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The Influence of Universal Design for Learning through Cooperative Learning and Project- Based Learning on an Inclusive Classroom

Katherine Taylor

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ABSTRACT

There are three major principles to the Universal Design for Learning (UDL) design: multiple means for engagement, representation, and action/ expression. Problem-based Learning (PBL) and Cooperative Learning (CL) are two instructional methods that allow for the three major components of UDL. Research shows that these two instructional methods are effective academically and promote students exploration and engagement (Altun 2015, ChanLin 2008). This quantitative and qualitative action research study explores the effects of implementing UDL through Project-Based Learning and Cooperative Learning in science units in an inclusive classroom. Student participants in this study passed (70% or above) the post-test for the PBL and CL units. The growth scores of students were not conclusive due to limitations in the methodology. Student preference did not conclusively show a majority preference one way or the other. Although there was not a definitive preference, this data shows that students prefer to learn in different environments and is useful information for educators.

INTRODUCTION

Guiding this research is the Universal Design for Learning (UDL) instructional theory. The Universal Design for Learning model has many years of extensive research in a variety of settings. UDL was originally derived from architectural concepts where constructive designs were planned for efficiency for *all* students. UDL means that teachers must provide access to curriculum for all students (Michael & Trezek, 2006). There are three major principles (blocks) to the UDL design: multiple means for engagement, representation, and action/ expression.

Problem-based Learning (PBL) and Cooperative Learning (CL) are two instructional methods that allow for the three major components of UDL. Research supports the effectiveness of PBL and CL. A major component of PBL is learning curriculum content through the process of the project (Hovey & Ferguson, 2014). Researchers concluded that CL promotes a "collaborative learning environment, supported permanent learning, provided opportunities to be successful, and contributed to the development of social and personal skills," (Altun, 2015).

Previous research shows that UDL, PBL, and CL, are academically effective instructional strategies. However, there is little research that supports how these strategies compare to one another in addition to student perceptions of these methods. Previous studies should be applied to inclusive classrooms to compare effectiveness for students with disabilities and without disabilities. The objective of this study is to analyze effects of implementing UDL through PBL and CL in science units in an inclusive classroom.

In this research study, I ask the question: How does implementing UDL through PBL and CL influence an inclusive classroom? In order to better answer this question, I will address the following three subquestions:

(a) What is the effect of UDL through Project-Based Learning in a science unit in comparison to UDL through Cooperative Learning in a science unit on academic effectiveness?

(b) How is science content knowledge affected by implementing UDL through project-based learning and cooperative learning in a science unit on students with disabilities and students without disabilities?

(c) What are student perceptions of Project-Based Learning and Cooperative Learning?

LITERATURE REVIEW

Universal Design for Learning (UDL) is a method of instruction that provides differentiation in the forms of representation, action and expression, and engagement. UDL can be implemented in classrooms through a variety of methods that compliment these principles. This study focuses on the effectiveness on content knowledge, and student perceptions of Project-Based Learning and Cooperative Learning. Project-Based Learning and Cooperative Learning are two instructional approaches that provide opportunities for differentiation and UDL principles in the classroom. This literature review will focus on three major themes: Universal Design for Learning, Project-Based Learning Approach, and Cooperative Learning Approach. Although the literature presents these themes through various of curriculum content and grade levels, this study will focus on the Virginia third grade science curriculum.

Universal Design for Learning

The Universal Design for Learning model has many years of extensive research in a variety of settings. UDL was originally derived from architectural concepts where constructive designs were planned for efficiency for *all* students. UDL means that teachers must provide access to curriculum for all students (Michael & Trezek, 2006). There are three major principles (blocks) to the UDL design:

1. "Multiple means of engagement: options for motivating and engaging all learners using a constructivist approach that supports active engagement in their learning,
2. Multiple means of representation: options for perception, language and symbols, and comprehension,
3. Multiple means of action and expression: "focus of these option sis on variations in physical action, expressive skills and fluency, and executive functions," (Brand, Fravvaza, & Dalton 2012, pgs 135- 138).

Recent research calls for a fourth principle (block) to be added: multiple means of assessment (Brand, Fravvaza, & Daltion, 2012). This fourth block is suggested by the Rhode Island UDL Workgroup, and aims to assist in-service and pre-service teachers in meeting accountability goals and local and state standards.

Universal Design for Learning offers many learning benefits for students by providing skills that promote multiple literacy skills. The components and three major principles of this teaching method encourage experiential learning opportunities. These opportunities allow for kinesthetic and tactile learning which can further aid students, particularly those with disabilities. Relevant and authentic learning situations allow for various forms of student engagement, one of the major principles of UDL. Research argues that by providing experiential learning opportunities, students can synthesis information through enhanced retention (Michael & Trezek, 2006).

The Universal Design for Learning offers various benefits for students and teachers in inclusive classrooms. A study conducted by Stephanie Kurtts (2006) examined preservice teachers' experiences with UDL and the use of technological educational software. This study found three emerging themes in teacher attitudes toward UDL: "an effective instructional approach that addresses the needs of all students, creating high levels of success in learning for students, and creating high levels of engagement for students" (Kurtts, 2006, p 7). Planning in the UDL three block format, created heightened levels of awareness for student needs for differentiation and the importance of differentiation in the classroom. All preservice teachers recognized the effectiveness of engagement of students in the inclusive classrooms (Kurtts, 2006).

The use of technology can aid teachers and students when using UDL. There are a variety of technology based strategies that promote the implementation of UDL for students with disabilities. Instructional technologies include hypertext/hypermedia programs, CDs, DVDs, pod casts, Smart Boards, and alternative writing input methods (Michael & Trezek, 2006). These technological opportunities create an environment where all students are receiving appropriate instruction and are able to experience differentiation and choice in engagement, representation, action and expression (Kurtts 2006). The Universal Design for Learning does not require the use of technology to create an effective three block model. Teachers can use a variety of materials and strategies to create multiple means of engagement, representation, action and expression (Brand et. al., 2012). Many instructional strategies exist that can be manipulated to integrate the UDL design. Throughout the rest of this literature review, two strategies will be discussed: Project-Based Learning, and Cooperative Learning.

Project-Based Learning Approach

There are many overlapping definitions and strategies in the literature between Project-Based Learning and Problem-Based Learning. Problem-Based Learning is a method where students are presented with a realistic, engaging problem in which they solve and reflect on dilemmas and decisions (Mergendoller, Maxwell, & Bellisimo, 2006). There are many misconceptions Project-Based Learning (PBL) is a project at the end of a unit. However, a major component of a true PBL is learning curriculum content through the process of the project (Hovey & Ferguson, 2014). In an effort to clearly define Project-Based Learning, Hovey and Ferguson state it is an instructional method in which students utilize and create:

1. a complex project as a central aspect of the curriculum,
2. projects around a driving question that directs the activities and learning in the project,
3. student choice; with student involvement in all levels of the project both individually and in collaborative teams,
4. projects focused on a real world topic to increase student engagement and real application,
5. evaluations of learning throughout the project and culminate in a performance or utilization of the project created during the unit, and
6. reflection and revision is a continuous component of effective PBL curriculum (Hovey & Ferguson, 2014).

The components listed above in regards to the PBL approach provide opportunities for differentiation within the classroom. This differentiation can be in the form of representation, action, and engagement. Project-Based Learning has been studied on many different population types. The conclusions of previous literature studies show that PBL is effective with general education students and diverse students with exceptionalities. PBL allows for differentiation by allowing a student-centered approach where students are able to identify their own driving question within the curriculum content. In a study conducted in 2008, by Lih-Juan ChanLin, examined technology integration in a PBL in science. The study explained in detail the PBL implemented and assessed what students acquired from the project. This study allowed for students to not only choose how they were to engage in the project, but allowed them to have multiple ways to express their knowledge (ChanLin, 2008). The researcher conducted interviews to assess what the students learned and what skill they gained during the PBL. ChanLin concluded that PBL created an environment where both the teacher and the student benefit from the discovery through students' own investigation and exploration. The students in this study used computer based research and presentations (ChanLin, 2008). Students in an inclusive classroom would benefit from this use of technology by allowing students who require technological accommodations to have them, while still working in the group.

It is important to acknowledge that while there is evidence supporting PBLs as a method of use to promote differentiation, there is limited research that is defined as high quality. From the literature discussed, one can infer that there is a gap in measuring true effectiveness of Project-Based Learning. However, when researching effectiveness, Problem-Based Learning has research that concludes it is more effective than traditional-lecture style instruction (Mergendoller, Maxwell, & Bellisimo, 2006). Although Problem-Based Learning is different from

Project-Based Learning, the shared features (student centered and inquiry based) are proven to be characteristics of an effective instructional method.

Cooperative Learning Approach

Cooperative learning (CL) is a method that takes place in a classroom using small groups and collaboration between students. There are specific characteristics to this method which include: positive interdependence, individual accountability, face to face interaction, social skills, and evaluation of the group processing (Altun, 2015). There is strong support of the effectiveness of cooperative behavior in the literature (Altun, 2015). In a 2015 study on student achievement and perceptions of this method, researchers concluded that CL promotes a "collaborative learning environment, supported permanent learning, provided opportunities to be successful, and contributed to the development of social and personal skills (Altun, 2015). The study was conducted in a 6th grade classroom during a Science and Technology unit. The conclusions from the research, demonstrates that CL is a compatible with science and technology curricula. Students expressed positive thoughts toward the method, but did worry because this method requires students to have success at all stages mentioned above in order to properly engage (Altun, 2015).

Cooperative Learning allows for differentiation within the classroom. There are a variety of group placements that can be used when using CL in the classroom. Teachers can choose to group based on student needs, learning styles, interests, or heterogeneous grouping. Tiered lessons are also a component that can be used in CL to promote differentiation (Levy, 2008). When teachers use effective grouping, social skills can then be practiced and developed. This is critical in an inclusive classroom to promote overall engagement (Dieker, Finnegan, Grillo, & Garland, 2013).

Conclusion

There is a wide variety of research to support the effectiveness of Universal Design for Learning, however a gap exists when exploring the effectiveness between the instructional methods which aim to implement UDL principles. Project-Based Learning and Cooperative Learning are two methods of instruction that fit within the three block model of UDL. Project-Based Learning creates an environment where students are able to effectively engage in the content in a way that motivates them through a driving question. PBL also gives students choice in how to express and portray what they have learned. PBL creates a culture that is student-centered and allows for UDL style differentiation. Cooperative Learning allows for a variety of groupings, and creates an environment for differentiation between groups. CL also allows for multiple forms of engagement and expression by embracing different strategies such as jigsaw, and games. In both approaches, technology can be easily integrated to assist students with a need. Although both approaches appear to support UDL methods in the literature, there is a gap in the research in comparing the effectiveness, and/or student perceptions among the two different approaches. Although both approaches appear to support UDL methods in the literature, there is a gap in the research in comparing the effectiveness, and/or student perceptions among the two different approaches. The goal of this study is to provide research that compares the academic effectiveness between PBL and CL. This study will also provide student perceptions of PBL and CL instruction in the classroom.

METHODOLOGY

The objective of this study is to analyze effects of implementing UDL through Project-Based Learning and Cooperative Learning in science units in an inclusive classroom.

There are three research questions in this study:

(a) What is the effect of UDL through Project-Based Learning in a science unit in comparison to UDL through Cooperative Learning in a science unit on academic effectiveness?

(b) How is science content knowledge affected by implementing UDL through Project-Based Learning and cooperative learning in a science unit on students with disabilities and students without disabilities?

(c) What are student perceptions of Project-Based Learning and Cooperative Learning?

These research questions were be examined through a participant action research study. This was the appropriate method of research because action research studies in education examine a problem in order to understand and improve the quality of the educative process. In this study, I used quantitative and qualitative data to analyze the three research questions of this study.

Students selected for this study were in the third grade classroom that I am assigned for a student teaching internship. There were 25 students in the class. There were eight students with disabilities and 17 without disabilities. The disabilities in the class are: one student with visual impairment, one student with hearing impairment, and three students with OHI (ADHD), and three students in speech therapy. There were 17 boys and 8 girls in the class. 4 of the boys are African American, and 13 of the boys are Caucasian. Two of the girls is African American and six of the girls are Caucasian. The participants were required to complete parent/guardian assent forms (AppendixA) as well as student consent forms (Appendix B) for this study. I collected pre and post test data, and post perceptions survey for both strategies from these students.

DATA COLLECTION

Two science units were taught. One unit covered Simple Machines (Unit 1) and the second covered Life Cycles (Unit 2).

Unit 1: The first unit implemented was Simple Machines. This unit was taught in February 2016 and took place over two weeks. The Simple Machines unit incorporated UDL ideas by using Project-Based Learning. Throughout the PBL, students: developed and were guided by a driving question about life cycles, practiced research skills, created and present a form of representation of their work to an authentic audience. The PBL unit was student centered and allowed for UDL by providing multiple means of engagement, representation, and action/expression. Before the unit was taught, all participants completed a four question multiple choice, four fill in the blank pre-test to create a baseline for content knowledge (Appendix C). The multiple choice questions had only one answer choice that was correct. The pre-tests were scored out of eight points. The four multiple choice answers and four fill in the blank in the pre-test will also be on the post-test (Appendix C). The questions on the post-test that are the same as the pre-test were then be scored out of eight points. The rest of the questions on the post-test were used for classroom grade data, and disregarded for this study.

Unit 2: The second unit to be implemented is Life Cycles. This unit was taught in March 2016 and take place over seven days. The Life Cycle unit incorporated UDL ideas by using Cooperative Learning. Students engaged in group work using the following strategies: jigsaw, think pair share, and group-based activities. These strategies allowed for UDL by providing multiple means of engagement, representation, and action/expression. All participants completed a four question multiple choice, four fill in the blank pre-test to create a baseline for content knowledge (Appendix D). The multiple choice questions only had one answer choice that was correct. The pre-tests were scored out of eight points. The unit began after the pre-test, where participants engaged in Cooperative Learning activities in groups. The four multiple choice answers and four fill in the blank in the pre-test were also on the post-test. The questions on the post-test that were the same as the pre-test were scored out of eight points. The rest of the questions on the post-test were used for classroom grade data, and disregarded for this study.

After the participants completed the post test for both units, they will be given a survey composed of two parts (Appendix E). The first part of the survey asked students which unit they preferred. The were given the following three options to circle: Simple Machines, No preference, Life Cycles. They were then asked why they chose that answer. The second part of the survey asked students which method of instruction they preferred. They were given the following three options to circle: Cooperative Learning, No preference, Problem-Based Learning. They were then asked why they chose that answer. This survey accounted for student preference of content topic by asking what unit they preferred based on content and which unit they preferred based on strategy. The survey data was qualitatively analyzed for themes in responses.

DATA ANALYSIS

The data collected during this study was analyzed through various methods.

1. The Unit 1 pre-test scores of all participants was averaged to create a mean. The Unit 1 post-test scores of all participants was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 1. The Unit 2 pre-test scores of all participants was averaged to create a mean. The Unit 2 post-test scores of all participants was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 2. The mean of academic growth for Unit 1 and Unit 2 was compared and analyzed for academic effectiveness. This data was repre-

sented in a graph that shows the pre-test scores and post-test scores to create a visual of academic growth.

2. The Unit 1 pre-test scores of participants with disabilities was averaged to create a mean. The Unit 1 post-test scores of participants with disabilities was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 1. The Unit 1 pre-test scores of participants without disabilities was averaged to create a mean. The Unit 1 post-test scores of participants without disabilities was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 1. The mean of academic growth of students with disabilities for Unit 1 was compared to the means of academic growth of students without disabilities. This data was represented in a graph that shows the pre-test scores and post-test scores to create a visual of academic growth. This graph shows the rate of academic growth between students with disabilities and students without disabilities for Unit 1.

The Unit 2 pre-test scores of participants with disabilities was averaged to create a mean. The Unit 2 post-test scores of participants with disabilities was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 2. The Unit 2 pre-test scores of participants without disabilities was averaged to create a mean. The Unit 2 post-test scores of participants without disabilities was averaged to create a mean. The difference of the pre and post test means was calculated to create a mean of academic growth for Unit 2. The mean of academic growth of students with disabilities for Unit 2 was compared to the means of academic growth of students without disabilities. This data was represented in a graph that shows the pre-test scores and post-test scores to create a visual of academic growth. This graph shows the rate of academic growth between students with disabilities and students without disabilities for Unit 2.

3. The three answer options for the survey (Cooperative Learning, No preference, Problem-Based Learning) (Simple Machines, No preference, Life Cycles) were analyzed using a frequency count. The free response questions were coded for themes in the data. This data was used to discuss student perceptions of both methods.

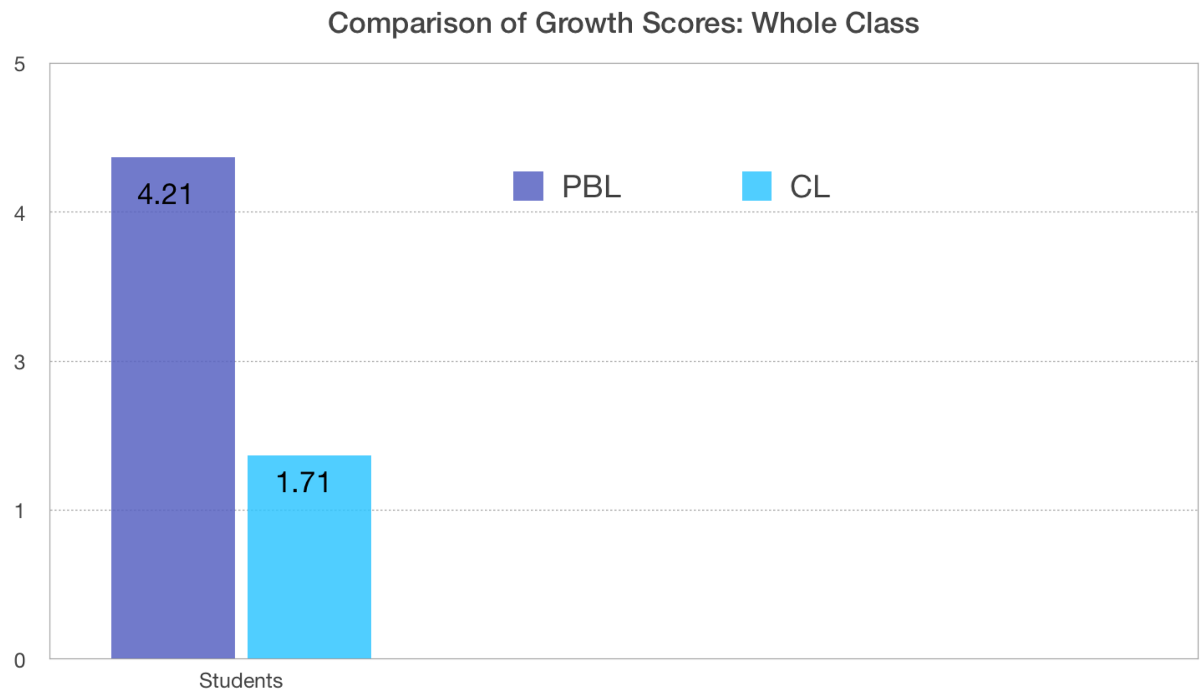
RESULTS

Unit 1, Simple Machines, was taught February 8th, 2016 through February 19th, 2016. Unit 2, Life Cycles was taught March 17th, 2016 through March 25th, 2016.

(a) Compare science content knowledge growth with Project-Based Learning strategy to growth in science content knowledge during Cooperative Learning.

The difference of the pre and post test data was calculated to determine the growth scores. The growth scores were then averaged to create a whole class growth score. The growth score for the Project Based Learning unit was 4.21 points on an 8 possible point test. The growth score for the Cooperative Learning unit was 1.71 points on an 8 possible point test (Graph 1).

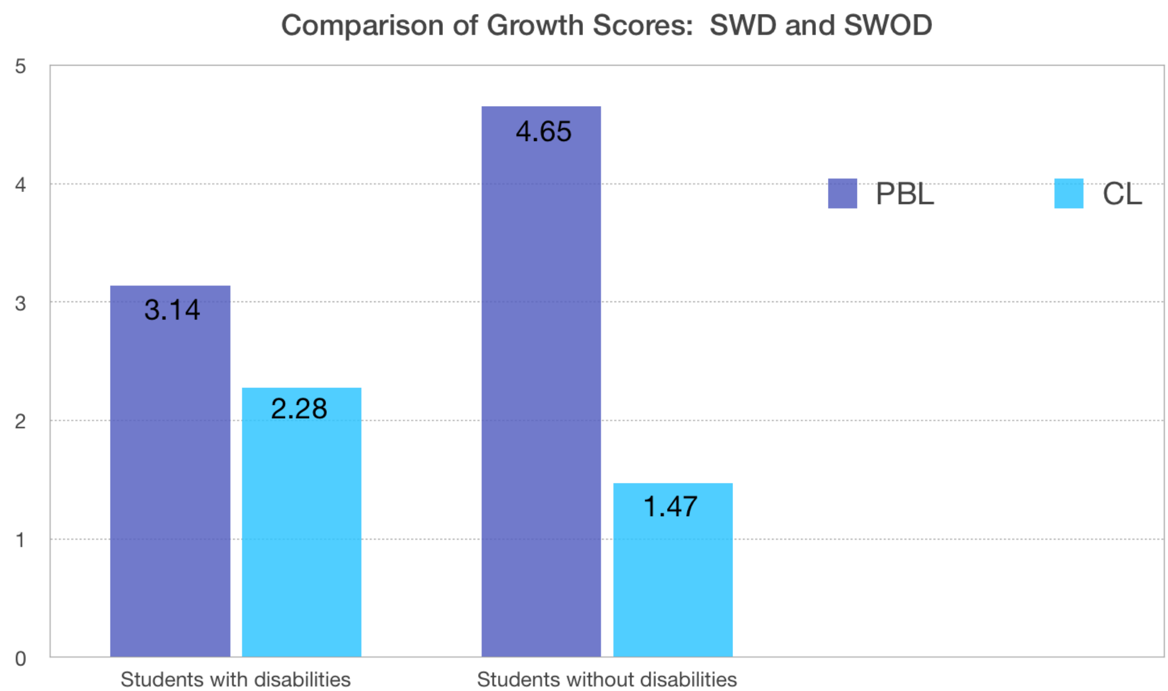
Graph 1



(b) Compare science content knowledge growth among the two strategies between students with disabilities (SWD) and students without disabilities.

The difference of the pre and post test data was calculated to determine the growth scores. The growth scores were then averaged into two groups: Students with disabilities (SWD) and Students without disabilities (SWOD). The growth score for the PBL unit of students with disabilities was 3.14 points on an 8 possible point test. The growth score for the PBL unit of Students without disabilities was 4.65 points on an 8 possible point test. The growth score for the CL unit of Students with disabilities was 2.28 points on an 8 possible point test. The growth score for the CL unit of students without disabilities was 1.47 points on an 8 possible point test (Graph 2).

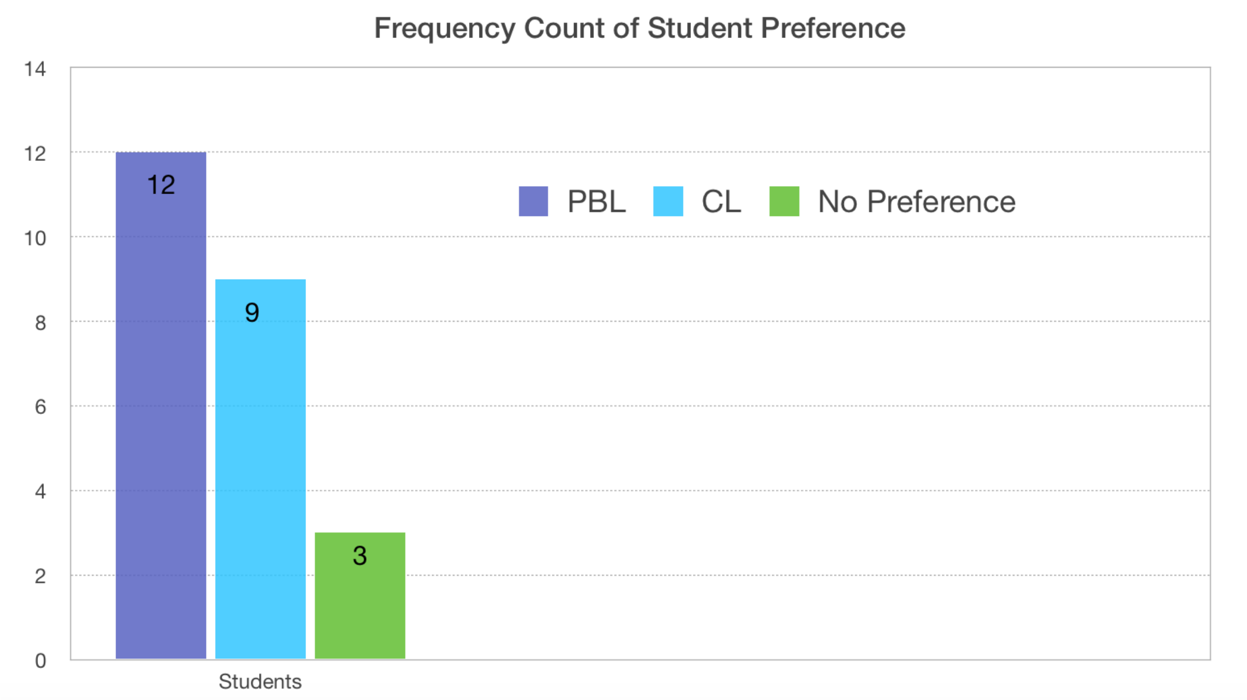
Graph 2



(c) Compare student perception of Project-Based learning and Cooperative Learning.

A frequency count of student preference of instructional style was taken. 12 students chose PBL, 9 students chose CL, and 3 students selected No Preference (Graph 3).

Graph 3



(c) Compare student perception of Project-Based learning and Cooperative Learning.

Student free responses were analyzed qualitatively for themes in PBL and CL. There were three prominent themes for PBL: Independent work, Creation, and Presentation.

Independent Work: Many students who selected PBL as their favorite style of instruction stated that they enjoyed the ability to work independently. By working on their own, students enjoyed the freedom use their ideas and 'do what they wanted to do.'

Creation: Many students stated that they enjoyed using their imaginations to create something new.

Presentation: Students stated that they enjoyed sharing their ideas and inventions with other students in the class.

There were two prominent themes for CL: Group Work, Peer Presentation

Group Work: Many students who selected CL as their favorite style of instruction stated that they enjoyed the ability to work with other classmates.

*Peer presentation:*Many students stated that they enjoyed presenting and learning from their peers presentations. Students participated in a jigsaw project where they shared life cycles of other animals and plants to the class.

DISCUSSION

It is important to report that all students received a passing grade (70 percent or above) on the post-tests for PBL and CL. The following discussion will address the data by each research question.

(a) What is the effect of UDL through Project-Based Learning in a science unit in comparison to UDL through Cooperative Learning in a science unit on academic effectiveness?

The data shows that students showed more growth in the PBL unit than they did in the CL unit. There was a difference of 2.5 growth points out of a possible 8. One possible reason for this large difference could be a limitation in the methodology. The PBL unit taught Simple Machines, a new concept to students and the first time it was in the K-3 curricula. The CL unit taught Life Cycles, a concept explored in previous K-3 curricula. Because students have had previous exposure to life cycles content, their pre-test class average was higher than the pre-test for simple machines. This resulted in a limited projected growth because students could not earn more points than a score of 8.

(b) How is science content knowledge affected by implementing UDL through project-based learning and cooperative learning in a science unit on students with disabilities and students without disabilities?

The limitation in the methodology also impacts this comparison. The students with disabilities showed less growth in the PBL unit and more growth than students without disabilities in the CL unit. This could be due to students with disabilities not showing as much growth during the Life Cycles unit in 2nd grade. This prediction is made based off the PBL data. The students with disabilities did not show as much growth and had a lower average on the post-test. It can be predicted by the data of this study that the academic knowledge of students with disabilities shown in the pre-test is similar to the knowledge they had as they finished the Life Cycles unit in 2nd grade. Students with disabilities started with lower pre-test scores than those students without disabilities, therefore were able to show more growth.

(c) What are student perceptions of Project-Based Learning and Cooperative Learning?

The frequency count of PBL, CL, and No preference did not conclusively show a majority preference one way or the other. Students that chose PBL are students that enjoy working independently, using creativity, and sharing their ideas. This can be seen in the classroom. The students that chose PBL are students that enjoy hands on activities and using their imagination. These students also typically chose to work alone when given the choice. The students that chose CL are students that enjoy working with other classmates, and learning from others. These students participated in a Jigsaw method of CL, where they were given an animal or plant to create a presentation on to teach the rest of the class. These students recorded the information given and used it to learn and review. The students that chose CL are students that enjoy working with others in the class and are classified as more social students. Although there was not a definitive preference, this data shows that students prefer to learn in different environments and is useful information for educators.

CONCLUSION

The results from this study indicate that both Project Based Learning and Cooperative Learning are positive instructional styles that show student growth. All students showed passing scores on the post tests for the Simple Machines unit and Life Cycles unit.

Universal Design for learning is an instructional design that can be implemented in various ways. UDL allows for student choice of action/expression, representation, and and engagement. PBL and CL are just two student-centered instructional methods that cater themselves to this design. This research shows that PBL and CL are effective uses of instruction. Based on the student academic performance, and student perceptions in this study, giving the student the choice of individual or group work could be a positive method where students in an inclusive classroom are able to choose the style that is best suited for them.

In order to enhance this research, it should to implemented with a larger group of student participants. The science units should also be chosen so that the content is new to the students and was not in the curricula of previous academic years. This research is a preliminary data for the comparison of PBL and CL while using UDL concepts. Although the limitations in this research effect the data for the comparison of PBL and CL on student academic growth, this research shows student perceptions of each instructional style. The data shows that UDL approach through PBL and CL is an effective form of instruction where students show academic growth. The research implicates that by further applying the UDL choice of engagement to a PBL or CL science unit (individual or group work) would greatly benefit students, creating a more positive perception of learning.

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Appendix A

Consent Letter

Dear Parent or Guardian,

Hello, my name is Katherine Taylor, and I am a student teacher in your child's classroom. I am currently a graduate student at the University of Mary Washington working towards my Masters in Elementary Education. A requirement of our program is to conduct an action research study in an area related to our studies. *I am inviting your child to participate in a research study I am doing. Involvement in the study is voluntary, so you may choose to have your child participate or not. I am now going to explain the study to you.*

I am interested in learning about how project-based learning and cooperative group instruction impact student science content knowledge and what student perceptions of both instructional techniques are present. For two weeks, your child's class will be working on two different units: Simple Machines, and Life Cycles. The Life Cycles unit will be taught using cooperative learning strategies. In this strategy, students will work in groups with their other classmates to learn content. The Simple Machines unit will be taught using a project-based learning approach where students will work in groups to complete a project. *I am requesting permission to give your child a survey to complete about his or her feelings on the units.* ***This project will be part of your child's work for class. It will in no way require extra work for him or her.***

Your child's work will be kept confidential. His or her name will not appear in any papers in the project. The name and location of the school will not be disclosed. Following the project, all samples I collect will be destroyed. Participation in this project will not affect your child's grade in any way. His or her participation in the study is voluntary, and you have the right to keep your child out of the study. Also, your child is free to stop participating in the study at any time. Your child would still participate in the classroom project, but his or her data for the research study will not be included in the analysis.

The benefit of this research is that you will be helping me understand the influence of cooperative learning groups and project-based learning on science content knowledge and student perceptions. The risk is students may feel uncomfortable that teacher will be disappointed of negative feedback on the survey. To accommodate for this, I will reiterate that student answers will not be graded, and that their answers will be confidential.

If you have any further questions or concerns, please do not hesitate to contact my university supervisor, Dr. Roberta Gentry (rgentry@umw.edu) at (540) 286-8083 or myself (ktaylor3@mail.umw.edu). Please return this form by January 15, 2015. I look forward to working with you and your student!

Thank you,

Katherine Taylor

I have read the above letter and give my child, ______________________________, permission to participate in this project.

____
(Parent/Guardian Signature)

I, ____________________________ agree to keep all information and data collected during this research project confidential.

____
(Researcher Signature)

Appendix B

Student Assent Letter

Dear Student,

I am very excited to be your student teacher throughout the spring! We will be learning about Simple Machines in one unit, and Life Cycles in another. For the Life Cycles unit, we will be working together in groups. For the Simple Machines unit, we will be working on a project in groups to learn more about simple machines.

While you work in your groups, I will be collecting information for a research project that I am doing to see how project-based group work and collaborative groups help you learn and make you feel. During my study, you will answer science questions at the beginning and end of both units. You will also answer questions on a survey about how you feel about each unit. You will not be graded for your help in my study, and this study will not require you to have extra work.

Your parents were given a letter about taking part in this study. If your parents did not allow you to participate in this study, you will not be asked to sign this form. However, if your parents did allow you to participate, I encourage you to participate in this study.

You do not have to be in this study. No one will be mad at you if you decide not to do this study. Nothing bad will happen if you take part in the study and nothing bad will happen if you do not. However, if you decide not to participate you still will work in groups and do all of the work that we will do; I will just not use your work in my research. Even if you start, you can stop later if you want. You may ask questions about the study.

If you decide to be in the study, I will keep your information private. This means that I will not use your names or the name of the school in anything I write and I will not reveal any personal, identifying information about you.

Signing this form means that you have read it or have had it read to you, and that you are willing to be in this study. If at any point you have any questions, please ask me!

Thanks,

Ms. Taylor

I have been read the above letter, all my questions have been answered, and I agree to participate in the project.

______________________________ ______________________________
(Student Signature) (Date)

I, ____________________________ will keep your names confidential.

______________________________ ______________________________
(Student Teacher/Researcher Signature) (Date)

Appendix C

Simple Machines Pre-Test and Post-Test Questions

Multiple Choice:

1. What is a simple machine that is a flat surface that is raised so one end is higher than the other?
   a. pulley
   b. wedge
   c. inclined plane

2. A flagpole is an example of which simple machine?
   a. lever
   b. pulley
   c. screw

3. What is a simple machine that is an inclined plane wrapped around a cylinder or cone?
   a. screw
   b. wedge
   c. lever

4. A knife is an example of which simple machine?
   a. pulley
   b. wedge
   c. inclined plane

Fill in the blank:

Word Bank: wedge, complex machine, lever, screw, compound machine, wheel and axel.

1. A ________________________________ is a combination of two or more simple machines.

2. A _________________________________ makes it easier to move or turn things.

3. A _______________________________ helps cut or split objects.

4. A seesaw is an example of a __________________________________.

Appendix D

Life Cycles Pre-Test and Post-Test Questions

Multiple Choice:

1. What cycle has stages that show parts of an organisms life?
   a. water cycle
   b. life cycle
   c. lunar cycle

2. What is the final stage of the frog life cycle?
   a. tadpole
   b. adult frog
   c. egg

3. Do all plants and animals have their own life cycles?
   a. Yes
   b. No

4. What is the first stage of the butterfly life cycle?
   a. caterpillar
   b. pupa
   c. egg

Fill in the blank:

Word Bank: tadpole, starts over, ends, seeds, stages, grass.

1. In the plant life cycle a seed grows into a new plant that forms ____________________.

2. The second stage of the frog life cycle is where it is a _________________________.

3. Every life cycle has _______________________.

4. After the adult phase of the life cycle ends, the life cycle _______________________.

Appendix E

Student Perceptions Survey

These questions will help me understand how you feel. Please be honest! You will NOT be graded on your answers!

1. Which unit did you like the best? Circle the answer that you feel.

Simple Machines **No preference** **Life Cycle**

2. Write why you chose your answer:

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3. Which style of learning did you like the best? Circle the answer that you feel.

Project Based Learning **No Preference** **Cooperative Learning Groups**

4. Write why you chose your answer:

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