THE EFFECTS OF STUDENT CREATED DIGITAL MEDIA ON UNDERSTANDING AND MOTIVATION IN A MIDDLE SCHOOL SCIENCE CLASSROOM

by

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DEDICATION

I dedicate this paper to my students and colleagues. I am thankful everyday that I have a job that I look forward to and appreciate the opportunity to work with wonderful people around the world.

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ABSTRACT

As technology progresses, teachers must constantly evaluate what tools are best practice for learning in their classroom. Student created digital media provides an avenue for students to express their learning and engagement in the classroom while practicing 21st century skills. This study looked at the effectiveness of student created digital media projects versus a traditional approach and their effect on learning and motivation. Utilizing qualitative and quantitative methods, this study found very little difference between these two approaches.

INTRODUCTION AND BACKGROUND

The purpose of my inquiry is to see if student created digital media projects improve performance in the middle school science classroom. Lincoln-The American International School of Buenos Aires (LAIS) is making a push to stay at the forefront of technology implementation. Educating the students of tomorrow means equipping them with the tools to survive in the 21st century. However, it is also important to measure the use of this technology and make sure that it has the desired effect on learning. I believe that if used correctly technology can be an effective tool to promote student learning and engagement.

Teaching Experience and Classroom Environment

I have taught at international schools throughout the world. I am currently located in Buenos Aires, Argentina. This is my second year at LAIS. It is a privately owned school located in a northern suburb of Buenos Aires. It is a K-12 school that provides schooling for students from over 45 countries. The student population is diverse and most often have parents that are expatriates whose work has brought them to Argentina. LAIS has a total of 813 students: 20% Argentine, 24% USA, and 56% from other countries. The school is certified through the New England Association of Schools and Colleges. The curriculums are based on United States national and state standards. I teach science in the middle school which consist of 6th through 8th grade. I focused on the 7th grade in my study with possible future implementation in 6th and 8th grade. The middle school science program at LAIS is an integrated curriculum with a heavy emphasis on inquiry-based learning.

As we delve into the 21st century the face of education is rapidly changing. Modern technology is having a tremendous impact on education. The skill set that students will need for the job market is changing at brisk pace. In addition, the actual mode of education is changing as teachers attempt to accommodate a very different learner. These learners are used to having rapid up to date information delivered in quick sound bites, video burst or text messages. Teachers are working with students that from a very young age knew how to navigate in a high tech world. No matter how much teachers strive to stay on top of the ever-changing technology it is still something they have most likely learned to do later in life. Whereas, the students that we are working with are were born in a digital era. This is all the more reason that we must study the effects of using technology in our classrooms. As we attempt to incorporate more and more technology into our classrooms it us our responsibility to make sure that student learning is kept at the forefront of decision making. This action research (AR) project will study the effects of student created digital media to ascertain whether it impacts learning and or motivation in the middle school classroom.

Project Background

Technology integration is a challenge that most quality schools address on a regular basis. LAIS is currently defining how they will integrate technology and what technology integration entails. Does LAIS provide each student with their own device or have them bring in their own? Should we be using laptops or tablets? The answers to these questions should be based upon student learning and need. This is also the driving question of how to implement technology integration at the classroom level.

There have been a number of studies based on what technology, teachers should be utilizing in their classrooms. However, this action research project will focus on the use of technology or digital media created by students. Student learning is enhanced when students are the ones doing the creating. The classrooms of today should not be teacher-centric. Peer collaboration and hands on learning is how students learn best. This learning can happen more effectively with the student use of technology.

What is digital media? Digital media can encompass a vast array of tools. For the purposes of this study, I am going to limit the digital media used to video based projects. These various forms of digital media are school appropriate and fit into the parameters of my schools technology guidelines.

My colleagues and I fight a constant barrage of new technology to use or not use in our classrooms. I believe it is important to take a step back and look at the impact of this technology integration. Some teachers seem to get caught up in using technology for the sake of using technology rather than letting it be a tool to drive student learning. I also question whether todays' students are being overwhelmed with digital media. This action research project will give solid information about technology integration.

The intervention is with two 7th grade science classes. The students in the intervention groups will be expected to produce a project using digital media while the other classes will do a more traditional project such as a poster or oral presentation. Middle school age students willingly embrace technology and are comfortable with this medium. However, the question remains does the use of said technology impact student learning. I believe this action research will show that student created digital media will

have a positive impact on learning and motivation. The use of digital media will also equip these students with skills for the future that cannot be measured in the present.

The purpose of this AR is to assess how I can improve student learning and engagement with digital media. My research questions include:

What are the potential positive or negative effects of student created digital media projects in the science classroom?

- What are the effects of student created digital media on learning content in the science classroom?
- What are the effects of student created digital media on student motivation?
- What are the effects of implementing student created technology projects on the teacher?

CONCEPTUAL FRAMEWORK

Some people state that in education we are dealing with a different type of student from years past. Students are growing up in a very different era with different technology at their disposal. In 2001 Marc Prensky coined the term “digital natives”. He said “… the most useful designation I have found for them is Digital Natives**.** Our students today are all “native speakers” of the digital language of computers, video games and the Internet”. (Prensky, 2001) Prensky goes on to state that those people who are not born in this time frame but came to technology use later in life are called “digital immigrants”. This divide or gap in how we utilize technology is an obstacle that many educators feel they must address in the their classroom.

How different are the students of today? Have they really changed that much because they were exposed to technology in their early years? It is easy to come to that

conclusion especially when many teachers consider themselves “digital immigrants” or visitors to the foreign land of technology. In their article, Digital Natives, where is the evidence? Ellen Helsper and Rebecca Eynon dispute the claim that there is any difference between students who have grown up with technology and those who have not. (Helsper & Eynon, 2010) Perhaps it is not a question of age or coming to technology later in life that determines whether a student learns better with technology but rather a point of being comfortable with that technology in the learning environment. Helsper & Eynon utilize this in their claim and say “being tech savvy is determined by exposure and experience then collaboration and learning is possible in environments where younger and older generations interact”. (Helsper & Eynon, 2010) It is important to keep both perspectives in mind when dealing with the implementation of technology and teaching.

Motivating students in this era of technology is also something teachers must consider. When students find value in what is happening in the classroom then they are much more likely to be motivated. In their study on problem based learning in a new media enriched environment researchers Liu, Horton, Olmanson and Toprac said that there are primarily two ways of motivating students. (Liu, Horton, Olmanson, & Toprac, 2011) First they said that students must have a belief that they can be successful and secondly students must value the task as interesting or it must have intrinsic value to the student. This study used a program in a new media format that had students logging on daily and using the technology to problem solve. Students acquired an adequate understanding of the concepts and motivation increased for most participants. This new media environment lent itself to a positive experience for the students.

From the teachers perspective it is also important to closely analyze what technology will be implemented into the classroom. Quite often teachers are implementing technology that is the most up to date rather than technology that they are comfortable implementing. Additionally, dictates from administrators frequently drive what technology is being used rather than what tool is best for student learning. In their research involving middle school digital documentary projects, Hofer and Owings Swan found that technology integration was a challenge for many teachers. (Hofer & Owings Swan, 2008) “Technology integration is a very personal and situated undertaking for teachers” (pg. 196). Teachers are often unsure what knowledge base they themselves require to implement technology. Koehler and Mishra have designed a schematic for technology integration. (Koehler & Mishra, 2008) They included three intersecting areas of knowledge that include content, pedagogical and technological. This schematic is included in figure 1.

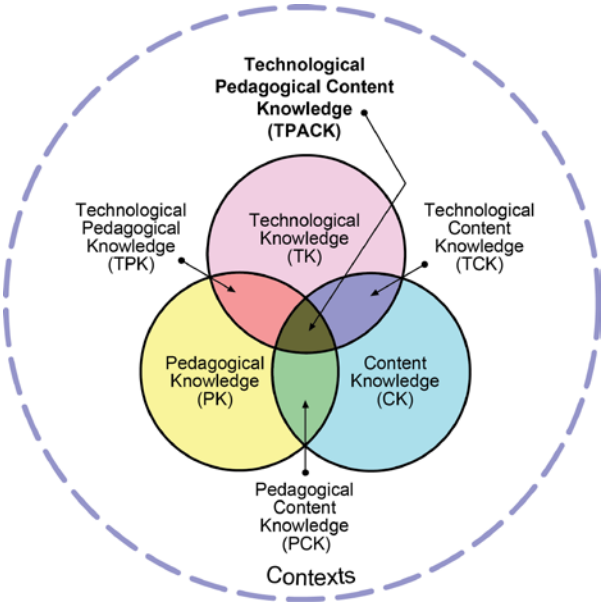

Figure 1: Technological Pedagogical Content Knowledge (TPCK). Reproduced by Permission of the Publisher, © 2012 by tpack.org .

Koehler and Mishra ascertain that all three areas come into play when teachers are utilizing technology in the classroom. For instance, if a teacher wanted to implement a digital media project about cells he or she would have to have technology knowledge about digital media. That teacher would also need a solid understanding of cellular biology, which would be the content knowledge and finally pedagogically be able to set up a project that was appropriate for the students. Teachers have to balance all of these areas as they implement technology.

Society is now functioning in an environment of rapidly changing technology. Since we are trying to prepare our students to survive in this dynamic environment we must constantly evaluate what skills and knowledge will be needed for tomorrow. As a leading scholar in the area of science, technology, and society studies Wiebe E. Bijker refers to us living in a "technological culture." (Cutcliffe & Mitcham, 2001) He says that to truly understand culture you must take into account the role of science and technology. However, it is important to not treat science and technology as the answer to everything. People use technology and its use can have a positive or negative outcome. Another concern that Bijker addresses are that when trying to communicate issues related to technology we often refer to the experts. (Cutcliffe & Mitcham, 2001) The experts have a difficult time passing on esoteric knowledge to the common layperson or someone who is not an expert in the field of technology. Therefore, it makes it difficult to predict what skills or knowledge will needed for tomorrow when the experts in technology cannot accurately predict or communicate what those skills will be.

In regards to the relationship between technology and education there has been a longstanding national effort in the United States of America to integrate technology into education. More recently we have paired technology with science, engineering and mathematics. This effort has been referred to as STEM standards, which is an acronym for Science, Technology, Engineering and Mathematics. The term "STEM education" refers to teaching and learning in the fields of science, technology, engineering, and mathematics." (Gonzalez, 2012) The importance of technology integration is evident in its equal standing with science, engineering and mathematics. The hope is that these areas of study will help humanity advance. The question then becomes how do we integrate technology with science. These two areas of study go hand in hand. The areas of science and technology are interdependent as stated in the Next Generation Science Standards (NGSS 2013). The NGSS goes on to state that not only are these areas interdependent but that they also have an influence on society and the natural world. The relationship goes both ways as society influences technology and science advancements. If something is important to society they will invest research and funding to go into these areas. Technology almost seems to have a blank check when it comes to this interest from people. There are very few that would argue against the point that we should invest in technology or be left behind.

The question then becomes how do we integrate technology into our classrooms. Ideally science should be taught with hands on inquiry-based learning method. Dr. Barron and Dr. Darling-Hammond explore this in their review of research on inquiry-based learning. (Darling-Hammond and Barron, 2008) "Decades of research illustrate the benefits of inquiry-based and cooperative learning to help students develop the

knowledge and skills necessary to be successful in a rapidly changing world." Inquiry and science are a mutually beneficial relationship. Inquiry produces skills like the ability to problem solve, question, investigate and find the answer. Technology is a tool like any other that can be utilized in the inquiry process. Furthermore, technology produces skills like generating ideas, manipulating, researching and producing or displaying those ideas. It seems that the balance of technology integration and inquiry-based learning will equip our students with the skills to be successful in the future.

METHODOLOGY

This action research was conducted in four seventh grade science classes at LAIS. The purpose was to determine if student created digital media would improve student performance and motivation in the science classroom. The action research happened over a nine-week period from February until April. A letter was sent home to all seventh graders at the beginning of the study to explain the project and request parent permission for their son or daughter to be involved in this project. (Appendix A) The research methodology for this action research received an exemption from Montana State University's Internal Review Board. It was found that the methodology for this project met all criteria for working with human subjects in an education setting.

In the 2013-14 school year there were a total of four seventh grade classes at LAIS. I taught two classes while my colleague taught the other two classes. During this time, all four classes followed a unit on cells and participated in the annual science fair. We randomly chose one of my classes and one of my colleague's classes to be the treatment groups. Having one class of each teacher would hopefully isolate the variable that I was studying rather than that of teaching styles or other various classroom

differences.

There were sixty-three students that participated in the study. (*N*=63) This included 35 girls and 28 boys. The population included seven English Language Learners and four that are on Individualized Education Plans and receiving Learning Center support.

Data Collection Methods

Qualitative and quantitative methods were used for collecting data in this action research project. As seen in the data triangulation in Table 1, data for this intervention was collected primarily in three ways; knowledge test, attitude surveys and student interviews.

Table 1
Data Triangulation Matrix

Questions	Data Source		
Focus Question: Does the use of student created digital media improve student learning in a middle school science classroom?	Common Pre-Unit Assessment	Common Unit Summative Assessment	Post-Student Interviews
Sub-Question 2: Does the use of student created digital media improve student motivation?	Pre-treatment Attitude survey	Post-treatment Attitude Survey	Post-Student Interviews
Sub-Question 3: Does the implementation of student created digital media effect teacher motivation?	Pre-treatment interview and discussion	Post-treatment interview and discussion	Journal and Observation

Students were given the Houghlin Mifflin Harcourt Science Fusion textbook pre-test for cells to assess their prior knowledge and introduce the content to be covered (Appendix B). It was a 10 question pre-test that had no bearing on the students' grade. This is a typical practice in both classrooms as it allows students to get an idea of the

upcoming unit and it gives the teacher insight into the level of student knowledge pertaining to that subject. For the purposes of this study, it will give a baseline of student knowledge to evaluate learning. Before the intervention students were given a Student Survey on Attitude (Appendix C) regarding science class. I created this survey with the intention of measuring students' perceptions about science. Students provide a 1-4 response regarding questions dealing with attitude towards science class. Once again, this was distributed in class and students were told that this had no bearing on their grade.

In starting the cells unit, it was explained that besides the normal quizzes and formative assessments students would also be responsible for a major project. The treatment classes would be creating a digital media project while the non-treatment classes were going to do a traditional poster project. After the content was covered students were given guidelines to these projects. The treatment group was given Cells Digital Media Project (Appendix D) and the non-treatment group was given Cells Poster Project (Appendix E) as guidelines for their projects.

The treatment group was instructed in the medium that they would use for their digital media project. My middle school principal allowed me to pilot a web-based program called VoiceThread. (https://voicethread.com/) This program allows students to create a video using voice, video or text. It has an entire network of educators and students that one can publish to and that you can utilize as a resource. It allows students to use a variety of digital media methods while also broadcasting to a wider announce. Another benefit for our school is that it is kept in an educational realm rather being broadcast to the entire web community. Security measures on the web and Internet

protocol can be an intimidating fact of web use. However, VoiceThread limits that audience to other schools and educators.

After the lesson on cellular processes students were given the guidelines for their specific project. For the digital media classes, I made a VoiceThread of the guidelines and how to do a VoiceThread. Plus, both teachers encouraged the students to investigate the “how to” videos found in VoiceThread. All classes were given guidelines a grading rubric (Appendix F) for their projects.

After the projects were presented students took an end of unit test. (Appendix G) This was the final measure for knowledge attainment. It had seventeen questions with a range of multiple choice and short answer critical thinking questions. Students were again given the Student Survey on Attitude post intervention to see if their motivation levels had changed. There was also a series of post-interview questions that randomly selected students from the treatment and non-treatment groups were asked. (Appendix H) These questions served as a guide for interviews that happened after the intervention.

For keeping track of teacher motivation and perceptions, both teachers kept track of how the action research project was progressing through weekly meetings and discussions regarding the science classes. I did a reflective journal of both teachers’ perceptions and observations of the task being implemented. This included but was not limited to the time it took for certain activities, student engagement, student successes and failures, and overall teacher impressions of the projects.

DATA AND ANALYSIS

In this data analysis section, you are going to read about the effects of student created digital media in the classroom. I will explore the answers to several questions surrounding the use of student created digital media. Are students more engaged with the use of technology or do traditional projects have the same effect? Does the student use of technology have any bearing on their learning? And finally does student created digital media have an impact on teacher motivation? These questions will all be addressed within this data analysis.

Pre- Knowledge Test

Before the unit of study and therefore treatment started all students were given knowledge pre-test. The goal of the pre-test is to ascertain what knowledge students have about the topic before beginning the unit of study. An analysis of the knowledge pre-test indicates that the treatment groups and comparison groups (N=63) were starting with very similar background knowledge about cells and cell structure. The Mean for the treatment group was 35.38% with a Standard Deviation of 11.79. The non-treatment group had a Mean of 35.29% with a Standard Deviation of 14.82. This gave a *t*-test of = 0.0568 and p value of = 0.9549. Thereby, indicating no statistical difference in the pre-knowledge of these two groups regarding cells and cell structure.

Pre- Attitude Survey

At the beginning of this action research project student attitudes were evaluated through a survey. The Student Attitude Survey before the treatment was given to all classes and the results were varied. Each question had a one to four rating on whether they agreed or disagreed with the statement. For instance, the first question in the survey

was “Science class is challenging”. Students were then to rank this with a one if they strongly disagreed and a four if they strongly agreed.

The pre-attitude survey indicated a negligible difference between the two groups. For the treatment group there was a Mean of 3.02 and Standard Deviation of 0.3005. Meanwhile the Mean for the nontreatment group was 2.90 with a Standard Deviation of 0.3274. The statistical analysis indicated a t=1.6066 and p-value of 0.1127. By conventional criteria this would indicate no statistical difference in their attitudes toward science at the start of this action research project.

Post-Test Knowledge

With the pre analysis done we next look to the question of whether the use of student created digital media improves student performance on written assessments. The post-test was a full unit exam with 26 questions scored out of 100%. The unit test was not exact to the pre-test but covered the same information and sought to evaluate student knowledge of cell function and structure. The scores on the test indicate that learning did take place and both treatment and nontreatment groups satisfactorily learned the topic by our school standards. The differences in knowledge attainment are negligible. The *t*-test indicated a score of 0.7515 and a p-value of 0.4552. The treatment group had a Mean of 77.23% with a Standard Deviation of 12.96, while the nontreatment was a Mean of 79.71% and a Standard Deviation of 13.58. This indicates no difference between the two groups regarding knowledge attainment.

Post- Attitude Survey

To address the second sub-question of whether digital media would effect student motivation and or levels of engagement we will need to look at the results of the post

attitude survey that was distributed. The post survey revealed a Mean of 2.90 with a Standard Deviation of .3287 for the treatment group. Following very closely the nontreatment group had a 2.91 Mean with a .3515 Standard Deviation. The *t*-test was .0392 with a p-value= 0.9688. This indicates that the treatment had an insignificant impact on students' attitudes toward science.

If we look more closely at specific questions on the survey we see that the differences between pre-treatment and post-treatment were also quite negligible. For instance, question #5 on the survey was "I enjoy science class". There was an average gain of +.09 in the treatment groups while the nontreatment groups had a slightly better gain of +.17. When referring to class participation we must look to question # 7 on the student survey, "I participate in science class on a regular basis". The treatment group had a increase gain on this question of +.1 while the nontreatment declined with -.08. Question #11 on the survey addressed the students' level of mental engagement. It reads, " I am mentally engaged in science class most of the time". The nontreatment group had a slight increase of +.01 while the treatment groups declined with a -.37. Specific questions on the survey did not indicate any trends for the treatment or nontreatment groups.

Post- Interview Questions

The qualitative interviews that were taken after the treatment did not indicate a consistent trend in the digital media projects impacting student learning or a change in students' attitudes about science. When students were asked why they enjoyed science class responses varied from "I enjoy science because of the labs and doing things with our hands" to "I like science because we are learning about the world". When further

asked if they thought using technology in science class was necessary a student said “I use technology all the time and sometimes it helps and other times it doesn’t”.

In one of the interview questions, students were asked if creating their own digital media projects helped them learn the material. The responses varied greatly in whether the digital media project had helped them learn the material. One student said that she had to learn the material really well to be able to present it in the dialogue that her and her partner created for their project. Another student disagreed with that and said that he totally forgot about the information after he presented it in his digital media project.

The interview responses were also highly varied in the use of VoiceThread as our tool of digital media. Several students liked it and felt it was easy to navigate while many students said that it was difficult and they would have rather created a Power Point or some other type of presentation. When I asked one student why this was he said “I think because I am more comfortable with Power Point, I’ve done it a million times”. This is a valid concern and one that I feel may have affected the results of this study.

Several students commented that it was frustrating at times because the Internet did not work or there was not access to computers that had both microphones and video equipment in our school. In an interview one student observed that she had really liked doing the digital media project but that it was hard to find the time to do it. Another student commented that it would have been easier if he had learned how to do the VoiceThread earlier in the year. He went on to say that learning new technology could be really frustrating.

Most students responded that they thought technology was helpful in the science classroom. After further questions, it was revealed that many students felt that technology

is not the sole key to their learning. When one student from the treatment group was asked about whether doing a project with digital media helped them score better on the test they responded “the project was cool but I think I learned about cells from our textbook and in the lab”. They were also very aware that technology sometimes does not work and you cannot solely depend on it as the only method for creating or learning. I asked one student from the non-treatment group about creating with technology and she explained that she is really good at art and does not like working on the computer that much so for her she enjoyed creating with a more traditional tool and didn’t feel like she had missed out on anything.

Teacher Attitude

I kept a journal and interviewed weekly with my colleague about the progress of this project. Overall, teacher attitudes were optimistic and remained so throughout the course of the project. However, there were frustrations with Internet and other technology mishaps the impacted teacher attitude toward this project.

The other factor that was evidenced was the amount of extra time that it took to teach the digital media project. A total of an extra 30-40 minutes was spent in treatment classes explaining how to operate Voicethread. However, this did not include making the video or the trouble shooting and individual assistance that some students needed. I would estimate that from my own experience and that which my colleague conveyed was that implementing this type of project added a substantial amount of time to an already very busy schedule. This definitely affected teacher attitude and made us question whether this type of project would be beneficial in the future.

INTERPRETATION AND CONCLUSION

Student created digital media is a technology tool that has the potential to augment student learning. This AR project found that the use of student created digital media was equal to the use traditional projects as it pertains to student learning and motivation. Teachers often jump to the conclusion that the use of technology will automatically lead to better learning and engagement. However, this is not necessarily the case.

As the evidence pertains to the question of student learning about the topic of study there was no direct correlation between the use of student created digital media and better test scores. Nevertheless, some students did seem to benefit and conveyed their approval of using technology to learn. It should therefore be noted that while some students will continue to benefit from learning with a traditional approach other students would be able to find value in taking a more progressive approach and use technology.

In regards to the motivation level of students there was also no direct improvement in regards to use of technology. Some students found value in the use of student created digital media but it did not necessarily make them like science more. The qualitative data suggested that other aspects of science class, such as labs, are what make some students enjoy science.

The data also did not display any trends with specific questions on the attitude survey. For the questions about enjoyment, engagement and participation there were all improvements but only slight declines in the treatment groups' engagement and the non-treatment groups' participation. Again not revealing that this particular action research had much impact in these areas. I believe that these areas are dictated by other factors

such as classroom environment rather than the use of technology. This would explain why we are unable to see any trends in the data at this time.

The use of technology is unpredictable in the best of times. Nonetheless, many students voiced frustration over keys aspects of this treatment. One of the benefits of using Voicethread was that the students would address several aspects of communication: visual, auditory and oral. However, there were times when our computer lab was unable to provide computers that had both microphone and camera capabilities. This was unknown to me at the start of this AR project. I incorrectly assumed that we were fully functional on this aspect of technology. The problem has since been addressed but it was a small hurdle that students had to overcome.

One outside variable that I feel may have impacted this AR project was that the 7th grade science classes that were being studied were also responsible for producing an independent science fair project that ran simultaneously with this cells unit. This science fair project is a longstanding tradition at our school and has a substantial amount of value placed on it by our community and parents. Some students expressed that they would have liked to explore the use of student created digital media more in the use of Voicethread but did not have the time because of the science fair.

Additionally, I feel the limited use of the intervention as a culminating project led to a negligible result. Perhaps with more time students would have benefitted from learning and utilizing this tool. It would be interesting to investigate a yearlong intervention of student use of technology and see if the impact remains negligible. However, the ethical question comes into play of whether you can have students

consistently not involved in technology use in the classroom to be able to ascertain a difference.

A positive effect that cannot be measured within the limitations of this AR project is that of specific technology skills that students may have learned by doing this project. There are potential long-term cross-curricular skills that were learned. Students will be able to utilize their ability to communicate and learn via digital media in many aspects of school and life.

In my literature review I referred to two differing opinions on how our students are learning with technology. Prensky states that we are dealing with a different type of student that has different needs because they are "digital natives." (Prensky 2001) My research contradicts this and supports the views of Helsper and Eynon in that not all students who have grown up in this era necessarily learn better with technology. (Helsper & Eynon 2010) It is easy to assume that technology makes learning easier because I think we often equate efficiency with proficiency. Meaning something easy is not necessarily better.

VALUE

In my opinion, this AR project has reinforced that as we look at implementing technology and using it in the classroom we must keep a balance and make sure that our end objectives of student learning are kept at the forefront. The evidence from this AR project overwhelmingly supports a careful balanced approach to technology integration.

Another glaring result of this study has been that not all students are at the same level of technology use and knowledge. I made the mistake of assuming that most if not all students would be able to navigate the Voicethread program on their own. This was

most certainly not the case. From the teacher feedback portion of this project it was evident that a substantial amount of time was spent helping a portion of students navigate the digital media world. At the time of this study LAIS did not have a technology class with a curriculum that addressed this skill base for students. Next year a class that addresses these skills is being introduced at our school. I plan on continuing to evaluate the use of technology in the classroom and would like to serve on a committee that addresses these issues.

My colleague I both agree that technology integration and science go hand in hand. However, we would like to see a more cross-curricular approach to technology integration. This digital media tool may have made more of an impact if students were using it across their academia. Learning a tool for one class and one project had a negligible effect. It is important to identify which programs as a school we value and want to utilize. Thereby making students familiar with the technology and hopefully allowing them to use this tool efficiently.

The largest impact that this AR project has had on me as a professional is to make sure that I am looking at technology as the tool that it is and not a quick fix for student learning. Next year I will be the science department head for LAIS middle school. I plan on making it a goal for our science department to identify technology use and tie it to our curriculum. Meanwhile keeping our inquiry based program intact and making sure that student learning and motivation is kept at the forefront. It is important to keep the end goal in mind and not get lost in the fast paced world of technology. This will be especially key as we are moving to having students bring their own tablets to middle

school. As we are utilizing these tools we must have a system in place that does not lose sight of achieving our main goals.

This AR project has challenged me both professionally and personally. It was difficult at times to see if this project was making me a better teacher. As I reflect back I definitely have to say that it has made me more contemplative about the practices that I utilize in my classroom. Like many educators, I am prone to pick up the latest and greatest tools hoping to stay at the forefront of my profession. However, through this AR project I see that I must collect solid evidence of how my students are learning and take a more balanced approach to technology integration. I plan on sharing this with my school and other international schools in South America as we all attempt to keep up with the fast pace of technology.

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APPENDICES

APPENDIX A

PARENT LETTER

To the parents of 7th grade science students,

Greetings and welcome back to the second semester!
I am writing to inform you that I will be conducting a study this semester within all of our 7th grade science classes. I am currently studying at Montana State University in the U.S.A. to obtain a Master's degree in Science Education. The title of my research is "The Effects of Digital Media in the Middle School Science Classroom". I am hoping to assess the impact that digital media has on student learning.
This research project will be taking place over the next semester. The structure and implementation of science class will not change but I will be surveying students and interviewing them to see the effects of the use of the use of digital media. Participation in this study is voluntary and has no impact on a student's grade or standing in the class. Student anonymity will be protected and all responses and information collected will be done anonymously. The research will abide by Lincoln school policy as well as that of Montana State University.
If you have any questions about the project please don't hesitate to contact me.

Jennifer Heisler
MS Science Teacher
Lincoln American International School
Asociacion Escuelas Lincoln
Andres Ferreyra 4073
B1637 AOS La Lucila,
Buenos Aires, Argentina

APPENDIX B

PRE KNOWLEDGE TEST

Pretest

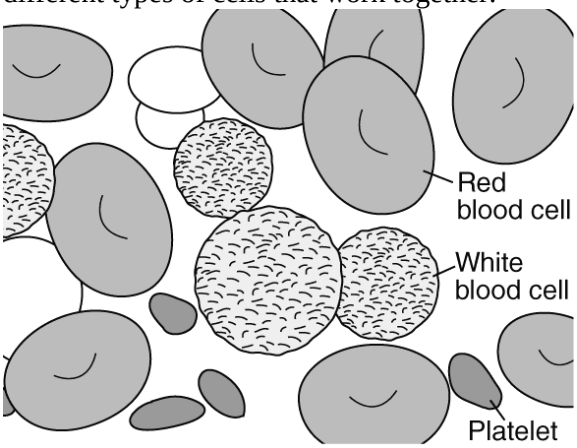
Cells

Choose the letter of the best answer.

1. Which of the following is a plant organ responsible for trapping light energy to make food?

A. leaf
B. fruit
C. petal
D. root

2. The following picture shows a microscopic view of blood. Blood is made of different types of cells that work together.



Which of the following best describes blood?

A. organ
B. tissue
C. organism
D. organ system

3. In biology class, Zach observes cells. Each cell has a structure that separates the inside of the cell from the environment. Which structure is Zach observing?

A. nucleus
B. cytoskeleton
C. cell membrane
D. genetic material

4. Which of these is the smallest?

A. cells
B. atoms
C. molecules
D. cell membranes

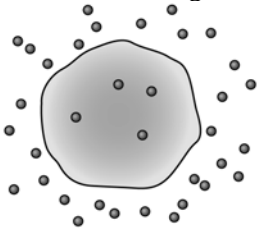
5. What is the result of homeostasis at the cellular level?

A. The cell dies.
B. The cell divides.
C. The cell no longer obtains energy.
D. The environment within the cell is stable.

6. Which of the following describes the structure of the endoplasmic reticulum?

A. a system of folded membranes
B. a tiny organelle that has no membrane
C. a rigid, protective layer found outside the cell membrane
D. an organelle surrounded by a double membrane and containing DNA

7. The diagram below shows molecules inside and outside of a cell. Molecules move from areas of high concentration to low concentration.



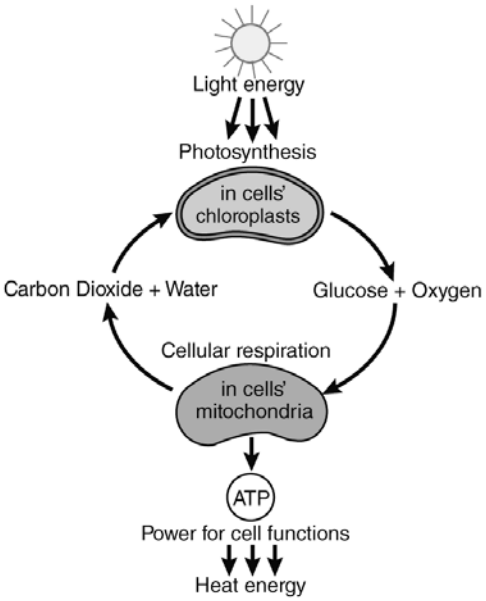
What is the name of the process that will move molecules into the cell?

A. diffusion
B. exocytosis
C. photosynthesis
D. cellular respiration

8. Which of the following statements describes a characteristic of a eukaryote?

A. It has no cytoplasm.
B. It has DNA in a nucleus.
C. It is made of many cells.
D. It has DNA in its cytoplasm.

9. Plants can provide the materials that animals use in cellular respiration, and animals can provide some of the materials that plants use for photosynthesis. This image below shows the relationship between photosynthesis and cellular respiration.



According to the diagram, how does cellular respiration aid the process of photosynthesis?

A. It produces ATP.
B. It produces glucose.
C. It produces mitochondria.
D. It produces carbon dioxide.

10. Nutritionists know that lipids are a vital nutrient that helps keep cells working properly. What is one way the cells in our bodies use lipids?

A. to make amino acids
B. to repair broken bones
C. to form cell membranes
D. to carry information in the cell

APPENDIX C

STUDENT ATTITUDE SURVEY

Student Survey- 7th Grade

Please tick each box with how you feel about science class. Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.

	Strongly Disagree	**Somewhat Disagree**	**Somewhat Agree**	**Strongly Agree**
1. Science class is challenging.				
2. Science class relates to my everyday life.				
3. Science is too complicated for most people to understand.				
4. I will use science in the future.				
5. I enjoy science class.				
6. I often need help with my science homework.				
7. I participate in science class on a regular basis.				
8. I make good grades in science.				
9. Science class is fun.				
10. The labs and projects we do in class are related to the material we are studying.				
11. I am mentally engaged in science class most of the time.				
12. I may pursue a career related to science.				

APPENDIX D

DIGITAL MEDIA PROJECT CRITERIA

Cells Project 1- Digital Media Project:

Students will use VoiceThread.
(VoiceThread is a Web-based digital storytelling program that enables users to upload pictures or documents, record accompanying audio (or video) commentary, and invite others to record commentary as well. It's simple combination of visual and recorded media is perfect for creating multimedia presentations in a relatively short time frame using simple tools.)
You will create your own Voicethread presentation that is approximately 1-2 minute(s) in length. It should be on lesson 3, lesson 4 or both lessons 3 & 4 in your book. This project is taking the place of a quiz or learning check and will take the place of a quiz grade (possible 10 points). Please look at the rubric on the back of this sheet for scoring reference. You may work with a partner but then you must cover both lessons and both of you must be on the Voicethread.
Criteria for Voicethread presentation:

- Audio and Visual in your presentation (you can use pictures from the web, your book, or other sources and record your own voice explaining them)
- Content should be facts about cell structure, function & levels of cellular organization. Need to show understanding of entire lesson.
- Teach the viewer about the topic you have studied. Please DO NOT read from the book or other sources. This needs to be done in your own language.
- Extended learning: To earn 10 points you must make a constructive comment on at least 2 other peoples Voicethreads in the class.

APPENDIX E

TRADITIONAL PROJECT CRITERIA

Poster Project:
Students will make a poster about one the lessons we have covered in the book. It should be on lesson 3, lesson 4 or both lessons 3 & 4 in your book. This project is taking the place of a quiz or learning check and will take the place of a quiz grade (possible 10 points). Please look at the rubric on the back of this sheet for scoring reference.
Poster criteria:

- Graphics and Text in your project.
- Content should be facts about cell structure, function & levels of cellular organization. Need to show understanding of entire lesson.
- Teach the viewer about the topic you have studied. Please DO NOT copy from the book or other sources. This needs to be done in your own language.
- Extended learning: To earn 10 points you must make a constructive comment on at least 2 other peoples' posters in the class.

APPENDIX F

PROJECT GRADING RUBRIC

CATEGORY	4	3	2	1
Required Elements	The project includes all required elements as well as additional information. Extended learning: Two constructive comments posted about other projects.	All required elements are included in the project. Extended Learning: At least one constructive comment posted about other project.	All but one of the required elements are included in the project.	Several required elements are missing.
Knowledge Gained	Student has accurately answered all questions related to facts in the project and processes used to create it.	Student has accurately answered most questions related to facts in the project.	Student has accurately answered more than 50% of the questions related to facts in the project.	Student appears to have insufficient knowledge about the facts.
Graphics Relevance	All graphics are related to the topic and make it easier to understand.	All graphics are related to the topic and most make it easier to understand	All graphics relate to the topic.	Graphics do not relate to the topic.

APPENDIX G

POST KNOWLEDGE UNIT TEST

Unit Test A

Cells

Key Concepts

Choose the letter of the best answer.

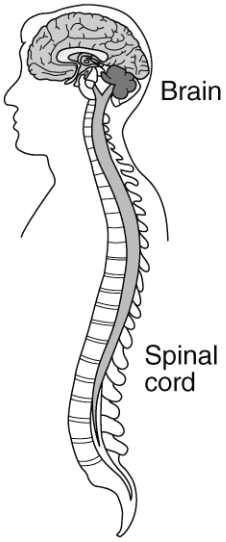
1. Plants make their own food during photosynthesis. In what group do plants belong?

A. producers
B. consumers
C. chloroplasts
D. decomposers

2. Which molecules make up proteins?

A. amino acids
B. nucleic acids
C. phospholipids
D. carbohydrates

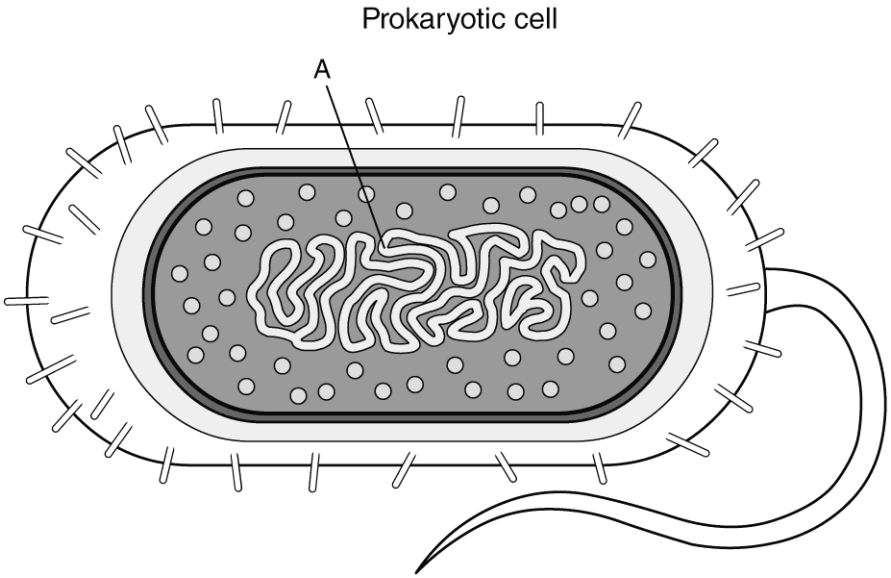
3. The diagram below shows the two main parts of the human body's central nervous system.



According to the diagram, which term best describes the spinal cord?

A. cell
B. organ
C. tissue
D. organ system

4. The following picture shows a prokaryotic organism.



What part of the organism is labeled *A*?

A. DNA
B. cytoplasm
C. cell membrane
D. membrane-bound organelle

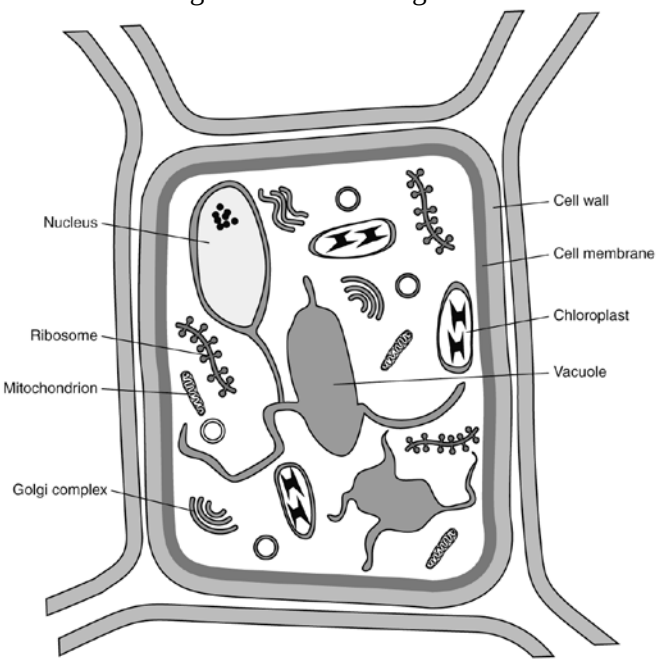
5. Which term describes the adaptation of cells, organs, or organ systems for a specific function?

A. structure
B. specialization
C. multicellular organism
D. level of cellular organization

6. What does a cell use to break down glucose during cellular respiration?

A. ATP
B. water
C. oxygen
D. nitrogen

7. This diagram shows a living cell.



What evidence exists in the diagram to explain that it is a plant cell and not an animal cell?

A. the nucleus
B. the cell wall
C. the ribosomes
D. the mitochondrion

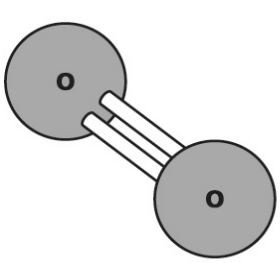
8. What is a difference between eukaryotic cells and prokaryotic cells?

A. Only prokaryotic cells have cytoplasm.
B. Only eukaryotic cells have a cell membrane.
C. Only prokaryotic cells have genetic material.
D. Only eukaryotic cells have membrane-bound organelles.

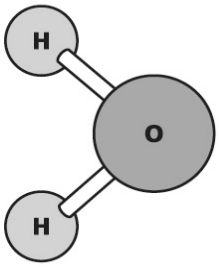
9. Eukaryotic cells and prokaryotic cells have some parts that are different. Which of the following would you find **only** in a eukaryotic cell?

A. a nucleus
B. a cell membrane
C. DNA in the cytoplasm
D. organelles without membranes

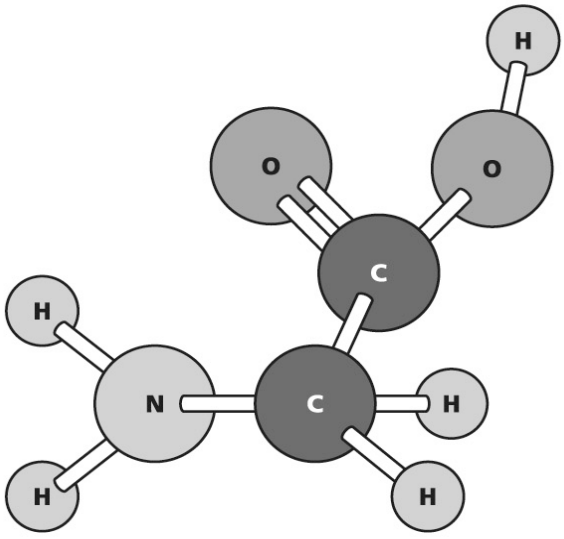
10. Study the diagram below to answer the following question.



Oxygen gas O_2



Water H_2O



Amino acid glycine $C_2H_5NO_2$

Which of the above images is a molecule?

A. Only the first image, oxygen gas, is a molecule.

B. Only the second image, water, is a molecule.

C. Only the third image, amino acid glycine, is a molecule.

D. All three images, oxygen, water, and amino acid glycine, are molecules.

11. Some organisms consist of one cell. Other organisms consist of multiple cells. Which of the following is true of cells in a multicellular organism?

A. All cells have the same function.

B. Every cell has a different function.

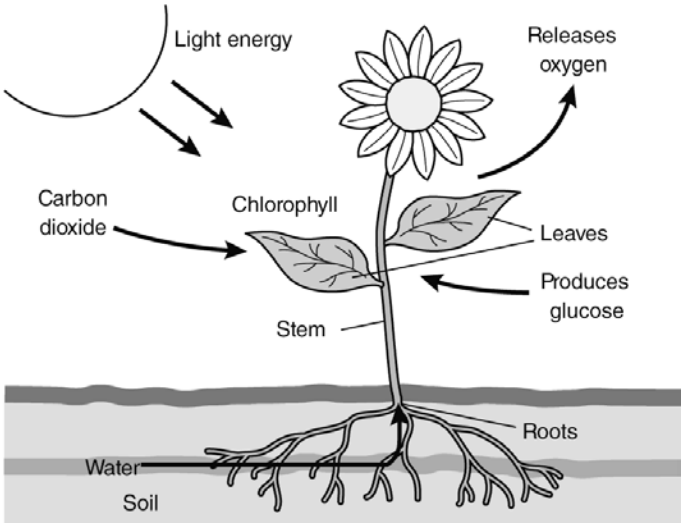
C. Different types of cells have the same function.

D. Different types of cells have different functions.

12. Even when it is cold outside, the human body maintains an internal temperature of 37 °C. Which term describes the maintenance of a stable internal condition?

A. endocytosis
B. homeostasis
C. mitosis
D. photosynthesis

13. When sunlight strikes a plant, the leaves capture most of that energy to use for photosynthesis. The image below shows the process of photosynthesis in action.



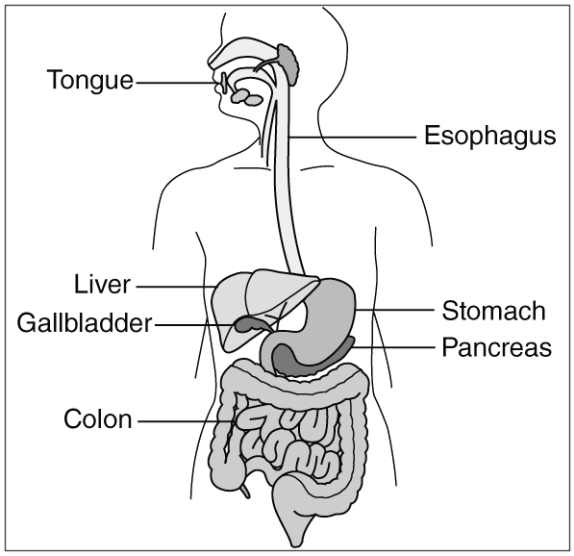
Which of these materials helps plants use energy from sunlight?

A. soil
B. roots
C. glucose
D. chlorophyll

14. What is mitosis?

A. the process by which plants make their own food
B. the process by which cells use oxygen to produce energy from food
C. the maintenance of a stable internal environment
D. the process in which a cell divides and forms two identical nuclei

15. The diagram shows parts of the human body. These parts work together to help you digest the food
you eat.



Which term best describes the entire group of parts that are labeled?

A. cell
B. organ
C. tissue
D. organ system

Critical Thinking

Answer the following questions in the space provided.

16. Explain the difference between simple and complex carbohydrates.

_____

_____

_____

_____

_____

Extended Response

Answer the following questions in the space provided.

17. Two important processes that cells use are photosynthesis and cellular respiration. Choose one process and describe it. Include why the process is important to cells.

_____

_____

_____

_____

_____

APPENDIX H

POST INTERVENTION- INTERVIEW QUESTIONS

1) What do you like about science class?
2) What effects your mental engagement in science class?
3) Do you enjoy using technology in science class? Is it necessary?
4) Do you think creating your own digital media projects with Voicethread helped you learn the material better?
5) What did you like/dislike about the unit project?