modification to classroom management by calling on each ecosystem individually to update their BioCraft biometrics. This had an amazing effect on my stress level and I was more at ease about handling everything. So far, I've modified the curriculum to add the "Good Afternoon" slide, individual ecosystem call ups, and implemented the adaptation cards. Speaking of adaptation cards, I handed out a lot more of them today due to the students' accelerated process of leveling up.

The students completed a worksheet that asked for the origins of their physical features such as hair color, eye color, and so forth. They held on to their sheets while we reviewed the structures, functions, and adaptations slideshow. I modified my slideshow to combine with genetics so we could scaffold the information into new territory.

Convenant was overexcited and being disruptive while I was trying to present information. I did not want to give him consequences for being extremely engaged so I jokingly asked him if he wanted to take my place as a teacher. Convenant took this as a challenge and accepted. So, I allowed him to come up to the front and explain what he wanted to say. It ended up setting a good dynamic to the group since the students were excited about having him in the front of the classroom and everybody stayed on task. I let this continue for several minutes, delegating power to Convenant and keeping things student centered.

We moved on to a short clip on heredity from the BrainPop website. The video introduced the students to punnett squares and I scaffolded the new information onto the worksheets they did at the beginning of the class. We did a gallery walk of each student's listed physical features by walking around the classroom, moving from table to table to observe each sheet. As a further transition, my cooperating teacher recommended in advance an excellent lesson to explore genetics, Spongebob Genetics. This lesson incorporated physical features of Spongebob and what would happen if he had children with Spongesusie Roundpants. This was age appropriate and the difficulty level was within reach of their skill level.

We went through the activity as a whole classroom, with the students working individually. I elaborated on the concepts discussed in the activity by using the whiteboard to draw an imaginary family with imaginary features. I used the imaginary family to show what “skip a gene” meant by having hair color transfer over to a person through a grandparent, rather than the person’s parents. We then had a brief discussion on what genes were skipped over the students’ parents from their grandparents.

To end the lesson sequence on genetics, we did the Genetics with A Smile activity to apply knowledge from what we learned earlier in the day. During this activity, the students had to toss a coin that represented either alleles on a gene and if the coin landed on whichever side, they had to note down the assigned gene. With the gene, they drew a physical feature on their smiley face that corresponded with a chart of phenotypes.

Some students finished before the class period was done and continued to do their bonus quests. I felt like today was a very productive day because we had the entire class time to focus on genetics and we managed to wrap everything up with what we had been learning all along in BioCraft. Earlier in the curriculum, I was concerned that some aspects were falling apart at the seams and we lost the purpose of gamification. But, after today, I saw how much the students had learned during their time with me and their investment in playing BioCraft was evident with each passing day.

**May 28, 2013 - Day Seventeen:**

Today, I gave my students a choice to select the date for their final boss battle. I presented the details of their boss battle against the Human Fleet. Within the operating model of BioCraft, this was the final invasion by humans with the ultimate objective of taking the planet from the native organisms of Planet Ooh. We went through the study guide sheets that I handed out and I explained that we would be studying independently or within ecosystems at the computer lab. The students ended up voting to take the test on May 29 since they wanted an end-of-the-year party on May 31st.

I collected a high amount of bonus quests that the students completed during the memorial weekend. Lumi handed in the highest amount of work that he was behind in doing and I thanked him for keeping his word about turning them in today. I could tell that the class' excitement level was high, considering they would be having their final boss battle within days. I saw comments like the one from Elmo, "If we use the ability 'Bite' repeatedly, we can make it work. Let's not forget that!" That comment was correct in the sense of being a strategy to beat the boss. That was what I was looking for during the battle against Armored Hunter. I could see that the students were seasoned players at this point and understood what they were working toward all these times in class.

They were seeing results from submitting class work, earning XP, and budgeting AP use in the class. Academic and BioCraft terms were merging into something easily drawn from their episodic memory. For example, their adaptation cards were relevant

toward the content they were learning about organisms' adaptations in nature. They understood that adaptations were something organisms acquired in order to survive better in their changing environment. Within BioCraft, they understood that earning more adaptations gave them a better chance to defeat bosses.

At the computer lab, I was a bit overwhelmed with the amount of questions that the students were asking me. Covenant was very curious about genetic disorders like the "wolfman" syndrome and recessive traits. Rica Blast and Lionkingful wanted clarification about their final grade in the class and any remaining possible XP to be earned. Frankenstein was concerned about her PP and whether it would affect her grade. Dumbo and Rica Blast went through the study guide sheet together and interviewed each other, using questions based on the guide.

I rewarded the class with 500 XP since there was a missing main quest we did not manage to cover, an ASL project that I planned to implement somewhere during the BioCraft curriculum. However, Rica Blast was the only student who did two ASL poems as part of the bonus quest list and managed to earn 400 XP more.

### **May 29, 2013 - Day Eighteen:**

The final boss battle against the Human Fleet portrayed an act of desperation on the part of the invading humans. This was the final stand between the organisms of Planet Ooh and its human invaders. The content material of the boss battle focused mostly on structures, functions, adaptations, and genetics.

Since this was the final act of BioCraft, the students exhibited a level of passion that I had not seen before. They arrived at the classroom, already discussing boss battle strategies and reciting facts from their study guides. The students retrieved their adaptation cards and PP/AP cups, placed them on their tables, and sat intently for further instruction.

Once everybody was ready, I proceeded with the first round. Frankenstein used her “Night Vision” adaptation and identified a free answer to a question. Both Wonder Woman and Covenant used the “Bite” ability to reduce the boss’ HP further. In the fourth question of round one, Lumi used “Bite” while Elmo answered the question right without any adaptations. Kenkeei used “Trample” to deal double damage and earned ten points for Derp. Closing out the first round, Wonder Woman and Covenant both used “Bite” again.

In the second round, things got way more interesting since the ecosystems were allowed to combine adaptations. It resulted into combos that I never imagined would occur in BioCraft. I was taken aback with the students’ creativity and how they manipulated their teammates adaptations along with their own to deal high amounts of damage against the boss. For example, the “Chomp” and “Trample” combination was devastating. Ohlo increased the stakes with “Trample”, “Night Vision”, and “Chomp”. This was an example of all three players in an ecosystem combining their adaptations.

Eventually, it got to the point where the students defeated the Human Fleet before even reaching round three. I had mixed feelings about this. Firstly, I was proud

of my students for obliterating the test with their knowledge and efficient use of the BioCraft operating model. Secondly, I felt that I set the boss' HP way too low for this battle. I should have set the HP at a much higher level so the students would need the entirety of round three to deplete all HP.

To keep the students in the game, I told them that they still needed to complete round three to determine which ecosystem earned the most points during the boss battle. We continued with round three and I was surprised that all three ecosystems scored a perfect answer in round three. It showed that they took the SpongeBob genetics learning activity to heart and used their new punnett square skills to complete round three.

The results of the scoring came back with Sesame Street, with Frankenstein, Elmo, and Wonder Woman, being the top scorer during the boss battle against Human Fleet. In the next section, I will discuss the evaluation process and results of the BioCraft implementation.

## VIII. CURRICULUM EVALUATION PLAN AND RESULTS

My curriculum is evaluated based on four pillars. These pillars have to co-exist with each other if I am to call this curriculum a success. The pillars I list here have arbitrary labels but represent a value in education that I wished to reflect in my teaching philosophy. The pillars will be scored in a rubric from 1-4 (one being the poorest score and four being the highest possible score).

### The Plan

**Fire** – This pillar represents the motivation of my students. Teamwork, classroom management, and efficiency are also noted. Their engagement level in the classroom are observed and measured by tracking XP and HP throughout the curriculum. This pillar depends on the classroom's leveling chart and recordkeeping of the students' HP and use of powers. Evaluation of the records will tell me whether the students actually gained levels and did not lose excessive HP during the curriculum. This is quite simple and straightforward to evaluate firsthand through the graphs. Results will be extrapolated into observations and interpretations.

**Wind** – Bilingualism is an integral essence of this curriculum since my students perform learning activities that stimulate the growth of two languages, American Sign Language and English. This pillar evaluates whether my students show evidence of developing expertise in the expression and reception of both language. The second pillar

will have two evaluations, one for ASL and one for English. The English component is covered mostly in the Earth Pillar since I had an emphasis on scientific terms. However, in the Wind Pillar, the students' ability to use ASL to express scientific content was measured. Through various learning tasks, the students used ASL to explore the meaning behind scientific terms and content that they learned during the curriculum.

**Earth** – My students are in school for a reason. They must learn content in the field of science. The Texas Essential Knowledge and Skills indicate that a middle school student is expected to learn critical knowledge such as (11.B) how organisms and populations in an ecosystem depend on and may compete for biotic and abiotic factors such as quantity of light, water, range of temperatures, or soil composition. This pillar evaluates the curriculum's ability to cover scientific content and show evidence of students learning content and applying them.

Formative and summative assessments from the lesson in my curriculum will evaluate whether my students met the goals and objectives of this curriculum. The Texas Essential Knowledge and Skills (TEKS) standards will be cross-referenced against the students' evidence of achieving these expectations. Individual and group projects, assignments, and activities were evaluated with a rubric and scoring system. For this pillar, a focus on scientific content was performed. The students must show evidence of scientific comprehension and application in scientific experiments and content presentations.

**Water** – To be successful, my curriculum needed to be flexible. A rigid structure does not survive an earthquake by being strong. It has to sway with the motion. A favorite quote by Bruce Lee that I live by, “Empty your mind, be formless, shapeless - like water. Now you put water into a cup, it becomes the cup, you put water into a bottle, it becomes the bottle, you put it in a teapot, it becomes the teapot. Now water can flow or it can crash. Be water, my friend.” This curriculum would not work if scheduling conflicts or unexpected delays were adversely affect the students’ progress.

The final pillar consisted mainly of my thoughts behind this curriculum. I reflected on the efficiency of my lessons and classroom management. I also referred to an original schedule shown on a calendar and compared it to the actual scheduling outcome of the curriculum. The pacing of the curriculum was evidenced by the amount of learning tasks that the students completed within the expected period of time versus the total amount of tasks that was originally planned.

I also decided if this approach was best suited to the pacing of the students themselves or a rigid pacing determined by the teacher. The layout and path of the learning tasks were revised with suggestions for use in future iterations of this curriculum. Modifications for individual students will be discussed as well under this pillar by considering the occurrences of varying individual performances in this curriculum. Was this curriculum adaptable for students with learning difficulties or accelerated abilities?

## The Results

**Pillar I: Fire** - The most surprising part of evaluating the Fire pillar was the fact of who came out in the lead in BioCraft's individual leaderboard. Rica Blast seized a commanding lead with 6,063 total XP. Coming in second was Elmo with 5,818 XP. These students are girls and do not reflect the general public opinion that boys are more into games than girls. Especially since this was a role-playing video game oriented curriculum, I would have expected the highest scoring players to be boys. I was mistaken on that part.

This is an excellent indicator that BioCraft works for both boys and girls. However, the XP was not consistent across the board. For example, the difference between Rica Blast and Nymeria (at the end of the leaderboard), is an astounding 2,353 XP. Upon investigating this, I realized that Nymeria did not participate for the final boss battle which was worth 1,500 XP. So I referenced the person with the second lowest XP, Dumbo with 5,243 XP. The difference between Rica Blast and Dumbo was 820 XP. So, that debunked my original conception that the XP accumulation was not consistent.

Another way to evaluate the results for Fire is the amount of times I had to discipline students by removing PP. The leading candidate for the most amount of PP lost would go to either Covenant or Wonder Woman. During almost every class session, I had to remove PP due to them engaging in side conversations or being off task. It did not seem like the PP system fazed the two boys. However, Nymeria had to lose PP repeatedly but she usually followed up with making right choices in the

classroom. For the rest of the class, there was not a problem with engagement levels and being on task.

Lastly, evidence to support the observations for the Fire scoring may be derived from the amount of bonus quests completed by students. Rica Blast completed the most amount of bonus quests, also being the only one to turn in the two quests with ASL poems. At times, I had to encourage students to complete bonus quests on their own. I even required certain bonus quests to be completed, period.

**Fire Score: 3** - The bonus quests were not completed independently by most of the class with several exceptions. PP had to be removed consistently for mainly two perpetrators. XP earnings were consistent across the board and all students managed to get an overall grade of B or above according to the BioCraft XP/grade scale.

**Pillar II: Wind** - Due to timing constraints, I did not manage to expand the BioCraft curriculum into uncharted territory. I originally wanted to develop an ASL lexicon of academic terms in scientific content during the implementation process. But, that did not come to fruition since I was pressured to cover critical content material in science and promote critical thinking. However, I felt that BioCraft performed well as a student centered curriculum, reducing the amount of time that the teacher seizes attention in the classroom and exponentially increasing the amount of time that students interact with each other.

Through the students' interaction, I could see that they transitioned between communicating key academic terms in writing and signing effortlessly. The terms were mostly fingerspelled but once they were asked to explain complicated concepts, the students were able to use classifiers to describe them. I felt that this was a result of myself being a model of communicating scientific content to the students and laying out a classroom framework for them to extrapolate content onto each other.

**Wind Score: 2** - I was disappointed that an ASL lexicon could not be created but I enjoyed in-depth group discussions with my students and reading their written work in assignments. With more time, it would be very possible to increase ASL's role in this curriculum. However, vocabulary is only one part of academic language. What stood out in my evidence was that the students used scientific terms when they presented and when they were interacting with each other. The students had to use the vocabulary appropriately across settings and learning situations. The lexicon was not established in the way I had planned but this does not mean complete failure in Pillar II.

**Pillar III: Earth** - The content that we covered during BioCraft was grade-level appropriate for this age group. Genetics and genetic variation included a lot of intimidating scientific terms like DNA, genotypes, and phenotypes. We also opened the curriculum with systems in the human body that contained a never-ending list of vocabulary words pertaining to organs and the systems the organs belonged to.

Nevertheless, I saw that BioCraft constantly stimulated the students' episodic memory through the operating model. They were consistently bombarded with words like adaptations, carnivores, and photosynthesis that had duality in both the curriculum and the operating model. The parallels between elements of game and content entwined into one entity and the students used content material either consciously or unconsciously during each class meeting.

For example, the results of the final boss battle explicitly showed that the students were confident with their content knowledge and they used academic terms freely during the final without realizing it. This is a direct result of gamification in the classroom and one of the primary reasons I wanted to go through with this approach to teaching.

**Earth Score: 4** – My operating model worked wonders for my students' acquisition of content material. This is a primary reason for gamification along with engagement and motivation. However, results may vary depending on the GameMaster's implementation of a twist on BioCraft in future classrooms.

**Pillar IV: Water** - If I had to pick the strongest pillar out of the four holding BioCraft up on a pedestal, I would pick water. I was forced to adjust lessons and my schedule constantly due to exterior conflicts and miscalculations in the length of lesson sequences. The students' presentations on human body systems took nearly two weeks in real time. The same could be said for the students' viewing of "Walking with

Cavemen”. However, I was able to adjust XP rewards for previous quests and future quests.

The bonus quests helped greatly with their ability to keep students busy during times when it was not possible to implement full lesson sequences. I was able to add more elements to BioCraft like the opening slide at the beginning of each class and techniques to manage the classroom. I believe that it is important to establish a strong operating model to keep the students hooked in the curriculum and stimulate their imagination throughout the implementation. Once you have this down, everything else will fall in place.

**Water Score: 4** – The flexibility of BioCraft is its strongest feature since it will adapt to any existing curriculum and act as a framework for classroom management and tracking students’ progress in the class. BioCraft would be useless if it stood alone but if it is integrated properly in a classroom, it proved to be a valuable asset to me as a teacher.

## **IX. CONCLUSION**

BioCraft was my first foray into the realm of gamification. I had done a role-playing approach to a curriculum in an earlier placement at a Californian middle school in a sixth grade Earth science class. I used experience from that implementation to reflect on creative approaches toward instructional methods. As a big fan of video games, I shared a common interest with my students and I knew that they would benefit from having their interests brought together with academic material.

Since this was my first production of an operating model, I expected several flaws to come up during the implementation. For one, I set the total XP value way too high with 8,400 XP necessary to get an A. I wanted to make room for necessary changes but that approach ended up giving me a hard time with number crunching throughout the implementation. A much lower number would have helped keep things tidy with quest XP rewards and an approachable leveling system for students to calculate on their own.

Furthermore, I felt that the inclusion of PP was too much to keep track of during class time. I often found myself avoiding the need to deal with PP removal since I would have to calculate the differences after each class and update the BioCraft website accordingly. Since PP was an integral part of behavior management in the classroom, I could tell that the students took advantage of how ridiculously high their PP levels got near the end of the implementation.

That was another miscalculation I made, expecting to manage the classroom by removing PP constantly. The opposite was the fact, with an average of 5 PP removed during each class time. A helpful change in the operating model would be to keep the maximum PP levels for each player class low so they would constantly face the possibility of extinction. In this iteration of BioCraft, none of the students experienced extinction. This defeated the purpose of keeping a game hard. BioCraft was too easy in that aspect for everybody playing the game.

In a future iteration, I would do away with the PP and keep AP as a central management unit for behavior and currency for students to spend. Basically, I would have benefited from a merger of PP and AP into one entity. That would keep things simpler and easier for students to follow. By doing that, I would be able to focus more on content material and reduce the amount of time I spent updating the world map.

On the other hand, the curriculum was successful in making the content material interesting to my students. Their engagement level was consistent and increased near the end of the curriculum once they grasped the concept behind the BioCraft operating model. I could see that they enjoyed the physical aspect of BioCraft like the adaptation cards, PP/AP cup, and the world map.

As a behavior management tool and framework for enhancing existing curriculums in a classroom, I can declare with confidence that BioCraft is an excellent addition to any classroom with a few modifications. As my first product of gamifying

the classroom, this was a revealing experience for me and I will continue to experiment with future iterations of gamification.

This experience was a big boost to my development as a bilingual teacher. It was an exciting challenge to promote the use of high-level academic language in a deaf, ASL-centric classroom. I managed to incorporate the teaching techniques and philosophy I learned at the University of California, San Diego's Education Studies department. I also witnessed the synthesis of learning and playing in an environment that was reliant on English print and ASL dialogue. Moments from my days managing BioCraft within a deaf classroom will always have a lasting impact on my career as an educator.

## **APPENDIX A**

The BioCraft Curriculum

# THE BIOCRAFT CURRICULUM

## Phase Zero: GameMaster Preparation

1. Assimilation
2. Operating Model
3. Leveling Up and Grading
4. Population Points and the World Map
5. Classes, Action Points, and Adaptations

## Phase One: World Building

1. Introduction and World Map
2. Organisms, Classes, and Ecosystems
3. BioCraft Binders

## Phase Two: Questing

1. Experience Points and Variations
2. Recording Data and Accessibility

## Phase Three: Boss Battles

1. Format
2. Content
3. Preparation
4. The Test

## GameMaster Strategy Guide

1. Materials
2. Management
3. Modifications

## Phase Zero: GameMaster Preparation

### 1. Assimilation

BioCraft is not an actual curriculum. It is merely an operating model that doubles as a behavior management model for engaging students in the classroom. As a model of gamification, BioCraft does not present new content material to students. Rather, it is an extension of an existing curriculum inside any classroom.

Your first step toward gamifying your classroom with an operating model such as BioCraft will require you to assimilate the game into your classroom. The majority of your existing curriculum, lesson plans, and content material will remain. The only drastic difference will be the classroom behavior management model and a shift toward a student centered learning environment.

If you are looking for a curriculum that teaches a specific content area then this is not for you. However, if you are looking for a radical new method to engage students inside the classroom and stimulate learning in an unorthodox way of running a classroom, then this curriculum will support the gamification of your classroom.

**GameMaster Tip:** Keep your lesson plans and existing curriculum and prepare to throw out your current behavior management system. Consider the content of your lessons and how you can assimilate a game into your lesson sequences.

## 2. Operating Model

To assimilate a role-playing game in your classroom, the BioCraft way is to use content from an existing curriculum to establish an operating model. BioCraft plays upon students' episodic memory and links content material to elements in the game. As an example, the operating model of BioCraft is as follows:

*A planet far, far away is being invaded by humans and their robotic creations. Players live on this distant planet as organic creatures who must fend off the humans and prevent them from exploiting resources from the planet. The players build strength by completing quests to earn XP and level up, earning adaptations along the way. The adaptations are abilities that the players use to defeat bosses. To win in BioCraft, the players must save their planet and live peacefully without any further human interference.*

This operating model is derived from the content material being learned in a seventh grade science classroom. The content is drawn upon the state of Texas' Essential Knowledge and Skills (TEKS) standards, with an existing curriculum developed by CSCOPE. In CSCOPE, the material being covered is:

- Unit 08: Structure and Function of Living Systems
- Unit 09: Physical, Chemical, and Energy Changes in Digestion
- Unit 10: Homeostasis
- Unit 11: Genetics
- Unit 12: Genetic Variations and Adaptations

You may recognize an underlying theme drawn upon these five units in the CSCOPE curriculum. Beginning at the structure and function of living system, the curriculum ends with genetic variations and adaptations. Without this knowledge, it will not be possible to develop a working game model. BioCraft is a product of an existing curriculum and it must remain a product.

To give you an example of how malleable this operating model can become, I will develop another assimilation within a different classroom. Let us move on to a third grade class in California as a model. The teacher in this third grade class needs an operating model to dictate the process of satisfying the following California Content Standards in Visual and Performing Arts:

1.0 ARTISTIC PERCEPTION: Students perceive and respond to works of art, objects in nature, events, and the environment. They also use the vocabulary of the visual arts to express their observations.

2.0 CREATIVE EXPRESSION: Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

3.0 HISTORICAL AND CULTURAL CONTEXT: Students analyze the role and development of the visual arts in past and present cultures throughout the world, noting human diversity as it relates to the visual arts and artists.

Let's call this game ArtCraft for the sake of continuity. The operating model of ArtCraft that assimilates within the existing curriculum may turn out as this:

*In a land far, far away, a group of beings called "erasers" are erasing all the art from the world. Players become colors who must fend off the erasers and protect the world's art. The players build strength by completing quests to earn XP and level up, earning*

*“brushes” along the way. The brushes are abilities that the colors use to defeat the erasers. To win in ArtCraft, the colors must eradicate the erasers from their land.*

You may notice that I exchanged the words “adaptation” with the word “brush”, “organism” with the word “color”, and “human” with “eraser”. Also, instead of “ecosystem” the labels given to teams can be “prisms”. In BioCraft, the player classes are carnivores, herbivores, and omnivores in an ecosystem. In ArtCraft, the player classes can be blue, red, and green in a prism.

This operating model of ArtCraft draws upon academic terms that will be taught during the duration of the curriculum. Like BioCraft in a seventh grade science class learning about genetics and adaptations, ArtCraft goes hand-in-hand with the skills that the students in that third grade class will learn during art.

**GameMaster Tip:** Review your curriculum and draft an operating model that will go hand-in-hand with gamification. The game world should use academic terms and general concepts that extrapolate educational content.

### 3. Leveling Up and Grading

Lvl 1	0 XP Needed	Grade = F
Lvl 2	50 XP Needed	Grade = F
Lvl 3	100 XP Needed	Grade = D
Lvl 4	200 XP Needed	Grade = D
Lvl 5	300 XP Needed	Grade = C-
Lvl 6	450 XP Needed	Grade = C
Lvl 7	600 XP Needed	Grade = C+
Lvl 8	800 XP Needed	Grade = B-
Lvl 9	1000 XP Needed	Grade = B
Lvl 10	1300 XP Needed	Grade = B+
Lvl 11	1600 XP Needed	Grade = A
Lvl 12	2000 XP Needed	Grade = A+

Leveling is a pivotal feature in BioCraft. Without leveling up, the students will not recognize any progress and lose the need to complete tasks. As you may notice in the table above, the leveling system in BioCraft is correlated with the grading system. Like in a regular classroom, you assign points to assignments and weigh the impact each grading category will have against the overall grade of a student.

In the syllabus of a common classroom, the grading system may resemble this:

40% - Projects

35% - Tests

20% - Homework

5%- Attendance

Within these percentages, individual homework assignments may be worth ten points each with unsatisfactory performance on a single assignment resulting in a six out of ten points. That would be 60% on an assignment and count against the 20% share of the overall grade of a student.

In BioCraft, grading does not work this way. Rather, the game follows the leveling system of a role-playing game. This leveling system is completely positive and points are never taken away. Points may only be gained by meeting expectations on an assignment. In BioCraft, the term for these points is XP. XP represents the ever-increasing experience that the students accumulate through this period of learning.

The relationship between XP, leveling, and quests are explained in-depth in **Phase Two: Questing**. For now, what you should worry about is the amount of XP you will give throughout the curriculum. BioCraft was a seven-week implementation through nineteen days of class meetings. The great thing about BioCraft is that the total XP does not really matter if you adjust the XP value of quests accordingly.

In BioCraft, the maximum amount of XP that a student may earn in class is 8,400. A student begins the game at Level One with zero XP since the student has not gathered any experience yet. You do not give a grade to a student who has not been assigned anything yet. The main thing to be concerned about here is how you will establish a leveling curve.

In BioCraft's leveling curve, a student levels up quicker at the beginning of the curriculum than toward the end of the curriculum. This leveling curve was designed this way as a form of instant feedback. I wanted my students to recognize their process immediately and see the pattern in earning XP by completing quests.

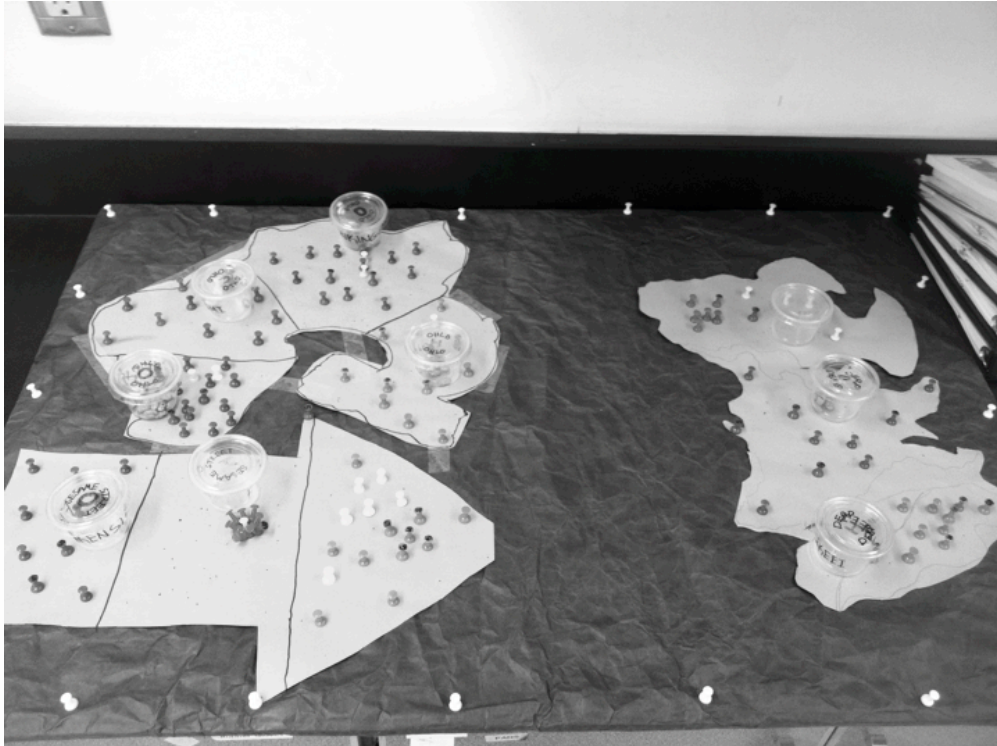
You will also see that a student may not earn an "A" in class if they do not reach Level Eleven or Level Twelve. Level Twelve is the maximum level that a student may attain in class. In BioCraft, if a student reached Level Twelve, that would mean that student attended every class session, completed every quest on time with the best quality, and passed every boss battle.

To transition from Level One to Level Two, a student must earn 50 XP. To transition from Level Two to Level Three, a student must earn 100 XP. At Level Three, that student will have a total of 150 XP with a grade of D. This pattern continues until the end of the curriculum.

**GameMaster Tip:** Establish the maximum possible total XP to be earned during your curriculum. Since BioCraft was my first iteration in gamifying the classroom, I wanted to give myself some breathing room and established the maximum at 8,400.

Realistically, in a curriculum lasting two months, you should establish a much lower number to reduce the need for number crunching.

## 4. Population Points and the World Map



This is a photo of the world map in BioCraft. Remember that the players are on a distant planet which is being invaded by humans. In BioCraft, the players are split up in three ecosystems. These ecosystems can be seen on the map as three different continents. On the continents, the colored thumbtacks represent PP. Each player has their own section within their ecosystem.

PP is the guiding behavior management principle in BioCraft. While XP directly reflects the amount of work the students do in the classroom and affects their overall grade in the end, PP reflects the choices that the students make in the classroom. In BioCraft, PP may be lost by doing the following:

- Being off task (1 PP)
- Not cooperating with the GameMaster (2 PP)
- Arrive to class unprepared (2 PP)
- Arrive to class late (2 PP)
- Tampering with the world map (5 PP)

Let's say a student begins BioCraft with 5 PP. In the next day, the student enters class two minutes late. That accounts for 2 PP being taken away from the student's section of the game board. For the rest of the day, the student will see that they have only 3 PP left on the game board. This is a visual reminder of the choices that they made so far. What makes this a definite behavior management model are the short-term and long-term consequences.

If a student reaches 0 PP on the world map, this is called an extinction. The student then must do an *Extinction Roll*, rolling a die to find out the results of making improper choices in the classroom. In BioCraft, the *Extinction Roll* has six possible consequences by landing on the corresponding number face up:

1. Nothing happens
2. Lose computer privileges
3. Earn half the possible XP on the next quest
4. One page report on an assigned topic
5. Ten minutes after school
6. Present a 5-minute report on an assigned topic

If expectations from an *Extinction Roll* are not met, further XP cannot be earned for that student until the completion of an *Extinction Roll* task. In addition to the *Extinction Roll* consequence, the students' teammates in their ecosystem lose half of their current PP. To

recover from extinction, that student's PP is restored to 50% of their maximum PP during the next class session.

In an imaginary situation, let's say in Ecosystem A, Student A is at Level One and has a maximum of 6 PP. Student A is a team member of Student B and C.

#### Ecosystem A

Student A: 6/6 PP

Student B: 10/14 PP

Student C: 4/6 PP

Student A reaches 0 PP. This results in Student B falling down to 5 PP and Student C falling to 2 PP. Student A does the *Extinction Roll* and accepts the consequences. Now, in the next class session, considering nothing else happens, this is what Ecosystem A will look like:

#### Ecosystem B

Student A: 3/6 PP

Student B: 5/14 PP

Student C: 2/6 PP

Student A's PP is restored to 50% his maximum PP and his teammates lost half of the PP they had on the world map during Student A's extinction event. As a GameMaster, you must update the world map constantly during class time. You may notice that there are plastic cups in the world map. These are the PP/AP cups labeled for each student as a reservoir.

Right now, Student A should have 3 PP in his cup and 3 PP *on* the world map to represent the amount of existing organisms on the planet. If Student A levels up, according to his organism class, he will increase the amount of his avatar's maximum PP. At Level Two, Student A's maximum PP may increase to 8 and that will result in 5 PP inside his plastic cup instead of only 3 PP.

In BioCraft's operating model, losing PP represents losing organisms to the human invaders who abduct creatures off the face of the planet. This is an ongoing scenario that caters to the students' imagination of fending off the invaders constantly by making the right choices during class. Making wrong choices reflect as a sign of weakness that the humans would exploit to the point of extinction.

This is a constant threat and gives the sense of losing a game. Going extinct is the equivalent of losing at BioCraft and doubles as a motivator for students to maintain a healthy PP level.

**GameMaster Tip:** Establish a visual model to track students' behavior and choices in the classroom. Use a model such as the *Extinction Roll* to represent consequences. In addition, this can be countered by AP and adaptations, explained in the next section.

## 5. Classes, Action Points and Adaptations

Player Classes			Omnivore				
			PP	AP			
Carnivore					Herbivore		
			PP	AP	PP	AP	
Lvl 1	3	5	Lvl 1	5	Lvl 1	10	3
Lvl 2	5	8	Lvl 2	8	Lvl 2	13	5
Lvl 3	7	11	Lvl 3	11	Lvl 3	16	7
Lvl 4	9	14	Lvl 4	14	Lvl 4	19	9
Lvl 5	11	17	Lvl 5	17	Lvl 5	22	11
Lvl 6	13	20	Lvl 6	20	Lvl 6	25	13
Lvl 7	15	23	Lvl 7	23	Lvl 7	28	15
Lvl 8	17	26	Lvl 8	26	Lvl 8	31	17
Lvl 9	19	29	Lvl 9	29	Lvl 9	35	19
Lvl 10	21	32	Lvl 10	32	Lvl 10	39	21
Lvl 11	23	36	Lvl 11	36	Lvl 11	45	23
Lvl 12	25	40	Lvl 12	40	Lvl 12	50	25

In BioCraft, the class is split up into three ecosystems with three or four students in each. Within these ecosystems, there must be at least three different player classes in each. The three player classes are: **carnivores**, **omnivores**, and **herbivores**.

The maximum amount of PP and AP increase differently for all three classes at each level. This is not the only difference between the three classes since all three acquire different sets of adaptations throughout BioCraft. To stay within the operating model, I used academic terms (carnivores, omnivores, and herbivores) to differentiate between three unique classes.

This promotes diversity within ecosystems and stimulates teamwork through self-determination. The students need to develop a sense of individuality but at the same time feel they are a vital member of their ecosystem. Via adaptations, team members can use unique abilities to boost team performance.

As the final step in Phase Zero, you should develop an intricate player class system that tailors to each player's preferred playing style. In BioCraft, I allowed the students to select their own player class after studying the difference between the three classes. This is a form of self-determination and will contribute toward their investment into the curriculum.

On the world map, the carnivores are represented by red PP, omnivores use blue PP, and herbivores are portrayed as green PP. Inside each player's PP/AP plastic cup, their AP levels are represented by pinto beans. I created adaptation cards via Apple's Pages application and each student is handed new adaptation cards every time they gather enough XP to level up. If students want to use adaptations, they must hand you the corresponding amount of AP required to spend.

**GameMaster Tip:** Develop three different player classes that will benefit from each other with adaptations that remain within the continuity of your operating model. Use visual aids to help yourself and your students keep track of everything. As a reference, in BioCraft I used:

- **Color Thumbtacks as PP:** Red Carnivores, Blue Omnivores, and Green Herbivores
- **Pinto Beans as AP**
- **Adaptation Cards for Adaptations**

## Phase One: World Building

### 1. World Map

This phase is critical to the success of your gamified classroom. If you followed all five steps in **Phase Zero**, you should be all set to allow your students to process the new model of classroom management. For a detailed guide to matching up learning tasks with XP rewards, please refer to **Phase Two: Questing**. In **Phase One**, I will give you a step by step guide on how I introduced BioCraft to my classroom.

**1. Establish Student Grouping:** Based on your knowledge of your students, divide up the students into balanced teams based on reading level, content knowledge, student dynamics, and diversity in skills.

**2. Activate Prior Knowledge:** Use a Keynote presentation to review academic terms that your students already know from previous lessons. These academic terms also should be implemented into the contents of your version of BioCraft.

1. What is an ecosystem?
2. What is a trophic level?
3. What is the difference between a producer, consumer, and decomposer?
4. What is the difference between a carnivore, omnivore, and herbivore?
5. What is the difference between photosynthesis and respiration?
6. How are the terms population and species related?

After displaying each question, prompt the groups to engage into a discussion for 1-2 minutes then have them share their answer with the classroom.

**3. A Mysterious Hook:** After the discussions during my implementation, I displayed two tasks for the classroom: 1. Create and name a planet. 2. Design its' three continents and ecosystems.

I had the world map prepared before class without the continents. I told the students to vote on a name for a new planet. After naming the planet, they were to use construction paper to design and cut out their own continents to represent their teams.

Now you have to present the operating model of the game to the students. I used a Keynote presentation that began with the question, “Why are humans at top of the food web?” and prompted a discussion among the students. I continued on through the presentation to show pictures of pollution, overfishing, deforestation, and human disputes through history.

I arrived at the slide that asked the students what would happen if this trend continued hundreds of years into the future. This prompted a sense of an ominous message. After that, I declared that the humans were leaving their desolate planet to explore the galaxy for a fresh planet and they found the planet that the students had just recently made in the classroom.

By this point, your students should make the association between the lore behind the operating model and their purpose in the classroom. After the initial hook, I proceeded to explain the contents of **Phase Zero** to the classroom.

For your classroom, make sure to keep everything as visual as possible, model possible scenarios and use materials that you should have already prepared such as the colored thumbtacks and pinto beans. However, this was done for BioCraft and you may use any other form of materials as you wish.

**GameMaster Tip:** Introduce the game to the students by using theatrics, visual aids, and keep everything explicit and easy to understand. Make sure to encourage a student-centered atmosphere and maintain this throughout the curriculum.

## 2. Organisms, Classes, and Ecosystems

Your students make most of the world-building choices in the classroom. During this phase, self-determination is the major booster in propelling your students' choices and this will result in a sense of ownership over their decision making.

1. Allow your students to select their organism classes. Emphasize that there must be one of each class within an ecosystem.
2. Students name their avatars (organisms).
3. The three ecosystems name themselves via a consensus.

## 3. BioCraft Binders

After doing the above, hand out empty binders for your students to keep any documents collected or developed during BioCraft. Keep in mind that your students will build their binder's features through bonus quests (**Phase Two: Questing**).

The students' adaptation cards can be kept in plastic baggies inserted inside the binder's interior flaps. With your personalized gamification model, you can use the binder method or any other variation to store student work.

## Phase Two: Questing

### 1. Experience Points and Variations

It is vital that you divide up the XP within the quests of your curriculum that account for the amount of work that your students put in the quest. I usually place a higher XP reward on **main quests**, a range of XP rewards for **side quests**, and a consistent level of XP for **bonus quests**.

Think of **main quests** as major projects while **side quests** are daily assignments or homework. In my model, I set three different levels of achievements for **main quests**. Let me use one of my **main quests** from BioCraft as an example.

#### **Main Quest** – Walking with Cavemen

Description: View the documentary and answer the questions on your worksheet with your ecosystem.

**GOLD:** 450 XP – Answer *all* questions with evidence from the movie.

**SILVER:** 400 XP – At least *two* questions were not answered with evidence.

**BRONZE:** 350 XP – At least *four* questions were not answered with evidence.

Remember that the quests in your curriculum should be derived from lessons or projects that are already planned, gamification or not. To assimilate the two, you should assign a XP reward to the quest and aggregate the expectations into levels of XP, especially for main quests. Also, stay true to the operating model of your game.

The main quest of viewing the documentary gave my students the purpose of studying the history of human beings. By studying the documentary, they would be able to understand their invaders better and discover ways to defeat the human invaders. Using

the existing rubric for the sheet with questions from the movie, I managed to set up GOLD, SILVER, and BRONZE medals as three levels of achievements. In these three levels, varying amounts of XP are give.

One of the earliest side quests that the students did for my curriculum was naming their planet. I rewarded my students with 2 XP for naming their planet, “Planet Ooh”. This is an example of how you can associate small XP rewards with side quests. Like I mentioned in **Phase 0.3: Leveling Up and Grading**, you should already determine the maximum amount of XP to be earned during your curriculum. With that in mind, you can spread the XP across quests in your curriculum accordingly.

To fill in the emptiness between main quests, side quests, and boss battles, I established a third form of quest: bonus quests. At the beginning of the curriculum, you should have a list of bonus quests ready for your students to peruse during the implementation period. These bonus quests will give your students something to do if they are done with other tasks during class time. Not only that, they can do bonus quests at home if they want to jump out further in the leveling system and earn more XP faster than the pacing of the classroom.

As a general idea, here is a short list of bonus quests that I provided my students with:

Create an ASL poem about your organism – 200 XP

Give your organism a name sign – 200 XP

Sketch your organism’s body systems – 200 XP

Write a description of your organism’s structures and functions – 200 XP

A high amount of XP is also given after defeating bosses in battles. For example, I rewarded my students with 1,500 XP for defeating the final boss in BioCraft.

## 2. Recording Data and Accessibility

All of your preparation will be for naught if you have no way of keeping track of data. I had a close friend, William Albright, develop a website to display and record everything that happened during BioCraft. The following is a brief instructional guide to develop your own Learning Management System web application:

*BIOCRAFT is a Ruby on Rails app hosted on Heroku.*

*VITAL KNOWLEDGE TO BUILD APP*

*HTML/CSS/JavaScript knowledge is required to work with the front-end, the visual components that are shown on the screen.*

*For the back-end machinery where data points like PP/AP/XP, user details such as name/email/password are calculated and stored, knowledge of the Ruby programming language and the web application framework Ruby on Rails is essential in BIOCRAFT's case, although anyone can replicate BIOCRAFT's functions with different technologies.*

*Data Modeling basically looks like this:*

*User*

*User\_id*

*Name*

*LVL*

*PP*

*AP*

*XP*

*MAX HP (AP, XP)*

*Total XP*

*Adaptation (same for activities, roughly)*

*ID*

*Name*

*Description*

*AP Cost*

*User\_ids (array)*

*Getting data models to work mostly has to do setting up relationships between activities/adaptations and users. In BIOCRAFT's case, this was done via Rails' "has\_many through:" relation model. For example:*

*User*

*has\_many :adaptations*

*Adaptation*

*has\_many :users*

*Each time an user gains an adaptation or completes an activity, that user's user\_id will be added to the adaptation/activity's user\_ids array, so the app will be able to load the right activities/adaptations for each user, or the users for each activity/adaptation.*

*The user data points are updated by Ruby code that looks at the ap\_value or ap\_cost of each activity/adaptation and calculates it against the pertinent user data point. This should be trivial for any experienced programmer.*

The BioCraft website can be accessed with the address: [biocraft.herokuapp.com/](https://biocraft.herokuapp.com/)

The website should be accessible to your students from home, in the computer lab, or through their mobile devices. This accessibility will give the students instant knowledge of their PP, AP, and XP statuses along with accumulated adaptations. Not only that, they will observe the quests they have completed and preview upcoming quests, all before walking into the classroom.

The main feature of accessing data will be the “leaderboard” on the main page of the website. This leaderboard ranks the total XP of students from highest to lowest. This is an extrinsic and intrinsic motivating factor for performance in the classroom.

## Phase Three: Boss Battles

### 1. Format

Boss battles are a form of quizzes or tests that occur at the ending of each unit in your curriculum. The quizzes follow a common quiz bowl format with a category shown before each question.

1<sup>st</sup> round questions are multiple choice, with a time limit of twenty seconds to answer:

- One player in sequence from each ecosystem is called up to buzz in, the first lightbulb to flash gets the opportunity to answer. If the response is not correct, a second chance is given to the remaining two ecosystems.
- All three players can perform an adaptation before viewing the question.
- If the answer is correct, the player attacks the boss by rolling a die. If the answer is not correct, the boss will attack in a varying strength.

2<sup>nd</sup> round questions are open ended, with a time limit of twenty seconds to answer:

- Three randomizers are used to select a player from each ecosystem to target for the question. The player may perform an adaptation before viewing the question. However, the player may confer with members from the same ecosystem to discuss the answer.
- If the answer is correct, the player attacks the boss by rolling a die. If the answer is not correct, the boss will attack in a varying strength.

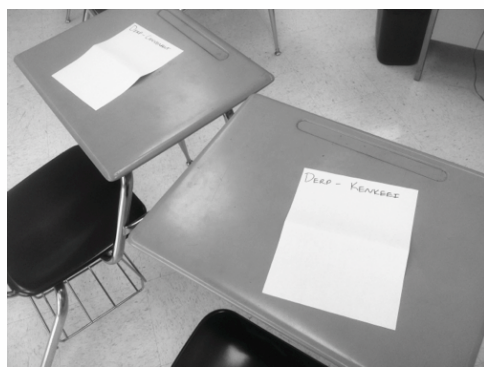
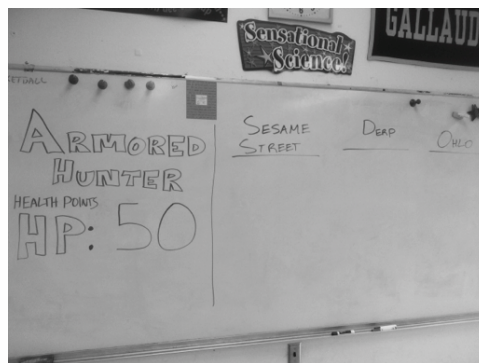
The final round is given via a piece of paper with varying tasks (match the terms to definitions, label diagrams, etc.), with a time limit of two minutes. The final round allows a total team effort to complete the task within the time limit.

## 2. Content

Naturally, the content of each boss battle should include what the students learn during the quests leading up to that point. For example, in BioCraft's first boss battle, the students had to face Armored Hunter. This boss was sent as a dangerous expert to capture and bring back organisms to a human spaceship. Armored Hunter's weakness was the players' knowledge of the human body systems.

For the students' main quest before Armored Hunter, they gave individual presentations on systems from the human body and made a chart that was filled out with information from each other's presentations. This chart doubled as a study guide for the boss battle. So, in a sense, the students were preparing to exploit Armored Hunter's weakness.

### 3. Preparation



Set up your classroom before the students come in for the session. From the pictures, you may see that I pre-arranged the tables into ecosystem groupings with labels on each table. These pieces of paper establish the seating arrangement within each ecosystem and double as scratch paper to use for discussing answers during the boss battle.

The white board at the back of the classroom displays the boss' HP and the scores of each ecosystem. Make sure to keep yourself or an assistant handy to record changes in HP and score during the boss battle.

For my boss battles, I used an educational resource called an Eggspert. The Eggspert is a quiz bowl buzzer system with lights that allow the players to buzz in and claim the right to answer a question. The Eggspert kit also performed as a random selector via "Wheel of Fortune" mode for the 2<sup>nd</sup> round of all boss battles.

## 4. The Test

During the test keep track of scores in any method that appeals to you. For my boss battles, I used the white board as a visual and immediate representation of the students' progress. In addition, I used a customized sheet of paper that tracked who answered which question in each round of play. The sheet of paper also tracked the adaptations that each student used during the boss battle.

Keep in mind that HP represents the Health Points of each boss. Armored Hunter had a HP of 50. Each question in the boss battle was worth 5 points so each correct answer would take 5 HP away from the boss and add 5 points to the ecosystem with the correct answer. Once Armored Hunter reaches 0 HP, it means that the students defeated the test.

However, during my implementation, Armored Hunter escaped the end of round three with 4 HP remaining. The consequence for not defeating the boss was the requirement to take individual written tests. If you want to follow this formula, I would recommend using the exact same questions from the boss battle on the written test so you can further evaluate the performance of individual students.

# GameMaster Strategy Guide

## 1. Materials

### A. World Map

- a. Cardboard underlay
- b. Corkscrew middle sheet
- c. Crumpled blue paper covering
- d. Green construction paper for the continents
- e. Colored thumbtacks for PP
- f. Pinto beans for AP
- g. Small plastic cups with cover for students' PP/AP storage
- h. Customized adaptation cards made in Apple's Pages

### B. BioCraft Binder

- a. Generic 3" to 5" plain binders

### C. Recording Data

- a. Index cards for on-the-fly recording
- b. Herokuapp web application for the BioCraft website
- c. Web developing skills or a friend who can develop the website

### D. Boss Battles

- a. Educational Eggspert quiz bowl kits

## 2. Management

**Consistent PP tracking:** Be firm with your expectations for the students. Keeping track of PP may feel like a hassle but if you are not consistent with the removal of PP, your students will test your authority. If you want to give warnings, warn them once per infraction early in the implementation but give your students no leeway late in the implementation.

**Encourage use of adaptations:** Remind your students to perform adaptations in class and use their AP in their storage cups. Often, students forget that they can perform adaptations at any time during the class. It is their privilege to do so since they earned them through leveling up.

**Manage the beginning of each class:** I learned to call each ecosystem one by one at the beginning of each class to update the world map, perform adaptations, and turn in assignments so I could record the process smoothly. Later in the curriculum, I implemented a to-do list shown by projector on the white board for students to follow in order to get ready for class.

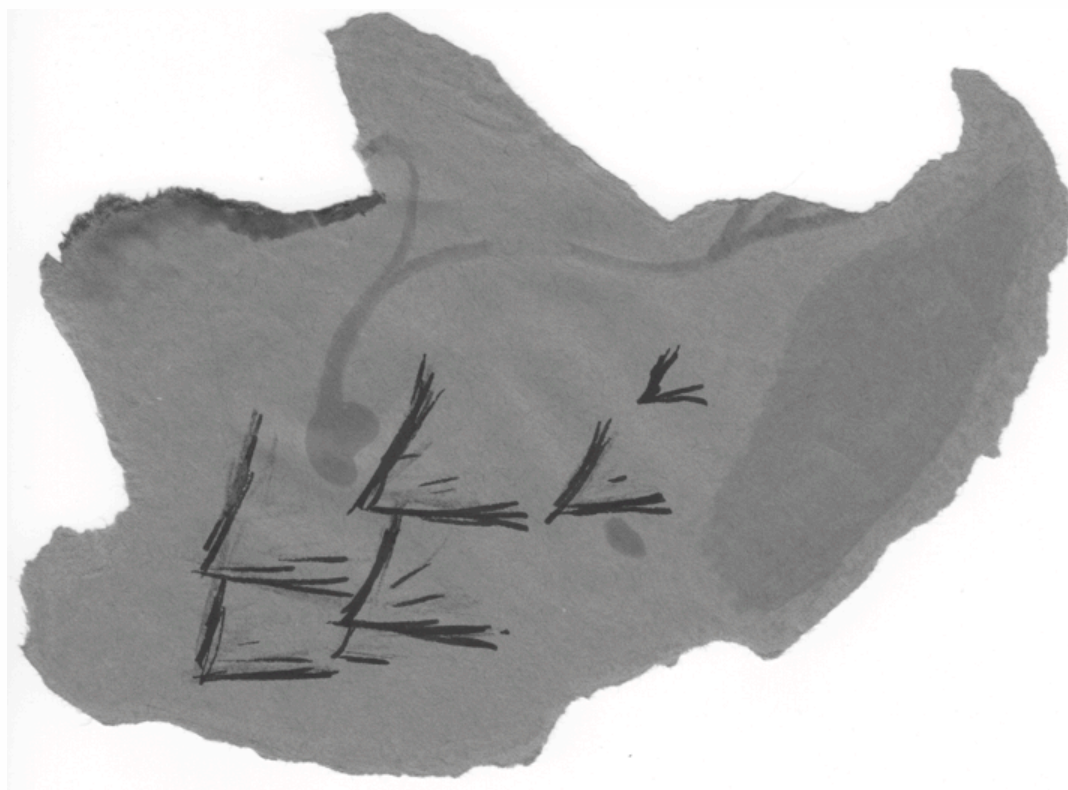
### 3. Modifications

**XP adjustments:** The positive thing about this curriculum stems from the XP system. You may keep the total required XP level for a grade of A+ but if, for some reason, you realize that you've been giving too much XP rewards or too little XP, you may update the system. You must communicate with your students explicitly about this since it will impact their motivation if not done properly.

**Elimination of content:** Often, a quest will take longer or shorter than expected. At other times, too much time is lost and results in the need to eliminate or wrap up certain lesson sequences. In the BioCraft model, this is possible because of the set amount of XP. You can eliminate content but transfer the XP into future quests or create more bonus quests.

## **APPENDIX B**

BioCraft Resources and Samples






**A teacher-created continent for the world map**

# BIOCRAFT

A game of survival.

An ecosystem is not complete without organisms.

Your ecosystem must have at least one of each:

-  Herbivore
-  Omnivore
-  Carnivore

You will represent one organism living in your ecosystem. Brainstorm ideas for your species, such as its name, what it may look like, and how it will exist in your ecosystem. The Game Master will give you further information on Friday that may affect your decision.

Choose carefully.

# BIOCRAFT

A game of survival.

## STRATEGY GUIDE TO BUILDING YOUR ORGANISM AND ECOSYSTEM

You will be graded at the end of the year based on your organism's level. The leveling system can be referenced below:

Lvl 1	0 XP Needed	Grade = F
Lvl 2	50 XP Needed	Grade = F
Lvl 3	100 XP Needed	Grade = D
Lvl 4	200 XP Needed	Grade = D
Lvl 5	300 XP Needed	Grade = C-
Lvl 6	450 XP Needed	Grade = C
Lvl 7	600 XP Needed	Grade = C+
Lvl 8	800 XP Needed	Grade = B-
Lvl 9	1000 XP Needed	Grade = B
Lvl 10	1300 XP Needed	Grade = B+
Lvl 11	1600 XP Needed	Grade = A
Lvl 12	2000 XP Needed	Grade = A+

### XP = Experience Points

You receive XP by coming to class, following rules, completing quests, and defeating bosses (quizzes).

For example, you received **2 XP** for naming Planet Ooh. You will also receive **5 XP** each time you attend class. More information will be given later.

As of now, you are at **Level One**.

Organisms in **BIOCRAFT** are split in three unique classes.

The three classes level up differently and gain special **adaptations** that are used by spending **Action Points (AP)**. The health of your species is represented by the amount of organisms on Planet Ooh. You can measure this by **Population Points (PP)**.

A **Carnivore** Begins **Level One** with **3 PP** and **5 AP**.  
An **Omnivore** begins **Level One** with **5 PP** and **5 AP**.  
A **Herbivore** begins **Level One** with **10 PP** and **3 AP**.


I will give you an example.

You lose PP in various ways. For example, you lose **2 PP** for arriving late to class. Think of it as two of your organisms dying off the face of Planet Ooh!

You gain PP through using **adaptations**. *Reproduce* costs **2 AP** if you want to add more organisms to Planet Ooh.

Action Points (AP) is the energy you spend on Planet Ooh. Use it wisely!

You can earn AP in the same way you earn XP. For example, you gain **2 AP** by coming to class. You also earn AP by completing homework, etc.



Species: Absicoor

Class: Omnivore

Level 1

5/5 PP

5/5 AP

0/50 XP to Level 2

**Turn over the page for a list of adaptations learned by Carnivores, Omnivores, and Herbivores.**

**Use this information to help you choose your organism class for BIOCRAFT.**

# BIOCRAFT

## Carnivore Guide

Level	XP Needed	Grade	Max PP	Max AP	New Adaptation
Lvl 1	0 XP Needed	Grade = F	3	5	Reproduce
Lvl 2	50 XP Needed	Grade = F	5	8	Bite
Lvl 3	100 XP Needed	Grade = D	7	11	
Lvl 4	200 XP Needed	Grade = D	9	14	
Lvl 5	300 XP Needed	Grade = C-	11	17	Pounce
Lvl 6	450 XP Needed	Grade = C	13	20	
Lvl 7	600 XP Needed	Grade = C+	15	23	Nourish
Lvl 8	800 XP Needed	Grade = B-	17	26	Chomp
Lvl 9	1000 XP Needed	Grade = B	19	29	Intimidate
Lvl 10	1300 XP Needed	Grade = B+	21	32	Regenerate
Lvl 11	1600 XP Needed	Grade = A	23	36	Devour
Lvl 12	2000 XP Needed	Grade = A+	25	40	Hunt

Carnivore Adaptation	AP Required	Description	Available at Level:
Reproduce	2	Gain 1 PP-level, for a maximum of 10 PP	1
Bite	2	Roll a die to attack the opponent	2
Pounce	8	Eliminate an opponent from the world map	5
Nourish	10	Other organisms in the ecosystem gain 5 AP each	7
Chomp	12	Roll a pair of dice to attack the opponent	8
Intimidate	10	The carnivore can delay the beginning of class for five minutes	9
Regenerate	15	At any time once during the day, each organism in the ecosystem can resist PP loss	10
Devour	20	Roll three dice to attack the opponent and replenish PP equal to 1/2 the damage done	11
Hunt	20	Another ecosystem can be hunted, roll a die to bite each organism in that ecosystem and transfer PP to your ecosystem	12

# BIOCRAFT

## Herbivore Guide

Level	XP Needed	Grade	Max PP	Max AP	New Adaptation
Lvl 1	0 XP Needed	Grade = F	10	3	Breed
Lvl 2	50 XP Needed	Grade = F	13	5	
Lvl 3	100 XP Needed	Grade = D	16	7	Evade
Lvl 4	200 XP Needed	Grade = D	19	9	Consume
Lvl 5	300 XP Needed	Grade = C-	22	11	Stampede
Lvl 6	450 XP Needed	Grade = C	25	13	Migrate
Lvl 7	600 XP Needed	Grade = C+	28	15	Trample
Lvl 8	800 XP Needed	Grade = B-	31	17	
Lvl 9	1000 XP Needed	Grade = B	35	19	
Lvl 10	1300 XP Needed	Grade = B+	39	21	Photosynthesis
Lvl 11	1600 XP Needed	Grade = A	45	23	Harvest
Lvl 12	2000 XP Needed	Grade = A+	50	25	Hibernation

Herbivore Adaptation	AP Required	Description	Available at Level:
Breed	2	Gain 2 PP-level, no maximum limit	1
Evade	4	The herbivore can arrive 2 minutes late to class or skip a question anytime during Biocraft	3
Consume	5	The herbivore or an ecosystem organism can eat in the classroom	4
Stampede	5	An extinct organism in the ecosystem may reroll the Extinction Roll	5
Migrate	6	The ecosystem can arrive 2 minutes late to class or skip a question anytime during Biocraft	6
Trample	8	The herbivore may deal double damage from a die roll	7
Photosynthesis	15	The ecosystem receives free snacks from the classroom	10
Harvest	12	The ecosystem may receive free credit for a homework assignment	11
Hibernation	15	The ecosystem can complete a quest one day late with no penalty and gain free time during class	12

# BIOCRAFT

## Omnivore Guide

Level	XP Needed	Grade	Max PP	Max AP	New Adaptation
Lvl 1	0 XP Needed	Grade = F	5	5	Reproduce
Lvl 2	50 XP Needed	Grade = F	8	8	Camouflage
Lvl 3	100 XP Needed	Grade = D	11	11	
Lvl 4	200 XP Needed	Grade = D	14	14	Yawn
Lvl 5	300 XP Needed	Grade = C-	17	17	
Lvl 6	450 XP Needed	Grade = C	20	20	Growl
Lvl 7	600 XP Needed	Grade = C+	23	23	Nurture
Lvl 8	800 XP Needed	Grade = B-	26	26	Night Vision
Lvl 9	1000 XP Needed	Grade = B	29	29	
Lvl 10	1300 XP Needed	Grade = B+	32	32	Roar
Lvl 11	1600 XP Needed	Grade = A	36	36	Infrared Vision
Lvl 12	2000 XP Needed	Grade = A+	40	40	Symbiosis

Omnivore Adaptation	AP Required	Description	Available at Level:
Reproduce	2	Gain 1 PP+level for a maximum of 10 PP	1
Camouflage	4	Avoid PP damage in class or halve PP damage during Biocraft	2
Yawn	5	The omnivore can use a personal electronic device for 5 minutes during class, used once per day	4
Growl	10	Prevent an organism from another ecosystem from using an adaptation	6
Nurture	10	Feed 2 PP+level to anyone in the ecosystem	7
Night Vision	12	The ecosystem identifies a free answer to a question anytime during Biocraft	8
Roar	20	The ecosystem is prevented from extinction and restored to maximum PP	10
Infrared Vision	25	The omnivore's ecosystem gains access to a cheat sheet of hints	11
Symbiosis	25	The omnivore enables all other organisms in the ecosystem to use any adaptation for 1/2 AP cost, can only be used once per day	12

8/6/13

<p>_____ System</p> <p>By: Name, Species Name, Ecosystem</p>	<p><b>Main Function</b></p> <ul style="list-style-type: none"><li>• List functions here</li></ul> <p>A good spot for one of your pictures</p>
<p><b>Organs in the _____ System</b></p> <ul style="list-style-type: none"><li>• List organs and descriptions here</li></ul> <p>A good spot for one of your pictures</p>	<p>_____ System and _____ System</p> <ul style="list-style-type: none"><li>• Explain whether this system works with another system and how</li></ul> <p>A good spot for one of your pictures</p>
<p><b>Strengths and Weaknesses</b></p> <ul style="list-style-type: none"><li>• Describe the strengths and weaknesses of this system: how to improve it, how to hurt it, what it does best, and/or what it does not do well.</li></ul>	<p><b>Interesting Facts</b></p> <ul style="list-style-type: none"><li>• List your facts here with or without pictures</li></ul>

Human Body Systems Chart

During the presentations, fill in the information for each body system.

Organ System	Functions	Main Organs	Interacts With

# BIOCRAFT

## Bonus Side Quests - Round One

Quest	Description	XP Given
Create a cover for your BioCraft binder	Spend at least 20 minutes sketching and coloring your organism. The cover design includes the words: BioCraft, your name, species name, ecosystem, and name of planet.	5
Organize your resources in the binder	Gather all of the documents and work you've done for BioCraft and organize them neatly in your new binder.	5
Levels of organization chart	Make a data chart in "Pages" or "Word" with the categories: cells, tissues, organs, and organ systems. Give at least <b>5</b> examples of each category.	5
Sketch your organism's body systems (5 XP each)	On individual pages, draw the body systems that work inside your organism. The systems should be anatomically correct and the organs labeled. Coloring the pictures is optional.	5
Describe your organism's unique structures and functions	Use your creative mind to come up with your organism's unique abilities and the structures that enable these functions. Support your descriptions with scientific facts. This will be 1 to 2 pages long, double spaced.	5
Give your ecosystem a name sign	Whenever possible, work with your ecosystem to come up with a sign that represents your ecosystem.	5
Write a story about your organism	Type a short story describing a major event in your organism's life. Include and underline at least <b>10</b> vocabulary words learned in class during BioCraft. (names of organs, adaptations, etc.)	5
Create an ASL poem	Film yourself signing a poem about your organism. Use ASL rules like: ABC story, number story, handshapes only, or discuss an idea with the Game Master.	5
Create an ASL poem II	Film yourself signing a poem describing the structure and function of the body system that you researched. Use ASL poetry rules.	5
Research an organism from Earth	Write an one-page paper on an organism of your choice. Describe it as if you were explaining to a person who never saw and heard of this animal before. Be creative!	5
Give your organism a name sign	Come up with a name sign for your organism.	5

# ROUND THREE

Name the body system in the four columns  
(Armored Hunter will lose 5 HP for each correct answer)

System A	System B	System C	System D
Transports nutrients to body cells	Absorbs nutrients	Provides protection for tissues and organs	Produces chemicals to regulate bone growth
Transports oxygen to body cells	Breaks down food into simple substances	Provides structure and frame for body	Maintains proper blood sugar level
Helps with removing wastes from cells	Converts food into energy	Produces new red blood cells	Helps to shape mood and feelings

System A \_\_\_\_\_

System B \_\_\_\_\_

System C \_\_\_\_\_

System D \_\_\_\_\_

# ROUND THREE

Match the organs to their system  
(5 points each)

1. Pituitary gland \_\_\_\_\_

2. Vas deferens \_\_\_\_\_

3. Spinal cord \_\_\_\_\_

4. Kidney \_\_\_\_\_

5. Uterus \_\_\_\_\_

BOSS BATTLE:

Round 1

Question	Player	Adaptation	Result

Round 2

Question	Player	Adaptation	Result

Round 3

SeSt	Ohlo	Derp

BOSS DAMAGE

SeSt  
Ohlo  
Derp

# BIOCRAT

Main Quest Rubric

Student	Objective 1	Objective 2	Objective 3	Objective 4	Comments
Tristan					
Gareth					
Lexi					
Genevieve					
Jillian					
Jaelene					
Emma					
Trent					
Nicola					
Travis					

## GOOD AFTERNOON, PLANET OOH!

By 1:50 pm, do the following or lose 1 PP

1. Get your BioCraft binder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. Take out your *Human Body Systems Chart*
6. Sit at your assigned seat
7. Put your binder under your seat
8. Be ready for Frankenstein's presentation

## GOOD AFTERNOON, PLANET OOH!

By 12:55 pm, do the following or lose 2 PP

1. Get your BioCraft binder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. Take out your *Human Body Systems Chart*
6. Study for 10 minutes (memorize spelling!)
- 7. Human Body Systems Test @ 12:55 pm**
8. If you are done with everything, work on the **bonus side quests**
9. Have a great weekend!

8/6/13

**GOOD AFTERNOON, PLANET OOH!**

By 1:55 pm, do the following or lose 2 PP

1. Get your BioCraft hinder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. If you haven't turned in your *Human Body Systems Chart*, to the Game Master, do it now
6. If you haven't taken the **Human Body Systems Test**, do it now
7. Get the *Structures, Functions, and Adaptations* worksheet from the Game Master and copy down the following definitions:
  1. **Structure** – A structure is a part of an organism that performs a specific job.
  2. **Function** – A function is the job a structure performs.
  3. **Adaptation** – An adaptation is a specialized structure or function that allows the organism to survive by allowing its basic needs to be met.

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**GOOD AFTERNOON, PLANET OOH!**

Sesame Street: **Station One**

Ohlo: **Station Two**

Derp: **Station Three**

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**GOOD AFTERNOON, PLANET OOH!**

This week's XP:

- Structures, Functions, and Adaptations worksheet
  - **150** XP
- Walking with Cavemen worksheet
  - 1<sup>st</sup> place ecosystem (gold): **450** XP
  - 2<sup>nd</sup> place ecosystem (silver): **400** XP
  - 3<sup>rd</sup> place ecosystem (bronze): **350** XP

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## GOOD AFTERNOON, PLANET OOH!

By 1:55 pm, do the following or lose 2 PP

1. Get your BioCraft binder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. If you haven't turned in your *Structures, Functions, and Adaptations* worksheet to the Game Master, do it now for 150 XP
6. Sit with your ecosystem and discuss:
  1. What are the similarities and differences between the organisms in *Walking with Cavemen* and modern humans?
  2. Any questions you may have from last Tuesday.
  3. Be prepared to discuss with the whole classroom.

## GOOD AFTERNOON, PLANET OOH!

By 12:45 pm, do the following or lose 2 PP

1. Get your *Walking with Cavemen* worksheet from your BioCraft binder
2. Do not get your PP/AP cup from the game board
3. We will not use any adaptations today
4. Sit with your ecosystem and show me you are ready to continue the movie!

Congratulations to **Ohlo** for winning *Ecosystem of the Day* yesterday! Organisms in **Ohlo** all receive **50 XP** each for displaying excellent teamwork, cooperation, and performance in the classroom.

Ecosystem of the Day awards will be given after each day at Planet Ooh from this time forth. Remember, each XP counts toward your final grade!

## GOOD AFTERNOON, PLANET OOH!

By 1:55 pm, do the following or lose 2 PP

1. Get your *Walking with Cavemen* worksheet from your BioCraft binder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. Sit with your ecosystem and show me you are ready to continue the movie!

Congratulations to **Derp** for winning *Ecosystem of the Day* yesterday! Organisms in **Derp** all receive **50 XP** each for displaying excellent teamwork, cooperation, and performance in the classroom.

Ecosystem of the Day awards will be given after each day at Planet Ooh. Remember, each XP counts toward your final grade!

8/6/13

**GOOD AFTERNOON, PLANET OOH!**

By 1:35 pm, do the following or lose 2 PP

1. Get your *Walking with Cavemen* worksheet from your BioCraft binder
2. Get your PP/AP cup from the game board
3. Check if you have PP in the cup to reproduce
4. See the Game Master to use any adaptations
5. Sit with your ecosystem and show me you are ready to continue the movie!

Congratulations to **Derp** for winning the second *Ecosystem of the Day* award last Friday! Organisms in **Derp** all receive **50 XP** each for displaying excellent teamwork, cooperation, and performance in the classroom.

Ecosystem of the Day awards will be given after each day at Planet Ooh. Remember, each XP counts toward your final grade!

**BIOCRAFT REVIEW**

- With your ecosystem, discuss:
  - What are Population Points (PP) and what do they represent?
    - How many PP do you have *now*?
  - What are Action Points (AP) and what do they represent?
    - How many AP do you have *now*?
  - What are Experience Points (XP) and what do they represent?
    - Based on your total XP, what is your total grade in class? It is okay if you do not know.

Level	XP Needed	Grade
Lvl 1	0 XP Needed	Grade = F
Lvl 2	50 XP Needed	Grade = F
Lvl 3	100 XP Needed	Grade = D
Lvl 4	200 XP Needed	Grade = D
Lvl 5	300 XP Needed	Grade = C-
Lvl 6	450 XP Needed	Grade = C-
Lvl 7	600 XP Needed	Grade = C+
Lvl 8	800 XP Needed	Grade = B-
Lvl 9	1000 XP Needed	Grade = B
Lvl 10	1300 XP Needed	Grade = B+
Lvl 11	1600 XP Needed	Grade = A
Lvl 12	2000 XP Needed	Grade = A+

What is your grade right now?

Quest	Description	XP Bonus
Create a poster for your BioCraft binder	Keep at least one organism alive during your ecosystem. The poster design includes the words: BioCraft poster, organism, the ecosystem, and names of places.	1000
Organize your ecosystem	Collect all of the documents and work you've done for BioCraft and organize them neatly in your binder.	1000
Levels of organization chart	Make a chart from "Page 10" titled "Levels of organization, matter, organs, and organ systems. Give it a fancy colorful title, a picture, and a legend.	1000
Sketch your organism's body structure (on 1/2 sheet)	On individual paper, draw the body structure that each member of your ecosystem has. The drawing should be anatomically correct and use the organ labels. Coloring the pictures is optional.	1000
Organism's name, description, and function	On individual paper, draw a picture of your organism, label it, and write a short paragraph about its unique adaptations, its place in the ecosystem, and its role in the ecosystem. Turn in your paper to the Game Master.	1000
Write a story about your organism	Whenever possible, write a story about your organism to come up with a story that represents your ecosystem.	1000
Write a story about your ecosystem	Draw a short story describing a major event in your organism's life. Include an illustration of what you are talking about and a story about BioCraft. Sources of organs, adaptations, etc.?	1000
Create an ASL poem	After creating a poem about your organism, use ASL to write the poem. Use symbols and hand signs to represent the poem. Turn in your poem to the Game Master.	1000
Create an ASL poem (2)	After creating a poem about your ecosystem, use ASL to write the poem. Use symbols and hand signs to represent the poem. Turn in your poem to the Game Master.	1000
Research an organism from BioCraft	Write on one page paper on an organism of your choice. Describe it as if you were explaining to a person who never saw or heard of it before. (Include the organism's name!)	1000
Write your organism's name sign	Come up with a name sign for your organism.	1000

Updated XP awards for each bonus quest!

**BIOCRAFT OUTLOOK**

- By May 31st, we will have:
  - Frog dissection = 1,000 max XP
  - Final boss battle = 1,000 max XP
  - ASL project = 1,000 max XP
- 8,400 total XP for A+ grade, 8,700 possible XP given. Use your time wisely!

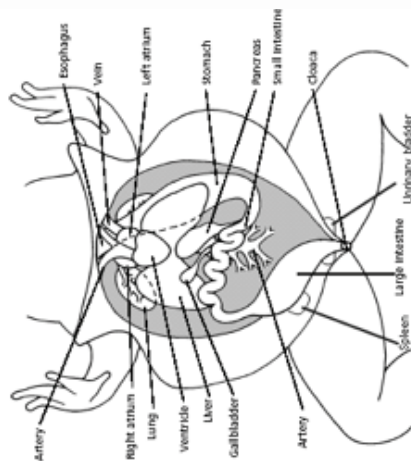
**HOMEWORK**

- By Friday, May 17 (from Bonus Quests):
  - BioCraft binder cover
  - Organism name sign
  - Ecosystem name sign
  - Describe your organism's unique structures and functions OR write a story about your organism

# BIOCRAFT

100 XP each identified organ

THE INTERNAL STRUCTURES OF A FROG  
Abdominal and Chest Cavities of the Frog



Heart \_\_\_\_\_

Lungs \_\_\_\_\_

Liver \_\_\_\_\_

Pancreas \_\_\_\_\_

Small Intestine \_\_\_\_\_

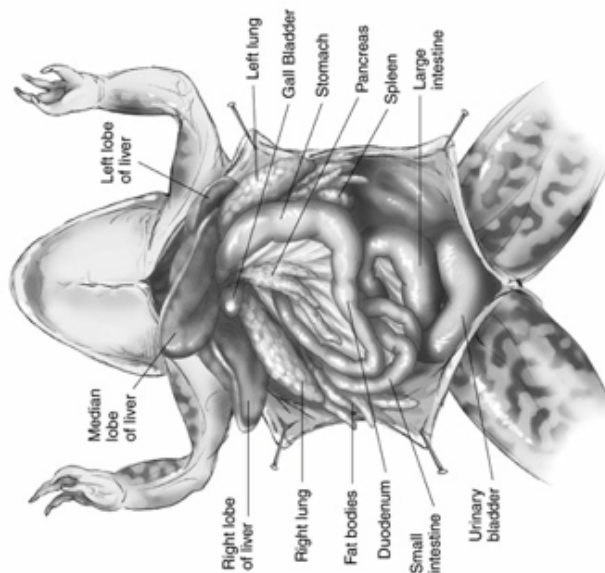
Large Intestine \_\_\_\_\_

Gallbladder \_\_\_\_\_

Spleen \_\_\_\_\_

Stomach \_\_\_\_\_

Fat Bodies \_\_\_\_\_



# BIOCRAFT

## Final Boss Study Guide

A final battle of wits is almost upon you and your ecosystem. Knowledge is key for your survival and you may train yourself to prove that you are worthy of existing on Planet Ooh!

The Game Master made this list of items to review for the final boss battle. Please use your time wisely to seek and review the information that we have covered the past several weeks.

Skill:

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**Investigate and explain how internal and external structures of organisms have adaptations that allow specific functions such as gills in fish, hollow bones in birds, or roots in plants.**

Define:

- **Structure**
- **Function**
- **Adaptation**

Key Understandings:

- **What purpose do adaptations serve?**
  - **How is structure related to function?**
  - **What are some specific internal structures of organisms that allow specific functions?**
- 

Skill:

**Define heredity as the passage of genetic instructions from one generation to the next generation.**

Define:

- |                          |                       |
|--------------------------|-----------------------|
| - <b>Traits</b>          | - <b>Genotype</b>     |
| - <b>Gene</b>            | - <b>Phenotype</b>    |
| - <b>Heredity</b>        | - <b>DNA</b>          |
| - <b>Dominant trait</b>  | - <b>Allele</b>       |
| - <b>Recessive trait</b> | - <b>Heterozygous</b> |
| - <b>Punnett square</b>  | - <b>Homozygous</b>   |

Key Understandings:

- **How do we get traits from our parents?**
- **How are genetic traits passed from one generation to the next?**
- **What is a dominant form of an allele?**
- **What is a recessive form of an allele?**
- **How is the Punnett square useful in predicting genetic combinations?**

# BIOCRAFT

## Understanding PP, AP, and XP

Each player begins at LEVEL 1 with a base PP and AP

PP = Population Points which means the number of organisms you have on the world map





AP = Action Points that represent the amount of energy you have to spend on “Adaptations”

Adaptations = The abilities that enable you to perform certain actions during class time and boss battles

To level up, you must earn XP (Experience Points) by completing homework, projects, and boss battles

<u>Ways to Gain XP</u>	<u>Ways to Lose PP</u>	<u>Ways to Gain AP</u>
Attend class (5 XP)	Being off task (1 PP)	Turn in homework (1 AP)
Clean up (5 XP)	Not cooperating (2 PP)	Complete task (varying AP)
Show teamwork (5 XP)	Arrive unprepared (2 PP)	Daily AP increase (2 AP)
Turn in homework (varying XP)	Arrive late (2 PP)	Answer correctly during boss battles (varying AP)
Complete tasks (varying XP)	Unfinished homework (1 roll of die = PP lost)	
Beat bosses (varying XP)	Tampering with world map (5 PP)	
Use adaptations to help others (15 XP)	Each point below 60% on a test (2 PP)	








<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Reproduce</b>  Gain one FP-Level for a maximum of 10 FP. <b>2</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Bite</b>  Roll a die to attack the opponent. <b>2</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Pounce</b>  Eliminate an opponent from the world map. <b>8</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Nourish</b>  Other organisms in the ecosystem gain 5 AP each. <b>10</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Chomp</b>  Roll a pair of dice to attack the opponent. <b>12</b> AP
<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Intimidate</b>  You can delay the beginning of class for five minutes. <b>10</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Regenerate</b>  At any time once during the day each organism in your ecosystem may reset FP loss. <b>15</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Devour</b>  Roll three dice to attack the opponent and replenish FP equal to 1/2 the damage done. <b>20</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Hunt</b>  Another ecosystem may be hunted, roll a die to bite each organism and transfer FP. <b>20</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Reproduce</b>  Gain one FP-Level for a maximum of 10 FP. <b>2</b> AP
<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Camouflage</b>  Avoid FP damage in class or halve FP damage during boss battles. <b>4</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Yawn</b>  Use a personal electronic device for five minutes during class. <b>Once per day.</b> <b>5</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Growl</b>  Prevent an organism from another ecosystem from using an adaptation. <b>10</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Nurture</b>  Feed two FP-Level to anybody in the ecosystem. <b>10</b> AP	<b>BIOCRAFT</b> Adaptation Card <b>C</b> <b>Night Vision</b>  The ecosystem identifies a free answer to a question anytime during BioCraft. <b>12</b> AP

<b>BIOCRAFT</b> Adaptation Card		<b>0</b>	<b>Roar</b>	The ecosystem is prevented from extinction and restored to maximum PP.	<b>20</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>0</b>	<b>Infrared Vision</b>	The ecosystem gains access to a cheat sheet of hints.	<b>25</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>0</b>	<b>Symbiosis</b>	Enable other organisms in the ecosystem to use any adaptation for 1/2 AP cost. Once per day.	<b>25</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Breed</b>	Gain two PP-Level with no maximum limit.	<b>2</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Evade</b>	Arrive two minutes late to class or skip a question anytime during Biocraft.	<b>4</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Consume</b>	The herbivore or an ecosystem organism can eat in the classroom.	<b>5</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Stampede</b>	An extinct organism in your ecosystem may reroll the Extinction Roll.	<b>5</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Migrate</b>	Your ecosystem may arrive two minutes late to class or skip a question anytime during Biocraft.	<b>6</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Trample</b>	You may deal double damage from a dir roll.	<b>8</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Photosynthesis</b>	Your ecosystem receives free snacks from the classroom.	<b>15</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Hibernation</b>	Your ecosystem may complete a quest one day late with no penalty and gain free time during class.	<b>15</b> AP
<b>BIOCRAFT</b> Adaptation Card		<b>1</b>	<b>Harvest</b>	Your ecosystem may receive free credit for a homework assignment.	<b>12</b> AP

Leaderboard

Assignments

Timeline (99)

Player	Ecosystem	Level	TXP	PP	AP
 Lionkingful	Ohlo	3	103	5	7
 Dumbo	Ohlo	2	88	10	5
 Wonder Woman	Sesame Street	2	88	2	7
 Lumi	Ohlo	2	83	3	7
 Convenant	Derp	2	83	3	7
 Rica Blast	Derp	2	68	5	7
 Kenkeei	Derp	2	58	10	5

Main Quest	XP
Defeat Armored Hunter	100
Body System Presentation - BRONZE	20
Body System Presentation - SILVER	30
Body System Presentation - GOLD	40

Side Quest	XP
Sketch organism's body systems	5
Create BioCraft binder cover	5
Organism name sign	5
Complete Body Systems Chart	15

2 out of 10 students attended class on time.  
 Posted about 3 hours ago.

8 out of 10 students attended class on time.  
 Posted about 3 hours ago.

8 out of 10 students performed clean up tasks.  
 Posted about 4 hours ago.


10 out of 10 students performed clean up tasks.  
 Posted about 4 hours ago.

 Wonder Woman **completed** Body System Presentation - SILVER  
 Posted about 10 hours ago.

 Lumi **completed** Body System Presentation - SILVER  
 Posted about 10 hours ago.

 Rica Blast **completed** Sketch organism's body systems  
 Posted 1 day ago.











 Rica Blast **completed** Create BioCraft binder cover  
 Posted 1 day ago.

 Lionkingful **completed** Organism name sign  
 Posted 1 day ago.





Biocraft Alpha





CreateQuestsAdaptationsPlanetOchHuman FleetAccount

Leaderboard













Player	Ecosystem	Level	TXP	PP	AP
 Rica Blast	Deep	10	6065	20	21
 Elmo	Sesame Street	10	5818	19	17
 Wonder Woman	Sesame Street	10	5758	10	22
 Lamé	Ohio	10	5708	9	20
 Frankenstein	Sesame Street	10	5618	17	20
 Kerckel	Deep	10	5538	19	17
 Convenant	Deep	10	5458	10	12
 Lookingfol	Ohio	10	5308	17	20
 Dumbo	Ohio	10	5243	21	17
 Nymrela	Ohio	9	3710	19	16

Assignments

	Main Quest	XP	AP
	Beat the Final Boss	1500	
	Align Dissection - 1,000	1000	8
	Align Dissection - 900	900	2
	Highest scoring VS Human Fleet	100	

	Side Quest	XP	AP
	Give your organism a name sign	100	
	BioCraft Header cover	100	
	Organism story	200	
	Organism structures and functions	200	

Timeline (78)

	Wonder Woman completed Highest scoring VS Human Fleet Passed 2 months ago.
	Elmo completed Highest scoring VS Human Fleet Passed 2 months ago.
	Frankenstein completed Highest scoring VS Human Fleet Passed 1 months ago.
	GM Kent Turner posted main quest: Highest scoring VS Human Fleet Passed 2 months ago.
	Rica Blast completed Beat the Final Boss Passed 2 months ago.
	Wonder Woman completed Beat the Final Boss Passed 1 months ago.
	Elmo completed Beat the Final Boss Passed 2 months ago.
	Kerckel completed Beat the Final Boss Passed 2 months ago.
	Lamé completed Beat the Final Boss Passed 1 months ago.
	Convenant completed Beat the Final Boss Passed 2 months ago.
	Dumbo completed Beat the Final Boss Passed 2 months ago.
	Lookingfol completed Beat the Final Boss Passed 1 months ago.

Previous123456789...181920Next

# Rica Blast

**Level 10 Omnivore  
Dirt Ecosystem**

Evo Profile
BioInfo User

## Biometrics

TP	34034 (49.006%)
AP	30352 (65.037%)
XP	33616680 (116.998%)
Total XP:	6969

## Adaptations

Adaptation	AP Cost
Reproduce	2
Carnal Rage	4
Yawn	5
Grovel	10
Nocture	10
Night Vision	12
Roar	20

## Experience

Assignment	XP
Beat the Final Boss	1500
ASM Poem	100
Experience Boost	500
Genetics with a Smile	250
Spongibob Genetics	1510
Attend class	5
Oganisue BioCraft blunder	200
Tetra Effect	100
Attend class	5
Allien Dissection - 1,000	1000
Attend class	5
Organism structures and functions	200
Attend class	5
Ecosystem name signs	100
Sketch your organism's body systems (use XP each)	100
Bio-Craft blunder cover	200
Give your organism a name sign	200
Attend class	5
Ecosystem of the Day	50
Clean up classroom	5
Attend class	5

## Omnivore Timeline (40)

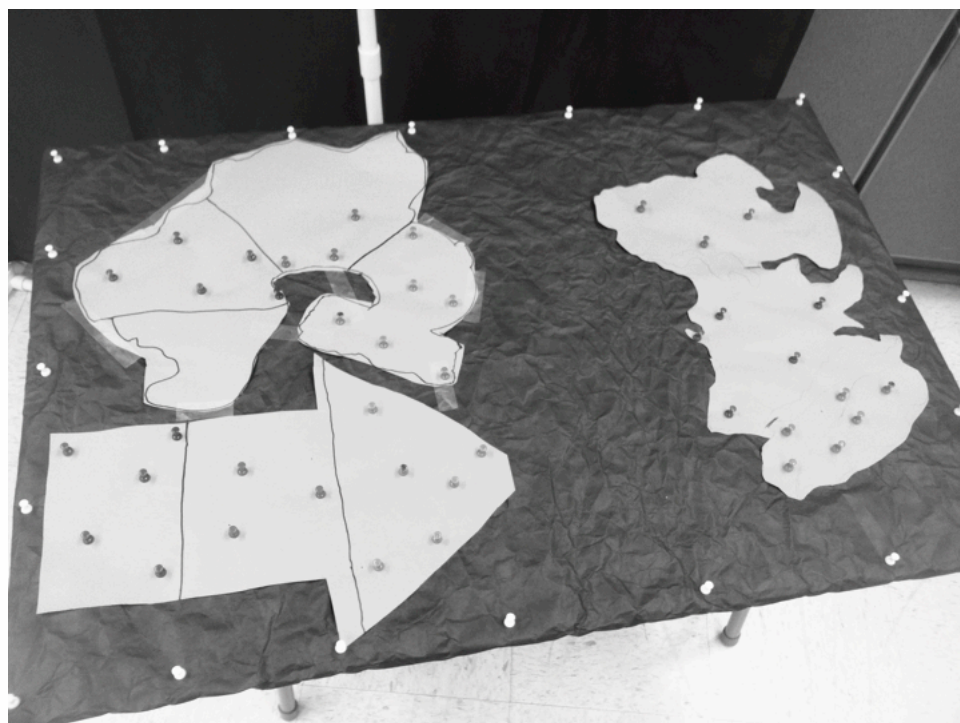
	Rica Blast completed Beat the Final Boss Posted 2 months ago.
	Rica Blast completed ASM Poem Posted 2 months ago.
	Rica Blast completed Experience Boost Posted 2 months ago.
	Rica Blast completed Genetics with a Smile Posted 2 months ago.
	Rica Blast completed Spongibob Genetics Posted 2 months ago.
	Rica Blast completed Attend class Posted 2 months ago.
	Rica Blast completed Oganisue Bio-Craft blunder Posted 2 months ago.
	Rica Blast completed Tetra Effect Posted 3 months ago.
	Rica Blast completed Attend class Posted 3 months ago.
	Rica Blast completed Body System Presentation - SEVER Posted 3 months ago.

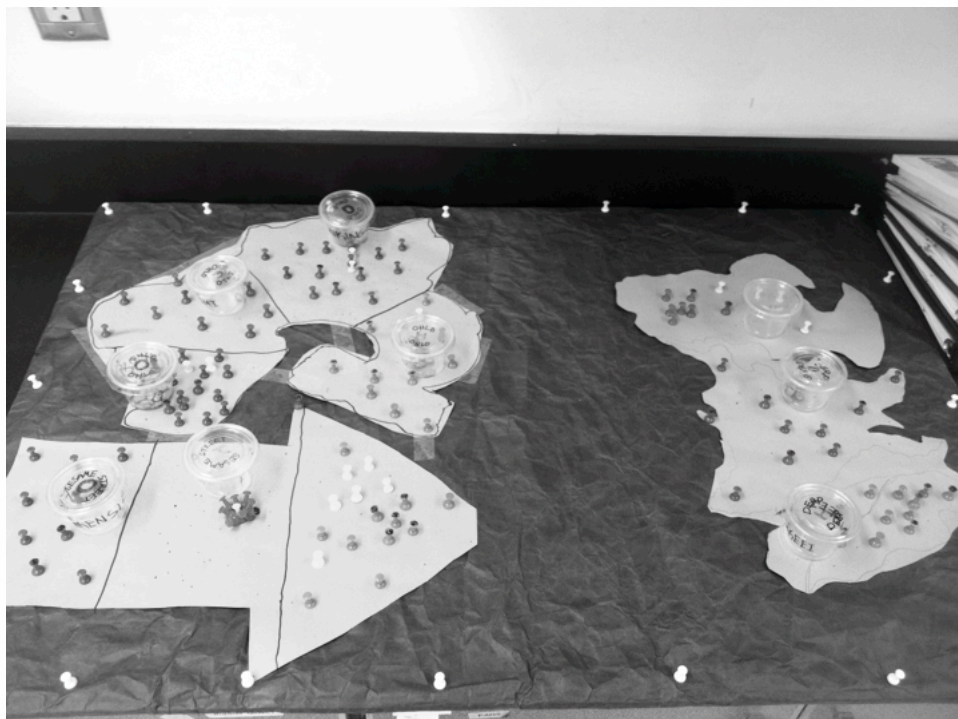
## **APPENDIX C**

BioCraft Student Documentation and Samples



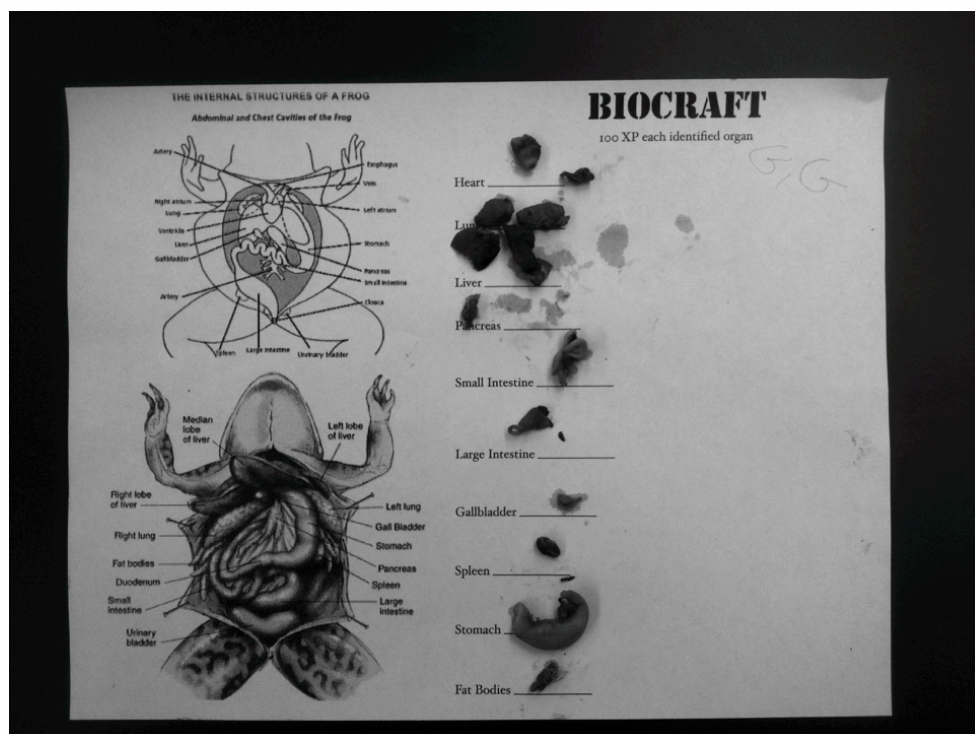
BioCraft World Map



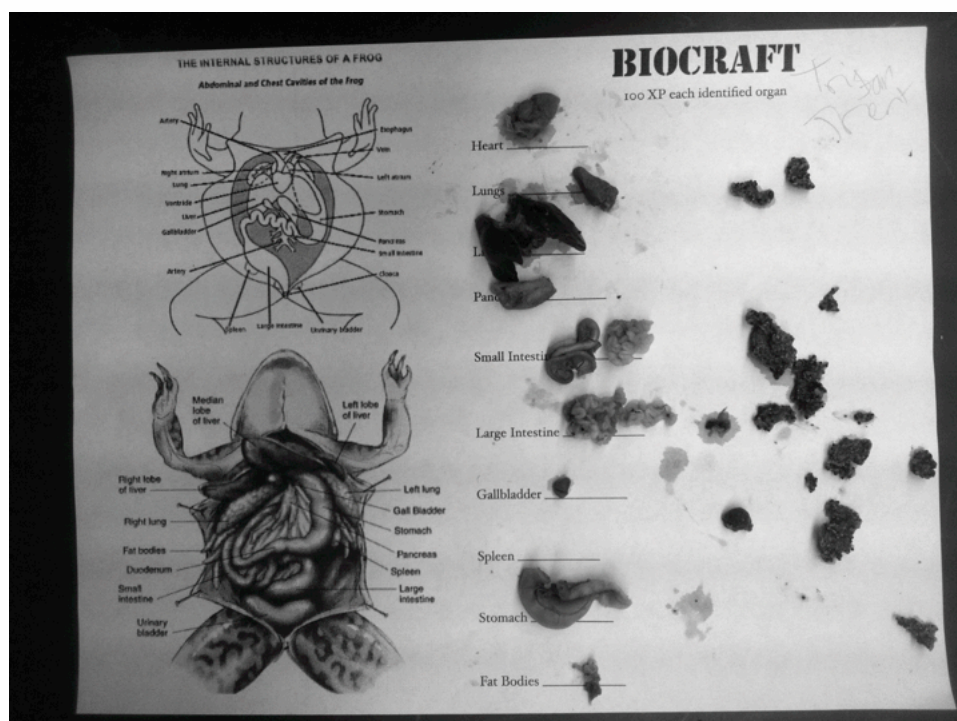


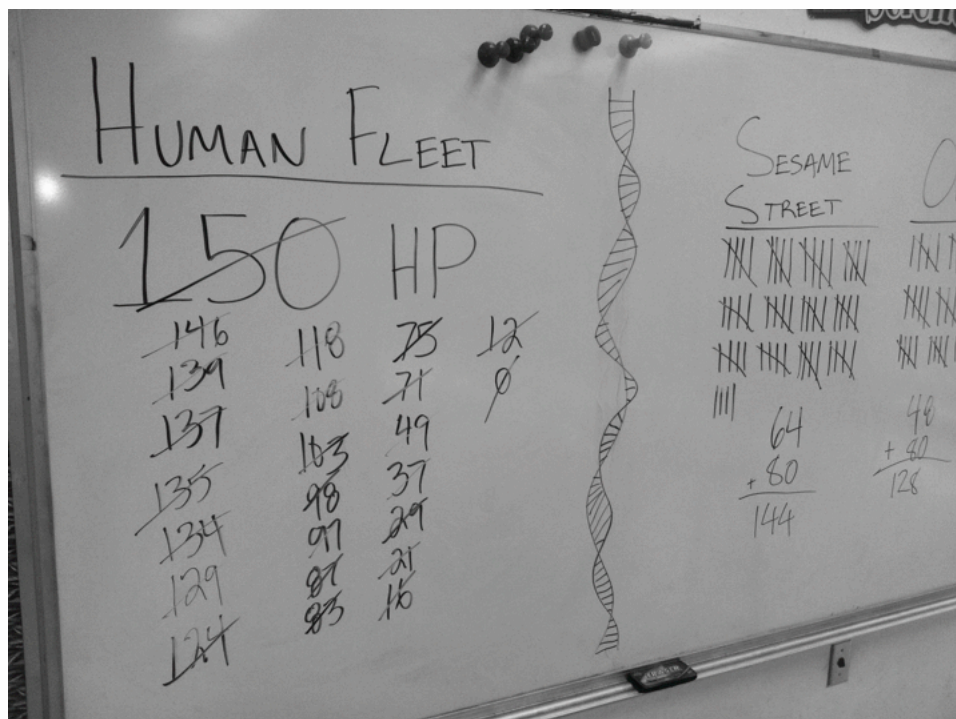
## BioCraft World Map





BioCraft Alien Dissection



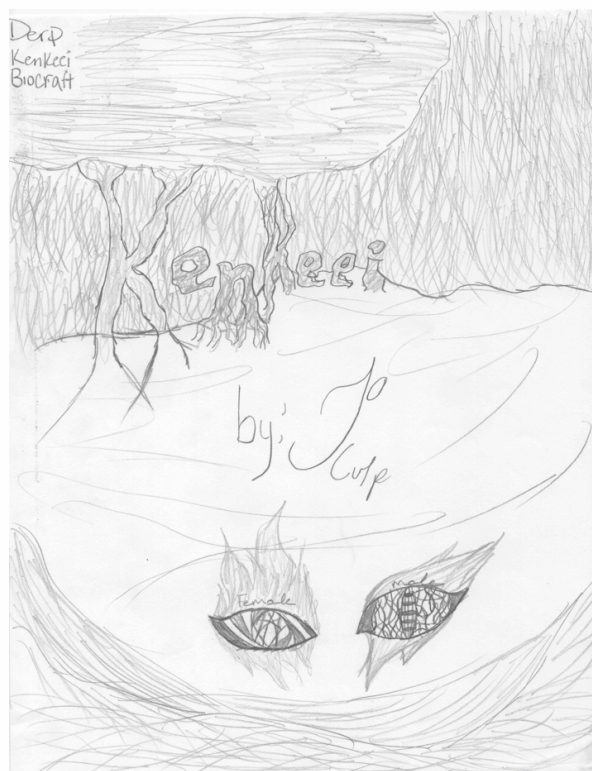


BioCraft Final Boss Battle





BioCraft Student Binder Covers





Imaginary Organism Structures and Functions

## Structures &amp; Functions 200 x P

## Kenkei

Kenkeis are deadly creatures, but they don't eat meats at all. But Kenkei's true features haven't been seen for many centuries after they appeared, which it means that Kenkeis is the eldest creatures who walked on the Earth before the others. (I am only fourteen and the eldest person in the classroom) :D

Anyway, that means Kenkeis are transmitters creatures. And they transform to different creatures when they first see it, or touch them. It's like when touch someone that has DNA will travel to Kenkei DNA & Gene, it's like tricking people thinking it's human or close. It's true they can transform but except their glowing eyes, they can be in many kinds of colors, and also they transform their genders, but their eyes remains stay same from their birth or name days. And they also could live to be several century, but they can aged slowly than humans could. Like when they reached up to 100 years old, their physical bodies itself 40's to 50's. Before humans came, Kenkeis were becoming to start to take a first step of forming to become more like humans, but still acting like animals. But as a deadly creatures, they know's all the animals weakness. And have abilities to do it.

Have you read "Animorphs"?

Interesting trait!

## Human Body Systems Chart

During the presentations, fill in the information for each body system.

Organ System	Functions	Main Organs	Interacts With
Respiratory System	get oxygen in your body and remove carbon dioxide of your body	Nose Lungs Pharynx/Alveoli Larynx Bronchi	Circulatory System Nervous system Immune system
nervous system	recive, deliver message from brain to body.	Brain Spinal cord	respiratory system
Digestive System	to break down food and water	Esophagus, liver Stomach, Gall bladder Duodenum, Pancreas Jejunum rectum, anus	muscle system
skeletal system	Protect fragile organ, act frame, support your body	long, small flat, irregular bones	muscle system
Cardiovascular system	rushing in vessels <del>fast</del> blood through <del>arteries</del> <sup>arteries</sup>	Heart veins Arteries	Circulator system

# **BIOCRAFT**

## Structures, Functions, and Adaptations

Name: Travis

Ecosystem: Convent

What is a structure of an organism?

part of organism that performs special job

What is a function of a structure?

job a structure perform

What is an adaptation?

is specialized structure or function that allows organism to survive by allowing basic needs.

**Read the passage at each station with your ecosystem and answer the questions together.**

### Station 1

Which structures and functions do plants have that are similar to humans?

Circulatory system.

Which structures and functions do plants have that are different from humans?

Vascular system

Give another example of structures and functions unique to plants.

roots to absorb water

How do you think plants are adapted to survive on Earth?

stem to reach suns  
roots to drink  
leaves to make sugar, glucose.

# **BIOCRAFT**

## Structures, Functions, and Adaptations

### Station 2

Which structures and functions do birds have that are similar to humans?

Skeletal system

Which structures and functions do birds have that are different from humans?

hollow bones

Give another example of structures and functions unique to birds.

air sacs to lungs

How do you think birds are adapted to survive on Earth?

hollow bones to be lighter to fly.

### Station 3

Which structures and functions do fish have that are similar to humans?

respiration system, gas exchange

humans,  $O_2 \rightarrow CO_2$  fish  $H_2O \rightarrow CO_2$

Which structures and functions do fish have that are different from humans?

gills

Give another example of structures and functions unique to fish.

gas exchange

How do you think fish are adapted to survive on Earth?

having ability to change  $H_2O$  to carbon dioxide  
in water, gills and scales.

# BIOCRAFT

Human Body Systems Test

Name: Lion King Fvl

Ecosystem: Ohlo

Armored Hunter barely escaped Planet Ooh, hanging on for dear life. You won't have to worry about him returning anytime soon. But, in order to earn your XP, you must defeat this test of knowledge.

Each question is worth 5 points. You can get a maximum score of 50 points. Your score will be multiplied by 6 to become XP points. So that means a maximum of 300 XP earned for you.

**Correct spelling is required.** Good luck!

1. What are the three types of muscles?

- 5
- A. Exterior, interior, and heart
  - ☒ B. Skeletal, cardiac, and smooth
  - C. Chest, arm, and leg
  - D. Protein, calcium, and steroids

45 pts  
x 6  
270 xp!

2. Which of the following is NOT a part of the integumentary system?

- 5
- A. hair
  - ☒ B. bones
  - C. skin
  - D. finger and toe nails

3. \_\_\_\_\_ carry blood away from the heart. \_\_\_\_\_ carry blood to the heart.

- 5
- ☒ A. Arteries, Veins
  - B. Red blood cells, White blood cells
  - C. Veins, Arteries
  - D. White blood cells, Red blood cells

4. Which body system is responsible for the exchange of oxygen and carbon dioxide?

5 Respiratory System

5 5. Ovaries produce and secrete hormones in addition to eggs. To what human body systems do ovaries belong?

Reproductive System

5 6. Which body system protects the human from diseases, physical damage, and changes in temperature?

Integumentary system

## BIOCRAFT

### Human Body Systems Test

7. Name the body system in the four columns. If an organism in your ecosystem fills in a blank with the correct answer, it will count for everybody else in the ecosystem.  
**Correct spelling is required.**

System A	System B	System C	System D
Transports nutrients to body cells	Absorbs nutrients	Provides protection for tissues and organs	Produces chemicals to regulate bone growth
Transports oxygen to body cells	Breaks down food into simple substances	Provides structure and frame for body	Maintains proper blood sugar level
Helps with removing wastes from cells	Converts food into energy	Produces new red blood cells	Helps to shape mood and feelings

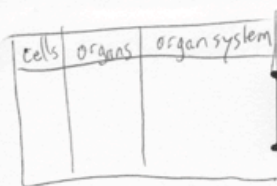
Circulatory/Cardiovascular

System A: Excretory system

5 System B: Digestive system

5 System C: Skeletal system

5 System D: Endocrine system



# BIOCRAFT

## Bonus Side Quests - Round One

Quest	Description	XP Given
Create a cover for your BioCraft binder ✓	Spend at least 20 minutes sketching and coloring your organism. The cover design includes the words: BioCraft, your name, species name, ecosystem, and name of planet.	5
Organize your resources in the binder ✓	Gather all of the documents and work you've done for BioCraft and organize them neatly in your new binder.	5
Levels of organization chart	Make a data chart in "Pages" or "Word" with the categories: cells, tissues, organs, and organ systems. Give at least 5 examples of each category.	5
Sketch your organism's body systems (5 XP each) ✓	On individual pages, draw the body systems that work inside your organism. The systems should be anatomically correct and the organs labeled. Coloring the pictures is optional.	5
Describe your organism's unique structures and functions	Use your creative mind to come up with your organism's unique abilities and the structures that enable these functions. Support your descriptions with scientific facts. This will be 1 to 2 pages long, double spaced.	5
Give your ecosystem a name sign ✓	Whenever possible, work with your ecosystem to come up with a sign that represents your ecosystem.	5
Write a story about your organism	Type a short story describing a major event in your organism's life. Include and underline at least <b>10</b> vocabulary words learned in class during BioCraft. (names of organs, adaptations, etc.)	5
Create an ASL poem	Film yourself signing a poem about your organism. Use ASL rules like: ABC story, number story, handshapes only, or discuss an idea with the Game Master.	5
Create an ASL poem II	Film yourself signing a poem describing the structure and function of the body system that you researched. Use ASL poetry rules.	5
Research an organism from Earth	Write an one-page paper on an organism of your choice. Describe it as if you were explaining to a person who never saw and heard of this animal before. Be creative!	5
Give your organism a name sign ✓	Come up with a name sign for your organism.	5

**BIOCRAFT**

Walking with Cavemen

SILVER

400 XP

Name:

Nymeria

Ecosystem:

OHLO

Which structures and functions in humans do you think helped them survive for thousands of years on Earth? ~~the~~ Their smartness, toughness, muscular, could stand up.

How are these adaptations similar and different from other organisms on Earth?  
 ✓ homo he ~~man~~ has dark skin to make them cooler,  
 has short neck to make them hot.  
 has smart mind.  
 Good imangitions.

1. How did the tree swinging apes adapt to less trees and a drier climate?

✓ ~~driness,~~  
 They started to walk.

2. What were the advantages and disadvantages of walking upright?

✓ They could see more higher  
 must for disad vantage really  
 not bad. @ Those are bad vantage  
 can see them more easily, and made them fast.

3. Why do you think *Australopithecus afarensis* became extinct?

✓ ~~Australopithecus afarensis~~ exist still but  
 just because ~~Australopithecus~~ are us.  
 ea, Bobbe's, that troops, Because  
 of evolution.

4. What happened when the ice did not melt properly in the summers? What effect did this have on the climate in Africa?

✓ The ice didn't melt properly  
 because of the tilt caused Africa to become  
 dry, because ice is made out of water  
 and had more mass

## BIOCRAFT

### Walking with Cavemen

5. How was *Paranthropus boisei* more adapted to the new climate?

✓ They had bigger teeth, and stronger bodies to find food more.

6. Why didn't *Paranthropus boisei* survive?

✓ Because of the world changes, and *Paranthropus* couldn't keep up.

1. What were the two secret weapons of *Homo habilis*?

Tools, Eats the meats to make them smarter

2. What traits of *Homo habilis* live on in humans today?

✓ More smarts.

3. Why do you think *Homo habilis* became extinct?

✓ *Homo habilis* couldn't keep up  
World revolution.

✓ 1. *Homo ergaster* had three adaptations that allowed them to hunt out in the hot African sun all day long when most animals had to hide in the shade during the day and hunt at night. What are they and how did each one help them?

brain, sense of smell. Hairless, enormous

✓ 2. What did larger brains allow for *Homo ergaster*? What did sweating instead of panting allow?

✓ Larger brains made them smarter.  
Sweating made them cooler.

## BIOCRAFT

### Walking with Cavemen

3. How did fire impact the life of *Homo erectus*?

✓ Warmth, for safety, as tools, when they started the fire and their minds become calm and has a good lots of ideas.

4. *Homo neanderthalensis* lived in frozen Europe during the ice age. How did they deal with cold temperatures? Describe what they were like.

✓ They weaved the clothes, fires. They do has communities, feelings just like us. They were shorter and which make them warmer and keep heats inside. And doesn't sweat a lot.

5. What did *Homo heidelbergensis* do that led the way for modern humans, *Homo sapiens*?

✓ taller, skinner, darker skin, imagination, use resources, mind's eyes show what's going on.

✓ What did you learn about how important adaptations are for survival?

That just a one little things really helped you to survive.

✓ What did you learn about humans' body systems (nervous, reproductive, digestive, muscular, etc.)

that reflect adaptations made through time? muscular really helps but needed the good, better brain. And more tough.

✓ List any questions you may have about structures, functions, and adaptations:

Is *Homo heidelbergensis* is exactly same as black people? Just because *Homo heidelbergensis* really look like some as black people.



# ACTIVITY

## GRAPHIC ORGANIZER






Name: Lion King Ful

Date: May 23, 2013

SCIENCE > CELLULAR LIFE AND GENETICS > HEREDITY

### TRAIT ANALYSIS

How much of your physical appearance did you inherit from your parents? Describe how each of the following traits is expressed in you, and compare it to your mother and father.

 <b>HAIR COLOR</b>	<u>dirty blonde from father.</u>
 <b>EYE COLOR</b>	<u>brown eyes from mother.</u>
 <b>HANDEDNESS</b>	<u>same hands as father</u>
 <b>HEIGHT</b>	<u>taller than mother that mean going taller than father.</u>
 <b>SHOE SIZE</b>	<u>As father's size.</u>
 <b>SPECIAL TALENT</b>	<u>Smart, tricky, fast, and prankster.</u>

## Bikini Bottom Genetics

Name Mad

Scientists at Bikini Bottoms have been investigating the genetic makeup of the organisms in this community. Use the information provided and your knowledge of genetics to answer each question.

1. For each genotype below, indicate whether it is a heterozygous (He) OR homozygous (Ho).

TT Ho Bb He DD Ho Ff He tt Ho dd Ho  
 Dd He ff Ho Tt He bb Ho BB Ho FF Ho

Which of the genotypes in #1 would be considered purebred? \_\_\_\_\_

Which of the genotypes in #1 would be hybrids? \_\_\_\_\_

2. Determine the phenotype for each genotype using the information provided about SpongeBob.

Yellow body color is dominant to blue.

YY P yellow Yy P yellow yy P yellow

Square shape is dominant to round.

SS S Ss S ss B



3. For each phenotype, give the genotypes that are possible for Patrick.



A tall head (T) is dominant to short (t).

Tall = T+ Short = ++

Pink body color (P) is dominant to yellow (p).

Pink body = Pp Yellow body = pp

4. SpongeBob SquarePants recently met SpongeSusie Roundpants at a dance. SpongeBob is heterozygous for his square shape, but SpongeSusie is round. Create a Punnett square to show the possibilities that would result if SpongeBob and SpongeSusie had children. HINT: Read question #2!


- A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with a square shape? 3 out of 4 or 75%

C. What are the chances of a child with a round shape? 2 out of 4 or 50%

5. Patrick met Patti at the dance. Both of them are heterozygous for their pink body color, which is dominant over a yellow body color. Create a Punnett square to show the possibilities that would result if Patrick and Patti had children. HINT: Read question #3!

	P+	P+
P+	P+	P+
P+	P+	P+

- A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with a pink body? 4 out of 4 or 100%

C. What are the chances of a child with a yellow body? 0 out of 4 or 0%

## Genetics with a Smile

Name Carey

### Part A: Smiley Face Traits

- (1) Obtain two coins from your teacher. Mark one coin with a "F" and the other with a "M" to represent each of the parents. The parents are heterozygous for all the Smiley Face traits.  
 (2) Flip the coins for parent for each trait. If the coin lands with heads up, it represents a dominant allele. A coin that lands tails up indicates a recessive allele. Record the result for each person by circling the correct letter. Use the results and the Smiley Face Traits page to determine the genotype and phenotype for each trait.

Trait	Female	Male	Genotype	Phenotype
Face Shape	C c	C c	Cc	circle face
Eye Shape	E e	E e	Ee	star
Hair Style	S s	S s	SS	straight
Smile	T t	T t	Tt	thick
Ear Style	V v	V v	Vv	curved
Nose Style	D d	D d	DD	bank
Face Color	Y y	Y y	YY	yellow
Eye Color	B b	B b	bb	red
Hair Length	L l	L l	Ll	long
Freckles	F f	F f	Ff	freckles
Nose Color	R r	R r	Rr	red
Ear Color	P p	P p	Pp	teal

### Part B: Is it a boy or girl?

To determine the sex of your smiley face, flip the coin for the male parent. Heads would represent X, while tails would be Y.

	Female	Male	Genotype	Phenotype
Sex	X	X Y	XY	male

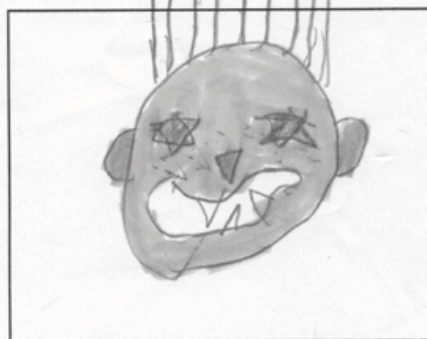
### Part C: Create Your Smiley Face!

Use the Smiley Face Traits chart and your results from Part A to create a sketch of your smiley face in the box. Once you have completed the sketch, use the drawing tools in Microsoft Word to create your smiley face!

Two things to remember ...

✓ Do not add color on the computer! Print a black and white copy and then use crayons or colored pencils to finish it.

✓ Don't forget to give your smiley face a name! You will also need to include your name as parent and your class hour.



Sesame  
Street

# ROUND THREE

Name the body system in the four columns  
(Armored Hunter will lose 5 HP for each correct answer)

System A	System B	System C	System D
Transports nutrients to body cells	Absorbs nutrients	Provides protection for tissues and organs	Produces chemicals to regulate bone growth
Transports oxygen to body cells	Breaks down food into simple substances	Provides structure and frame for body	Maintains proper blood sugar level
Helps with removing wastes from cells	Converts food into energy	Produces new red blood cells	Helps to shape mood and feelings

System A Excretory System

System B Digestive System <sup>5</sup>

System C Skeletal System <sup>5</sup>

System D ~~Endocrine System~~

Boss Battle Round Three Sheet (Armored Hunter)

80

~~DERP~~ DERP

# ROUND THREE

Use your knowledge of genetics to complete this round

(The Human Fleet will lose 5 HP for each correct answer)

Characteristic	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)
Nose Style	Long (L)	Stubby (l)

Use the information in the chart for SpongeBob's traits to write the phenotype (physical appearance) for each genotype.

- S 1. LL - long  
 S 2. yy - blue  
 S 3. Ss - Squarepants  
 S 4. RR - round  
 S 5. Rr - round  
 S 6. ll - stubby  
 S 7. ss - roundpants  
 S 8. Yy - yellow

Use the information in the chart to write the genotype (or genotypes) for each trait below.

- S 1. Yellow body - YY  
 S 2. Roundpants - ss  
 S 3. Oval eyes - rr  
 S 4. Long nose - LL  
 S 5. Stubby nose - ll  
 S 6. Round eyes - RR  
 S 7. Squarepants - SS  
 S 8. Blue body - yy

Boss Battle Round Three Sheet (Human Fleet)



## GLOSSARY

**BioCraft:** The title of the game being played in this operating model.

**Avatar:** Imaginary projections of students' selves in BioCraft. For this operating model, avatars are also referred to as organisms, species, players, or students.

**World Map:** The game board of BioCraft. A physical platform that presents the status of players during the curriculum. The world map is also referred to as the game board.

**Class:** The unique category of each player's avatar. Each player class are different from each other and possesses unique attributes. The three classes are: carnivores, omnivores, and herbivores.

**Ecosystem:** Another word to call a team of students. There are three ecosystems in BioCraft. These ecosystems are represented as continents on the world map. Each ecosystem must have at least one carnivore, one omnivore, and one herbivore.

**Level:** The overall status of a player in BioCraft. Each player begins at Level One. To move on to the next level, the player must gather Experience Points.

**Experience Points (XP):** XP is something to be earned during BioCraft. XP can be earned by completing tasks, displaying appropriate behavior during class, and passing tests. Each level has a set amount of XP to be gathered before moving up to the next level.

**Population Points (PP):** PP represents the amount of organisms each player possesses on the world map. If a player has 5 PP, then the player will have 5 thumbtacks on the world map. Physically, PP is represented as colored thumbtacks.

**Action Points (AP):** AP represents the amount of energy each player has in BioCraft. AP is used to perform actions in the classroom that are called adaptations. AP is a form of currency that is earned and spent. Physically, AP is represented as pinto beans.

**Adaptations:** Each player possesses special adaptations that are gained by leveling up. At certain levels, depending on the player class, adaptations will be made accessible and performable by spending AP. Physically, adaptations are represented by adaptation cards.

**Quests:** These are divided up into three categories: main quest, side quest, and bonus quest. Main quests are major assignments that require more time to complete and contain the majority of content material to be learned during a lesson sequence. Side

quests are small but necessary tasks to complete along the way toward a main quest. An example of a side quest would be obtaining a signed permission from a parent in order to complete the main quest of going on a field trip to the Zoo. Bonus quests are extra credit assignments that provide only positive XP rewards and do not have to be completed. Quests are completed and as a reward most of the time, XP are given.

**Boss Battle:** These battles are major tests or quizzes. In BioCraft, boss battles are represented as quiz bowls during which students buzz in answers to questions on the board. A boss battle tests the students' progress and knowledge of content material.

**GameMaster:** The title given to the teacher in the classroom. You will become the GameMaster of your own gamified curriculum in your classroom.

## WORKS CITED

- Baylor, M., & Souza, C. (2011). Knowledge Quest. In L. Sheldon, *The Multiplayer Classroom: Designing Coursework as a Game* (pp. 195-202). Boston: Cengage Learning.
- Buchanan, D. (2011). Biology Quest. In L. Sheldon, *The Multiplayer Classroom: Designing Coursework as a Game* (pp. 49-56). Boston: Cengage Learning.
- Entertainment Software Rating Board. (2010). *Video Game Industry Statistics*. New York: Entertainment Software Association.
- Gredler, M. (1997). *Learning and instruction: Theory into practice* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Hoffmeister, R. (2000). A piece of the puzzle: ASL and reading comprehension in deaf children. In *Language Acquisition by Eye* (pp. 143-161). Mahwah: Lawrence Erlbaum Associates, Inc.
- Ke, F. (2009). A qualitative meta-analysis of computer games as learning tools. (R. Ferdig, Ed.) *Effective electronic gaming in education* , 1, 1-32.
- Keller, J. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development* , 10 (3), 2-10.
- Malone, T., & Lepper, M. (1988). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. Snow, & M. Farr (Eds.), *Aptitude, learning, and instructions* (Vol. III, pp. 229-253). Mahwah, NJ: Lawrence Erlbaum Associates.
- Pavlov, I. (1927). *Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex*. London: Oxford University Press.
- Randel, J., Morris, B., Wetzel, C., & Whitehill, B. (1992). The effectiveness of games for educational purposes: a review of recent research. *Simulation and Gaming* , 23 (3), 261-276.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.

- Ryan, R., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* (55), 68-78.
- Singleton, J., & Morgan, D. (2006). Natural signed language acquisition within the social context of the classroom. In B. Schick, M. Marschark, & P. Spencer (Eds.), *Advances in the Sign Language Development of Deaf Children* (pp. 344-370). New York: Oxford University Press.
- Skinner, B. (1938). *The Behavior of Organisms: An Experimental Analysis*. New York: Appleton-Century.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.
- Young, S. (2013, January 23). Classcraft. (K. Turner, Interviewer)