Development of a Project-Based Learning Curriculum for Sixth- and Seventh-Grade Students at the Alborada School

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Abstract

The Unidad Educativa Particular Alborada is a private school in Cuenca, Ecuador, whose vision notes the importance of promoting daily improvement in all aspects of life. The goal of our project was to assist them in the development of a project-based learning curriculum for sixth- and seventh-grade students to improve their problem-solving and critical thinking skills. After our arrival, we identified the school’s current teaching practices and used our observations to collaborate with the teachers to create and implement lessons. We proposed recommendations for the future incorporation and expansion of project-based learning and produced a folder containing an introduction to the concept, lesson plans, and rubrics to ensure the sustained success of our project.

La Unidad Educativa Particular Alborada es una escuela privada en Cuenca, Ecuador, cuya visión destaca la importancia de promover el mejoramiento diaria en todos los aspectos de la vida. El objetivo de nuestro proyecto era ayudarlos en el desarrollo de un currículo de aprendizaje basado en proyectos para estudiantes de sexto y séptimo grado para mejorar sus habilidades de resolver problemas y pensamiento crítico. Identificamos las prácticas de enseñanza actuales de la escuela y utilizamos nuestras observaciones para colaborar con los maestros para crear e implementar lecciones. Propusimos recomendaciones para la futura incorporación y expansión del aprendizaje basado en proyectos y produjimos una carpeta que contiene una introducción al concepto, planes de lecciones y rúbricas para garantizar el éxito sostenido de nuestro proyecto.
Executive Summary

Introduction

The Ecuadorian education system has recently been undergoing reforms focused on its long-term improvement to prepare students for life beyond the classroom (Van Damme, 2015). Past teaching methods consisted mainly of memorization, and although this teaches discipline, it limits students’ development of critical thinking and problem-solving skills. An instructional method that allows students to gain these necessary interpersonal, communication, and problem-solving skills is project-based learning. Many institutions have begun to implement it into classes, as it emphasizes student learning through experiences and increases classroom engagement (D’Orio, n.d.). Ecuador’s new policies focus on improving the quality, consistency, and outreach of their education system (OECD, 2015) and have inspired our sponsor, a private school in Cuenca, Ecuador, the Unidad Educativa Particular Alborada, to implement changes in their curriculum.

The team incorporated a project-based learning curriculum at the Alborada school, supplementing their current mission to help “students develop a greater understanding and appreciation of the world around them and develop skills that include teamwork, collaboration and resilience” (Alborada, n.d.), we aimed to instill critical thinking and problem-solving skills in their students.

Goals and Objectives

The goal of this project was to assist the Alborada school in the development of a project-based learning curriculum for sixth- and seventh-grade students to improve their problem-solving and critical thinking skills. To achieve this goal, we outlined three objectives:

1. Identify the current teaching practices at Alborada
2. Adapt and implement lessons using project-based learning, drawing on observations to ensure that projects are appropriate for the context
3. Gather feedback to propose recommendations for the continued incorporation of project-based learning within sixth and seventh grade and translation to other grade levels

Methods

Upon our arrival at Alborada, we performed lesson plan evaluations and classroom observations to determine the current teaching practices. We also conducted pre-implementation interviews with the six teachers that we worked with to identify their perspectives on project-based learning. During the trial and test phase of leading projects, we utilized student feedback, team observations, and teacher evaluations to analyze the response to our projects. To gain insight into the effectiveness of our projects and learn how the project could be further developed and implemented, we conducted interviews with the teachers and distributed surveys to both teachers and students.
Key Findings

1. **Alborada already uses elements of project-based learning and understands the importance of engagement, but does not fully incorporate projects into their three stages of lesson plans.**
   - Teachers understand the role that engagement plays in their students’ learning and used an active lecturing technique which promoted student engagement; however, more reserved students were left out. In the teachers’ three-phase lesson plans, which included anticipation, knowledge construction, and consolidation, most used projects in the consolidation phase, where they served as review activities. Projects did not include a driving question that encouraged research.

2. **Our implementation of project-based learning resulted in overall positive trends in areas such as engagement and skill development, and teachers as well as students want to continue using this style.**
   - We found that the highest levels of engagement occurred when students were creating something or making decisions for themselves, with the maximum being during the hands-on activity phase. Students and teachers reported improvement in their abilities to work in groups, solve problems, and communicate. Students commented that they learned more with projects as they worked alongside their peers. Teachers felt that the projects motivated their students and that we delivered the concepts in a better way than what they had planned.

3. **There are some limitations in their resources and capacity to continue and expand project-based learning.**
   - Although they want to continue with project-based learning, teachers commented that current limitations include infrastructure, cultural issues, and lack of professional training.

Final Recommendations

With the current incorporation of project-based learning at Alborada and the aforementioned limitations, we have identified areas of potential growth. The key stakeholders for the continued success of this initiative include the administration, parents, students, and teachers. With this in mind, we developed recommendations for Alborada and future collaborators.

**For the Alborada Administration**

- Organize information nights for parents so that they can better understand the reasoning behind this change to support their students.
- Provide professional development opportunities and workshops where teachers have specified time to continue learning new strategies as they begin to incorporate this change in their teaching style.
- Consider shifting the classroom set-up from desks to tables to foster collaboration as well as investing in materials such as posters, research books, and art supplies with the growth of a project-based learning curriculum.
- Set up reliable WiFi for the computer lab and promote its use so that it can be a resource for students and allow for more in-depth research projects.
For the Alborada Teachers

- Introduce students to communication and interpersonal skills through peer revisions, team charters, and peer evaluations.
- Use projects in all phases of learning:
  - Anticipation: provide the framework for students to learn research techniques through situated inquiry
  - Knowledge construction: reinforce the topics and allow students to share ideas with one another
  - Consolidation: give an alternate method of evaluation for the specific content as well as the development of skills
- Collaborate with one another to plan intercurricular projects that span longer time frames and combine lessons from various subject areas. They can also adopt a team teaching methodology to lead and facilitate these projects.

For Future Collaborators

- Communicate early and often with the teachers and faculty at Alborada to make sure they will be able to complete the project during the class period as well as to ensure that the class has achieved the prior learning objectives that the lesson plans outline.
- Request lesson plans in advance of arrival to allow more time to develop projects that align with the learning objectives.
- Propose ideas for intercurricular projects to determine if they are possible within the confines of the already-determined schedule.
- Be flexible and adaptable as change is the only constant when working with students.

Deliverables

We submitted our final deliverable which was a guidebook containing an introduction to project-based learning, lesson plans, group work management tools, and evaluation rubrics to our sponsor at the conclusion of our time in Cuenca. We included lesson plans that directly outline their alignment with the Ministry of Education’s national learning objectives. The guidebook contains lessons that we implemented and other lesson plans relating to Alborada’s required curriculum that we developed after receiving feedback from teachers. In addition, there is an explanation of project-based learning and a sample lesson plan methodology that teachers can use when designing their own project-based learning lessons and evaluation rubrics. To create a resource for teachers at Alborada and beyond, we posted our guidebook online to serve as a database for educators. It can be accessed with the QR code below:
Resumen Ejecutivo

Introducción

El sistema de educación de Ecuador recientemente ha estado implementando reformas enfocado en el mejoramiento a largo plazo, para preparar a los estudiantes para vida más allá del aula (Van Damme, 2015). Métodos de enseñanza anteriores consistieron principalmente de memorización y aunque esta enseña disciplina, limita el desarrollo de las habilidades de pensamiento crítico y solucionar problemas. Un método de instrucción que permite que los estudiantes ganan estas habilidades interpersonales, de comunicación y solucionar problemas es aprendizaje basado en proyectos. Muchas instituciones han comenzado a implementar este estilo en clases porque enfatiza el aprendizaje de los estudiantes por experiencias y aumenta el compromiso en el aula (D’Orio, n.d.). Nuevas políticas de Ecuador se centran en mejorar la calidad, consistencia y alcance de su sistema de educación (OECD, 2015) y han inspirado nuestra patrocinadora, una escuela privada en Cuenca, Ecuador, la Unidad Educativa Particular Alborada, a implementar cambios en su currículo.

El equipo incorporó un currículo de aprendizaje basado en proyectos en la escuela Alborada complementado sus planes actuales para ayudar a “estudiantes desarrolla[r] un entendimiento mejor y apreciación del mundo que los rodea y desarrollar habilidades que incluye trabajo de equipo, colaboración y resiliencia” (Alborada, n.d.), nuestro objetivo era inculcar capacidades de pensamiento crítico y solucionar problemas en sus estudiantes.

Metas y Objetivos

La meta de este proyecto era ayudar la escuela Alborada en el desarrollo de un currículo de aprendizaje basado en proyectos para los estudiantes de sexto y séptimo grado para mejorar sus habilidades de pensamiento crítico y solucionar problemas. Para lograr esta meta, formamos tres objetivos:

1. Identificar las prácticas de enseñanza de hoy en día en Alborada
2. Adaptar e implementar lecciones, usando nuestras observaciones para asegurar que los proyectos son apropiados para el contexto
3. Recopilar comentarios para proponer recomendaciones para la incorporación continua de aprendizaje basado en proyectos dentro sexto y séptimo grado y traducción a otros niveles de grado

Métodos

Después de nuestra llegada a Alborada, realizamos evaluaciones de los planes de clases y observaciones de las aulas para determinar las prácticas de enseñanza de hoy en día. También, conducimos entrevistas pre-implementación con los seis maestros con que trabajamos para identificar sus perspectivas el aprendizaje basado en proyecto, un estilo pedagógico con el que estaban familiarizados. Durante la fase de prueba de liderando proyectos, utilizamos realimentación de los estudiantes, observaciones de equipo y evaluaciones para analizar la respuesta a nuestros proyectos. Para obtener información sobre la efectividad de nuestros proyectos y aprender cómo el proyecto podría desarrollar e implementar, conducimos entrevistas con los maestros y distribuimos encuestas a los maestros y los estudiantes.
Resultados Claves

1. **Alborada ya usa elementos de aprendizaje basado en proyectos y entiende la importancia de compromiso, pero no incorpora completamente proyectos en sus tres etapas de planes de lecciones.**
   
   - Maestros entiendan el papel que compromiso juega en el aprendizaje de sus estudiantes y usaban una técnica de conferencia activa que promovió el compromiso de estudiantes sin embargo, los que eran más reservado quedaron fuera. En sus tres fases de planes de lecciones, que incluyeron anticipación, construcción de conocimiento y consolidación, proyectos frecuentemente son usados en la fase de consolidación como actividades de repaso. Proyectos no incluyeron una pregunta de enfoque que alentó la investigación.

2. **Nuestra implementación de aprendizaje basado en proyectos resultaron en tendencias positivas generales en áreas de compromiso y desarrollo de capacidades y los maestros y estudiantes ambos quieren continuar con aprendizaje basado en proyectos.**
   
   - Encontramos que el mayor compromiso fue cuando los estudiantes eran creando algo o tomando decisiones por sí mismos, con el máximo durante la fase de actividad manual. Estudiantes y maestros informaron un mejoramiento en las habilidades de los estudiantes a trabajar en grupos, resolver problemas y comunicar. Estudiantes comentaron que ellos aprendieron más con proyectos mientras trabajaban juntos con sus compañeros. Los maestros sintieron que los proyectos motivaron a sus estudiantes y que los conceptos se entregaron de una manera mejor de lo que habían planeado.

3. **Hay limitaciones en sus recursos y capacidad para continuar y ampliar aprendizaje basado en proyectos.**
   
   - Aunque ellos quieren continuar con el aprendizaje basado en proyectos, maestros comentaron que limitaciones actuales incluyen infraestructura, problemas culturales y una falta de entrenamiento profesional.

Recomendaciones Finales

Con la incorporación actual de aprendizaje basado en proyectos en Alborada y las limitaciones citadas, hemos identificado áreas de crecimiento potencial. Las partes interesadas clave para el éxito continuo de esta iniciativa incluye la administración, los padres, los estudiantes y los profesores. Teniendo esto en cuenta, desarrollamos recomendaciones para Alborada y colaboradores futuros.

**Para La Administración de Alborada**

- Organizar reuniones de información para los padres para que pueden entender mejor la razonamiento detrás de este cambio para apoyar sus estudiantes.
- Proporcionar oportunidades de desarrollo profesional y talleres donde maestros tienen tiempo especificado para continuar aprendiendo estrategias nuevas a medida que los maestros comienzan a incorporar este cambio en su estilo de enseñanza.
- Considerar cambiar la configuración del aula de pupitres a mesas para fomentar la colaboración, así como invertir en materiales como carteles, libros de investigación y materiales de arte con el crecimiento de un currículo de aprendizaje basado en proyectos.
- Configurar WiFi confiable para el laboratorio de computadores y promover su uso para que pueda ser un recurso para los estudiantes que permita proyectos de investigación más profundos.
Para Los Profesores de Alborada

- Introducir estudiantes a las habilidades de comunicación e interpersonales por revisiones de compañeros, cartas de equipo y evaluaciones de grupo.
- Utilizar proyectos en todas las fases de aprendizaje:
  - Anticipación: proporcione el marco para los estudiantes a aprender técnicas de investigación a través de la investigación situada
  - Construcción de conocimiento: refuerce las temas y permita los estudiantes a compartir sus ideas entre ellos
  - Consolidación: de un método alternativo de evaluación para el contenido específico, así como el desarrollo de habilidades
- Colaborar entre sí para planificar proyectos intercurriculares para durar períodos de tiempo más largos y combinar lecciones de diversas materias. También pueden adoptar una metodología de enseñanza en equipo para facilitar los proyectos.

Para Colaboradores Futuros

- Comunicarse temprano y frecuente con los maestros y profesores de Alborada para asegurarse de que podrán completar el proyecto durante el período de clase, así como para garantizar que la clase haya alcanzando los objetivos de aprendizaje previos que los planes de lecciones describen.
- Solicitar planes de lecciones antes de la llegada permitirá más tiempo para desarrollar proyectos que se alineen con los objetivos de aprendizaje.
- Proponer ideas para proyectos intercurriculares para determinar si son posibles dentro de los límites del horario ya determinado.
- Ser flexibles y adaptables porque el cambio es la única constante cuando se trabaja con estudiantes.

Entregables

Enviamos nuestro entregable final, una guía que contiene una introducción al aprendizaje basado en proyectos, planes de lecciones, herramientas para el manejo de trabajo en equipo y rúbricas de evaluaciones, a nuestra patrocinadora a la conclusión de nuestro tiempo en Cuenca. Incluimos planes de lecciones que describen directamente su alineación con los objetivos de aprendizaje nacionales del Ministerio de Educación. La guía incluye lecciones que implementamos durante las cuatro semanas y otros planes de lecciones relacionados con el plan de estudios requerido de Alborada que desarrollamos después de recibir comentarios de los maestros. Además, hay una explicación del aprendizaje basado en proyecto y una metodología de muestra del plan de lecciones que los maestros podrán usar al diseñar sus propias lecciones de aprendizaje basado en proyectos y rúbricas de evaluación. Para crear un recurso para los profesores a Alborada y más allá, publicamos nuestra guía en línea para que sirva como base de datos para educadores. Se puede acceder con el código QR abajo:
Acknowledgements

We would like to thank our sponsor, Maricela Alaña, and all the other teachers, administrators, and especially the students of Alborada who welcomed us to the school. Everyone’s enthusiasm and dedication allowed our project to be a successful, enjoyable experience as we worked at what really is “a great place to be.” Specifically, thank you to the sixth- and seventh-grade instructors who let us observe their classrooms, interview them, and teach their students: Andrés, Carmita, Christina, Fabiola, and Monica. Many thanks to our advisor, Professor Courtney Kurlanska, who gave us valuable feedback which guided the improvement of our final paper and deliverables far beyond what we could have accomplished alone.
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Introduction & Background

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Introduction & Background

“Knowledge is a consequence of experience.”
– Piaget (Martinez, 2014)

Have you ever thought about tying your shoes? You watch, listen, and practice again and again until one day, you master the process. Although you encounter many failures, the final feeling of accomplishment provides the confidence and energy to learn new things. In the classroom, hands-on experience and teamwork can have the same effect. When projects become an integral part of the classroom, they give students a platform to express their creativity and relate the lessons of the day to the world around them. The incorporation of projects into all subjects and classes has developed into the idea of project-based learning.

From primary school through college, project-based learning has made its home in the global educational system. In elementary school, projects like designing a water filter with household supplies and analyzing the filter and resulting water quality challenge students to critically analyze real-world problems. A university student may tackle the same problem while looking through a larger lens, focusing on supplying clean water to remote locations through water purification, fog harvesting, and other innovative techniques. In the past, educators taught these topics through lectures or other forms of direct explanation, but using a project delivers the same concepts through a hands-on approach. This stimulates an interest and involvement in the solutions of the world’s greatest challenges, inspiring students to be critical thinkers and problem-solvers throughout their lives. Project-based learning allows students to pursue their own passions, develop interpersonal, communication, and technical skills, and explore topics that are relevant to their lives and interests.

Project-based learning is an instructional method that emphasizes student learning through experiences by taking part in project work. This teaching technique allows students to develop interpersonal, communication, and problem-solving skills as well as a deeper understanding of the content that their instructors are teaching. By challenging students to answer a question such as “How can we reduce the number of days Foster's Beach is closed because of poor water quality?” students must take a multifaceted approach to the issue that includes learning about a water-borne bacterium, its effects, and disease prevention and treatment (Larmer & Mergendoller, 2010, p. 35). This project challenges students to answer the question, which they discuss and use as a guide to develop innovative solutions. They have the freedom to create their own unique deliverable to answer this driving question, whether it be a poster, model, or video. Overall, the project allows students to learn about this bacterium and collaborate to solve the problem while receiving feedback during the process and gaining real-world experience. Many institutions have started to implement this pedagogical strategy into their classes (D’Orio, n.d.). Known as project-based learning, it is a technique that enhances the engagement, motivation, and achievement of students in school and beyond as they develop their skills.

Knowledge is a consequence of experience.
– Piaget (Martinez, 2014)

Figure 1: “Foster’s Beach”
(Children’s Pool Beach, n.d.)
History and Efficacy of Project-Based Learning

As university student populations dramatically increased in the 1960s, teaching innovations began to gain momentum. A method labelled case-based learning had the goal of “bringing practical experiences into the classroom” (de Graaff & Kolmos, 2007, p. 1), and led to the development of project-based learning. The popularity and adaptation of this method in schools around the world began with its implementation in a new medical school at McMaster’s University in Canada. The founders chose project-based learning as the primary method that would accomplish its holistic vision. Simultaneously, Denmark founded two universities that focused on having their students “Learn … by doing” due to the engineering industry’s desire for competent workers (de Graaff & Kolmos, 2007, p. 3). The curriculum’s success in Canada and Denmark sparked its use at other institutions and it has since spread to other disciplines and education levels globally with recent support expressed by political leaders. A key outcome of project-based learning is the development of critical thinking skills. In 2014, United States President Barack Obama introduced critical thinking as “one of six skills for the new economy” with his Race to the Top program (“Supplement to Critical Thinking: History,” n.d.). In addition, The Centre for Educational Research and Innovation of the Organization for Economic Development decided to intervene in educational programs in 2018 to “improve … critical thinking” (“Fostering and assessing students’ creative and critical thinking skills in higher education,” n.d.). Although critical thinking skills were not a large focus of the educational system before this time, there has always been a push to further include these skills in the standard curriculum; however, without a strong political backing, nothing had happened to make them a key part of students’ standard education.

As project-based learning became incorporated into the education system, it proved itself to be a valuable teaching method. In a study conducted in 2018 on lower-secondary school students, statistical analysis of the researchers’ results showed that “student learning outcomes in [project-based learning] are higher than those in conventional learning” (Siswono et al., 2018, p. 197). A 2017 study on university students found similar results, with the students analyzed showing “higher levels of student success with increased retention, persistence, and graduation rates” when exposed to a more engaging curriculum (Deutsch, 2017, p. 3). With a political backing defended by positive results from studies, the role of project-based learning in the education system continues to grow.

Fundamentals of Project-Based Learning

Project-based learning is a pedagogical style that fulfills an educational purpose by teaching students through a meaningful task (Larmer & Mergendoller, 2010). By allowing students to learn through participation in a project aimed towards solving a problem or accomplishing a goal, engagement and productive learning in the classroom increase dramatically (Krajcik & Blumenfeld, 2005). In the project-based learning model, every effective project has four main elements, which the waterborne bacterium project described above exemplifies. The first component is the development of a driving question or problem. The project’s driving question was “How can we reduce the number of days Foster's Beach is closed because of poor water quality?” (Larmer & Mergendoller, 2010, p. 35). The second element of project-based
learning is the exploration of the problem through situated inquiry. In this project, it came in the form of a class-wide guided discussion about possible solutions to the problem before students were split up into teams. The third phase focuses on utilizing collaborative activities to find a solution to the problem where instructors use scaffolded teaching techniques and promote personal decision making. In the example project, students participated in a guided discussion about the water quality at Foster’s Beach, building off of the teachers’ foundation to make their own choices while completing the project. Collaboration took place in the form of team activities, such as participation in peer revisions and group inquiry. The fourth and final element of project-based learning is the creation of a tangible product that addresses the problem. In this project, the students made a final poster representing their solution to the driving question and presented it to their class (Krajcik & Blumenfeld, 2005).

Overall, project-based learning is a teaching style that allows students to solve a problem through a real-world approach, promoting opportunities for collaboration that foster students’ ability to communicate with one another and allowing for the incorporation of both long- and short-term projects through scaffolding.

The Importance of Project-Based Learning

The integration of project-based learning into education benefits students within the classroom and beyond. Project-based learning incorporates problem-solving, communication, and interpersonal skills which students can use throughout their lives (Kizkapan & Bektas, 2017). As students work on projects, they practice collaborating to find solutions. The problem-solving process begins with the identification of the problem and the definition of the context (Snyder & Snyder, 2008). Then, students “enumerate the choices,” identifying plausible and feasible options (Snyder & Snyder, 2008, p. 96). By analyzing their options, they can determine how to solve the problem and defend the reasons why they believe that their solution is the best course of action. The final phase of the problem-solving process is to self-correct, identifying any mistakes to foster a cycle of continuous improvement. Problem-solving approaches include experimentation, evaluating possible solutions, and trial & error. Through this, students gain innovation, resilience, and analytical abilities that will transfer into higher levels of education, industry, and daily life.

Students develop communication skills as they collaborate, share their ideas with one another, and create a final product. While working in groups, students learn how to actively listen to their group members as well as ask and respond appropriately to their peers’ questions (Musa et al., 2012). Likewise, students learn to be assertive to “express and change their ideas” when
sharing concepts and to interrupt in an appropriate manner (Musa et al., 2012, p. 568). Working with peers, students gain an understanding of the importance of determining when to use formal and informal language based on context. As they develop project ideas, they contribute to the group and give each other suggestions to improve the team. Depending on the final deliverable, students may have the opportunity to exercise both verbal and written communication skills as they share their findings with a greater audience. Often, they create a written report summarizing the final product.

As students work in groups, not only do they learn the material, but also how to work effectively with others. Interpersonal skills are the basis on which “relationships are initiated, negotiated, maintained, and ended” (Knapp & Daly, 2011, p. 484). In group work, students learn how to become “more perceptive and sensitive to the needs of others during group work” independent of any differences within group members (Musa et al., 2012, p. 570). Additionally, while working with others, students learn to make team decisions through cooperation and collaboration (Notari & Herzog, 2013). In a team, group members develop leadership skills as students become responsible for their own product and the work ethic of the group (Meyer & Wurdinger, 2016).
The physical setup of the classroom can also directly affect class engagement. Depending on the activities included in the lesson, teachers can organize students in groups to support more interactivity or separate them to enforce traditional learning by rearranging the setup of desks and tables in the classroom. Researchers have found that students thrive in classrooms that promote collaboration (Miller & Cunningham, 2011). In these classrooms, students can talk with one another to assist in each other’s learning. Lessons can incorporate collaboration into lesson plans to ensure that there is adequate time.

Lesson plans are a common tool utilized by instructors as a guide for teaching students, ensuring that they cover all necessary steps and give them a comprehensive basis in the subject. In the preparation of lesson plans, the instructor must identify the learning outcomes of a lesson, required materials, allotted time, and how to measure student improvement (Juth et al., 2017). A lesson plan must ensure that students have time to learn new information, practice it, and communicate with their peers and teacher.

The lesson plan should incorporate the four main elements of an effective project to ensure that the project is meaningful. An example of a sample lesson plan exemplifying these elements for a potato chip packaging project is located in Appendix A (ibid). The goal of the project is for students to collaborate in designing a container that protects the chip during transport. Each step outlines the intended task, allotted time, and necessary materials. This provides a template for lesson plans and the various phases included.

Figure 5: Team Member Colleen Helping a Student During the Citations & Sources Project
Critical Thinking

A key outcome of project-based learning is the development of critical thinking skills. Critical thinking is a skill that is necessary for daily interactions (“Critical thinking and problem-solving,” n.d.). It allows students to feel a sense of confidence and vindication in their beliefs, the decisions they make, who they are as a person, and their actions (Gelerstein, 2016). Critical thinking is the “metacognition … to maintain awareness … and manage one’s own thoughts” about themselves and the role they play in the world around them (Frey, 2019, p. 432). This skill guides individuals to draw inferences from information to form evidence-based judgements. It encourages the identification of one’s own biases to be able to consider other perspectives and analyze the validity of others’ viewpoints. Critical thinking is important for students to decide what to believe or how to proceed in a situation. This important skill allows individuals to be independent and accountable for their thoughts, words, and actions, focusing on continued improvement.

Classrooms have incorporated critical thinking and other methods to augment reasoning skills into a project-based learning education. While identifying their own biases, this skill guides students to form their opinions after considering other perspectives and sources of information. Critical thinking assists in the development of problem-solving skills through project-based learning by providing students with the ability to rationalize steps to arrive at a desired outcome. In groups, this tool helps students communicate their ideas during the problem-solving process. The use of project-based learning stimulates the development of critical thinking as students tackle problems from various perspectives and share their thoughts and ideas with their peers. While engaging in active participation, students can perform continuous analysis of presented ideas to iterate the design of their solution. Educators have systematically incorporated this strategy into all levels of education due to the role that it plays in the development of critical thinking and problem-solving skills.

Case Studies on Project-Based Learning

Five Forks Middle School

In 1995, the EduTech Institute at the Georgia Institute of Technology collaborated with an eighth-grade science classroom at Five Forks Middle School to implement project-based learning principles (Gertzman & Kolodner, 1996). The purpose of this project was to improve “cognition of learning and problem solving” within the science and math classes (Gertzman & Kolodner, 1996, p. 1). At the time of the study, a constructivist teaching ideology and project-based learning were novel concepts, making this is one of the earlier studies done regarding implementation of this method.

Figure 6: Alborada Students Working in Pairs During the Citations & Sources Project

Utilizing critical thinking skills through the process of active learning allows for better retention and a deeper understanding of the material. Engagement in the classroom makes students more likely to put effort into learning by studying on their own and developing curiosity in presented topics (Blumenfeld et al., 1991). Critical thinking is a skill that students need to cultivate throughout their educational career to ensure they have the confidence to solve problems for themselves. In a classroom that prioritizes critical thinking, instructors encourage students to ask questions to foster inquisition and curiosity (Goosseen, 2002).
EduTech facilitated the project, using the fundamentals of project-based learning to guide the process. Some of these included collaborative learning, real-world problem solving, and incorporation of key course concepts, all of which simultaneously fostered critical thinking skills. The phase of the project discussed in the paper lasted for one class period, where the instructor gave her students the following prompt:

“"A thirteen-year-old boy in North Carolina recently found a sapphire worth $33,000 in an abandoned mine. Georgia has riches too. ‘There's gold in them thar hills.’ And much of this gold is in the Atlanta area. Maybe we can get lucky too. Where might we find gold, and what areas would be worth mining? You will make a presentation to potential investors”’ (Gertzman & Kolodner, 1996, p. 3).

After the teacher presented the problem, students were split into teams and engaged in a guided brainstorming period where they listed facts, related thoughts and hypotheses, what they need to know more about, and their intended course of action to find a solution. The students then took part in research, during which they compiled locations that they thought would have gold that was worthwhile to mine. The final stage of the project was the review phase, in which each group presented their findings to the class.

Along with project outcomes, the study discussed challenges that both the instructor and her students faced during the project. When given the problem statement, some students had a difficult time understanding their teacher’s expectations and were not able to reach the intended conclusions during the brainstorming phase. Instead of considering the quality of the gold in the different areas it was found, many students copied down lists of every place that contained gold. In doing so, they attempted to “satisfy the teacher with the minimal effort required,” rather than critically analyze their research to come to a more educated solution (Gertzman & Kolodner, 1996, p. 4). Many middle-school students have limited experience with real-world research, so they benefit greatly from teachers’ directions, which can include hints, guiding questions, and repetition of project goals.

The Compass School

The Compass School, a public charter school in South Kingstown, Rhode Island, utilizes a project-based learning in their K-12 interdisciplinary curriculum which focuses on social responsibility and environmental consciousness (D’Ambra, 2014). They incorporated a project-based learning curriculum within a whole-school context so that the planning of the curriculum was collaborative among all teachers. Their implementation of project-based learning focused on incorporating the following five criteria:

- Centrality, meaning that the project is the center of the curriculum
- A driving question, which sets up the project
- A focus on realistic and authentic problems
- Constructive investigations, which utilize inquiry, knowledge building, and resolution
- Autonomy, otherwise known as student-directed learning

Along with project outcomes, the study discussed challenges that both the instructor and her students faced during the project. When given the problem statement, some students had a difficult time understanding their teacher’s expectations and were not able to reach the intended conclusions during the brainstorming phase. Instead of considering the quality of the gold in the different areas it was found, many students copied down lists of every place that contained gold. In doing so, they attempted to “satisfy the teacher with the minimal effort required,” rather than critically analyze their research to come to a more educated solution (Gertzman & Kolodner, 1996, p. 4). Many middle-school students have limited experience with real-world research, so they benefit greatly from teachers’ directions, which can include hints, guiding questions, and repetition of project goals.

Through the project-based learning curriculum, students were able to identify relevant problems at their school. As a focus of the school is to protect the environment, students investigated food waste in a project called No-Waste Lunch, in which they sorted the waste produced during lunch and took a field trip to a local landfill to talk to experts about waste. Throughout these real-world projects, students had opportunities to connect what they were learning with the reality of the world beyond the classroom, generating questions in lessons and continuously expanding their research. This social responsibility can lead to an increase in students’ motivation to learn.
For teachers instructing, this environment requires balance. Projects necessitate adequate structure so that all students can achieve the same learning objectives but still have the flexibility to make decisions regarding their projects, ensuring that there is “deeper student investment in the learning process” (D’Ambra, 2014, p. 89). Using scaffolding techniques by reconstructing parts of the project-based learning process in “developmentally-appropriate ways” can ensure that all students have the appropriate “cognitive development and level of independent skill” to achieve the same learning goals (D’Ambra, 2014, p. 63). Teachers need to become experts on the specific project topics that their students are working on, which can be especially challenging in primary and late primary education due to the breadth of topics covered by the age group and the “depth that is involved in knowing a topic in order to facilitate a project” (D’Ambra, 2014, p. 103). Additionally, team learning includes collaboration, so teachers need to develop skills to facilitate and manage teams, integrating topics like conflict resolution into the projects.

The Compass School uses a collaborative, holistic approach to guide students to tackle authentic problems and create meaningful solutions. By giving students a voice and choice, they have freedom in content exploration and project representation. With the inclusion of some form of a final presentation, the “project share is the culminating learning opportunity,” which highlights the results of the projects as well as students’ reflections with an audience (D’Ambra, 2014, p. 60). The aspect of reflection is a common part of projects and serves as a formal assessment as well as a place where students can share their “place and role in the greater community” (D’Ambra, 2014, p. 76). Students feel a personal responsibility for their own education as they learn to be aware of their own thought processes and become metacognitive learners.

The Philadelphia OST Program

The City of Philadelphia and its Public Health Management Corporation (PHMC) implemented a project-based learning teaching strategy throughout all grade levels in 180 out-of-school time (OST) programs in 2012 (Schwalm & Tylek, 2012). After contracting the Buck Institute for Education to adapt their project-based learning model to an OST setting, they trained site directors who then taught their staff how to implement this type of curriculum. Focusing on support for OST providers, the PHMC strived to make sure that all organizations were still able to deliver it to their students independent of their level of understanding of project-based learning.

Through this process, the organization realized that having clear expectations for what the curriculum should include as well as utilizing properly trained instructors is essential to a successful implementation. Without these expectations, confusions early in the program’s conception caused shifts in the intention of the project-based learning curriculum. They also found that parents who understand its concept can help support the program and their own children. After discovering that project-based learning can conflict with other activities during OST, the PHMC realized that they should implement it as a full learning methodology rather than as an additional activity. Project-based learning tends to be time-consuming and adding it alongside existing curriculums can be stressful to the teachers and counterproductive to the students’ learning. They found that before implementation, pilot testing with a small number of programs can help identify and remedy any issues in a smaller population before they become too hard to deal with.

This case study demonstrates that communication is a vital part of a successful program. By ensuring that instructors know what project-based learning is and
how to teach it, as well as educating parents to become at-home resources for any students they have in the program, the program has a higher chance of being properly implemented at a school. In addition, time should be spent to make sure that project-based learning has the chance to be successful before implementing it in a curriculum. Individuals involved in the process must be aware that projects can provide a new challenge to students and teachers, so it is beneficial to gradually implement projects into the curriculum.

**Lessons Learned**

From these case studies, we now understand the importance of community while a classroom or school transitions to project-based learning. Students, teachers, and parents are all stakeholders in this change and the quality of communication within this community can define how well they might be willing to accept a project-based learning curriculum. In these case studies, teachers worked closely with one another across grade levels to create a fluid continuation of lessons from one grade to the next. This consideration provides students with the opportunity to continue to grow throughout their journey with the use of projects in the classroom. When a student’s education emphasizes critical thinking, interpersonal, and communication skills, then parents, peers, and teachers must ensure they are learning within a supportive environment.

Depending on the required length and depth of a project, educators can modify the template for lessons that range from a single class period to several days of project work. For example, a three-day project may introduce the topic of the first lesson by identifying the question and laying out the foundation. For the brain activation phase, common tools include a discussion or preliminary demonstration. On the second day, teachers instruct students either directly or through guided inquiry and then delve into their own project work while collaborating with classmates. The final day allows students to continue to make improvements to their projects as well as share their findings with the class through a discussion, presentation, or other medium. To accommodate the specific needs of the project, teachers can alter the lengths of the various activity stages accordingly.

Finally, the utilization of feedback within project work supports an environment of constant growth and allows students to take risks without the fear of failure. These aspects are essential to project-based learning because of its reliance on students working without direct assistance from instructors. Students may complete projects differently and, without feedback, they would have no knowledge of what they did well and what they need to improve on. Recurring feedback encourages students to strengthen their critical thinking skills by making individual decisions and solving problems (Webb & Moallem, 2016).

**Education in Ecuador**

Since 1992, education in Ecuador has been undergoing reformations focused on the long-term improvement of their education system to prepare students for life after school (Van Damme, 2015). In the past, their teaching methods consisted mainly of memorizing information. Although this style teaches discipline, it limits students’ innate ability to think critically and does little to develop any problem-solving skills applicable to the real world.

In 2006, the Ministry of Education implemented the Ten Year Education Plan, which contains specific objectives to improve the entirety of the education system (ibid). The purpose of these goals were to standardize education throughout grade levels within and between private and public schools while aiming to increase high school graduation rates and literacy lev-
els (ibid). Through the promotion of an inclusive environment by providing textbooks in students’ native languages and changing their current curriculum to be more accessible, students from various cultures and linguistic backgrounds can have equal educational opportunities.

The National Plan for Good Living, a policy established by the Ministry of Education in 2009, has contributed to infrastructure improvement within the education system. However, as of 2016, gaps remain both in the training and professional development of teachers. Although they have adopted new technology and equipment in the classroom, teaching styles remain largely unchanged (Fajardo-Dack, 2016). As this is a structural transition which takes time to be fully effective, revisions of the course material did not correlate to instructional modifications (ibid). Though Ecuador has made investments to strengthen traditional learning styles, they have done little to advance the incorporation of communication and problem-solving skills into their lessons (ibid). The next step towards further improvement will demand adaptations to the country’s learning objectives that center on the development of problem-solving skills.

Our sponsor is the Unidad Educativa Particular Alborada, a private school located in Cuenca, Ecuador. The school’s vision notes the importance of creating a dynamic learning community and promoting daily improvement in all aspects of life. Alborada’s mission is to help “students develop a greater understanding and appreciation of the world around them and develop skills that include teamwork, collaboration and resilience,” which will aid them in their future (Alborada, n.d.). Our incorporation of a project-based learning curriculum for sixth and seventh grade students supplemented current plans for the goals that the Alborada school had already established.

Conclusion

Project-based learning promotes learning through experience. This hands-on teaching approach inspires students to individualize and be held accountable for their learning. This style improves student knowledge and understanding of core curriculum standards as well as how to apply these concepts. Through projects, students learn how to collaborate with one another by expressing their ideas to solve problems as well as consider the emotions and perspectives of their classmates. This learning method also strengthens students’ critical thinking skills. Projects require students to reason among themselves, draw inferences, and make rational conclusions, which results in an improvement of their problem-solving skills. These skills are important beyond the classroom into students’ careers and personal lives. In Ecuador, several recent policies aim to address the development of the education system. As the country continues to reform, there will be a need to incorporate novel learning techniques to ensure students have the skills they need to succeed in the real world. The following methodology describes how we integrated a project-based learning curriculum into the curriculum at the Alborada school.

Figure 10: Alborada Students Showing off their Pizza Slices from the Fractions Project

“[S]tudents develop a greater understanding and appreciation of the world around them and develop skills that include teamwork, collaboration and resilience.”

(Alborada, n.d.)
Methods

Table of Contents:
- Objective #1: Identify the current teaching practices at Alborada
- Objective #2: Adapt and implement lessons using project-based learning, drawing on observations to ensure that projects are appropriate for the context
- Objective #3: Gather feedback to propose recommendations for future use
Methods

The goal of our project was to assist the Alborada school in the development of a project-based learning curriculum for sixth- and seventh-grade students to improve students’ problem-solving and critical thinking skills. To achieve this goal, we outlined three objectives:

1. Identify the current teaching practices at Alborada
2. Adapt and implement lessons using project-based learning, drawing on observations to ensure that projects are appropriate for the context
3. Gather feedback to propose recommendations for the continued incorporation of project-based learning within sixth and seventh grade and translation to other grade levels

Objective #1: Identify the current teaching practices at Alborada

To establish a baseline understanding of the school’s system and pedagogical methods, we examined current classroom practices at Alborada. To do this, we looked at the current incorporation of project-based learning in their curriculum and the teachers’ inclination to adopt project-based learning through an analysis of lesson plans, observations of classroom activities, and semi-structured interviews. We then determined which aspects of project-based learning were already used in the school. From this, we determined that the school would benefit from an expansion of project-based learning, but that an introduction to its principles was not necessary.

We performed evaluations during the first week by reviewing lesson plans from each of the six teachers. Teachers submitted lesson plans from the current school quarter and we randomly chose three. We later observed some of these lessons in action to evaluate how the lesson plans translated to the reality of their in-class lessons. Using qualitative content analysis and investigator triangulation, we evaluated the lesson plans through the Lesson Plan Evaluation form (see Appendix B) to gain information about the current teaching style and structure of each class and complete a preliminary identification of project-based learning concepts in a variety of classes (Flick, 2014).

Additionally, we observed the sixth- and seventh-grade classrooms at Alborada to better understand the daily operations of the school. We conducted observations and each team member filled out their respective sections of the protocol sheet to check for the various criteria that exemplified the use of project-based learning (see Appendix C). The characteristics that we evaluated included the use of probing questions, classroom engagement, and collaboration. By attending classes, we gathered data in an unobtrusive manner without disrupting the scheduled lessons. This method allowed us to introduce ourselves, establish a baseline for the project, and identify areas we wanted to further explore during semi-structured interviews (Beebe, 2014, p. 55).

Figure 11: A Classroom at Alborada (Unidad Educativa Alborada, n.d.)

We conducted 30-minute semi-structured interviews with six teachers at Alborada during the first week of working at the school (Berg, 2012). The strong Spanish speakers of the team conducted and managed the interviews to identify current teaching practices and perspectives on aspects of project-based learning (Beebe, 2014, p. 55). Prompts included “Please describe your teaching style,” and “What real-world problems do you address in your classroom?” Appendix D contains the full list of interview questions.

After transcribing and translating the interviews, we used thematic coding to analyze the information presented during the interviews. Utilizing key words and concepts, we organized the data into categories such as classroom management, projects, values, skills for learners, and skills for life. Coding allowed us to un-
derstand the pre-implementation perspectives of the teachers we will be working with.

**Objective #2: Adapt and implement lessons using project-based learning, drawing on observations to ensure that projects are appropriate for the context**

Based on the observations and interviews conducted previously, we finalized the development of our lessons. Then, as we received feedback throughout the process, we implemented the lessons in the classroom. We had four weeks to teach the lessons upon arrival in Ecuador, each of which consisted of one three-day-long project to supplement the scheduled curriculum. The projects focused on mathematics, natural sciences, social studies, and English. Based on the country and school standards, we developed projects that taught the learning objectives while establishing the fundamental skills necessary for collaboration. We utilized the lesson plans provided by the teachers and set up weekly meetings with them to discuss how the projects we developed would align with their intended plans for the week.

During this trial and test phase, we handed out anonymous feedback sheets to students at the end of each three-day lesson to analyze the efficacy of the curriculum. We designed the Anonymous Lesson Evaluation feedback sheets (see Appendix E) to receive honest responses regarding their enjoyment, engagement, perception of the challenge presented, and comfort working in groups. We chose anonymous feedback sheets to assess the efficacy of our lesson plans and continuously improve the project (Beebe, 2014, p. 65). The sheets asked students to give their opinions of the lesson plans in general as well as the specific phases of each lesson.

During the implementation process, we completed observations to determine how the students reacted to our lessons and which aspects of project-based learning we visibly incorporated. Two of us assisted the instructor in leading the activity while the other two observed the classroom. The Team-Led Activity Observation Protocol (see Appendix F) highlights two roles, Observer 1 and Observer 2, which we used to identify the students’ reactions to project-based learning. The rubric helped us identify the students’ reactions to the project, specifically if they could recognize the problem, collaborate effectively, actively discuss, and succeed academically independent of skill levels. If two classes occurred at the same time, we split our team in half to attend both, making sure that one strong Spanish speaker was in each group to assist the teacher while the other group member completed both observation sheets.

To understand how the teachers felt about our lessons, we distributed Teacher Lesson Evaluation sheets at the end of our three-day lessons to identify their perspectives on the project and allow us to continuously improve them. They contain questions asking about their opinions on topics such as how they felt about the amount of time taken up by our lessons, and whether they thought they would use this project in their future classes (see Appendix G).

Feedback received from the students and teachers throughout the four weeks of iterating the design of our project allowed us to identify areas of improvement. While working with the instructors, our goal was to better understand students’ reactions to activities for future endeavors. We took this feedback into account when creating a sustainable plan for the con-
continued incorporation of project-based learning into the curriculum.

**Objective #3: Gather feedback to propose recommendations for future use**

Using feedback from the students and teachers at Alborada, we worked to deliver recommendations for future use and translation of the curriculum to other grade levels. After implementation, we conducted a survey for teachers (see Appendix H) to gain insight into how the project could be further developed and implemented. We analyzed the answers to prompts such as “Rate the changes in students’ written communication skills,” and “Which of the factors would restrict your implementation of project-based learning?” We asked teachers about their opinions of the lessons, regarding aspects like their efficacy and sustainability. More information on specific topics covered in the surveys can be found in Appendix H.

Then, we administered a survey to the students (see Appendix I) to examine their self-identified changes in skill strength due to the incorporation of project-based learning in their curriculum. Some of the questions we asked included, “Rate the changes in your problem-solving skills,” and “Rate the changes in your abilities to work in teams” with the purpose of understanding the impact of our projects from their perspectives.

Following these surveys, we conducted semi-structured interviews with the six teachers to identify successes and failures of the project, impacts on their students, and ways to sustain our project after our departure (see Appendix J). The interviews identified how the teachers want to see the future incorporation of project-based learning in the curriculum by setting a timeline for goals and action items based on needs communicated by the teachers. We compared these interviews with the surveys to understand the validity of the answers to the interview questions (Surveys, 2009). Topics that we considered include required supplies, necessary professional development training, and any other tools that would promote the sustainability of our project. We also collaborated with our sponsor to ensure that there is a long-term plan for this initiative.

Using the information from surveys and interviews, we triangulated the data and coded it based on the evaluation of the efficacy of the project, potential areas of improvement, and plans to sustain the work. Working directly with our sponsor and the other stakeholders, including students and teachers, we developed deliverables to ensure the sustained success of our project. We created a guidebook that includes an introduction to project-based learning, sample lesson plans, and evaluation rubrics. The following Gantt chart outlines the steps of our project during our time in Cuenca, Ecuador.

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**Figure 13: Gantt Chart of Our Project Timeline**
Findings & Discussion

Table of Contents:
- Finding 1: Partial Incorporation & Understanding of Project-Based Learning
- Finding 2: Positive Skill Development
- Finding 3: The Future of Project-Based Learning at Alborada
- Discussion & Research Limitations
Findings

Drawing on data collected during our three-phase research plan, which included initial observations, an overview of the curriculum, the implementation of project-based learning in the classroom, and exit interviews of the faculty, our research led to three main findings:

1. Alborada already uses elements of project-based learning and understands the importance of engagement, but does not fully incorporate projects into their three stages of lesson plans.

2. Our implementation of project-based learning resulted in overall positive trends in areas such as engagement and skill development, and teachers as well as students want to continue using this style.

3. There are some limitations in their resources and capacity to continue and expand project-based learning.

The mission and vision of the school gives important insight in understanding why Alborada wanted to implement project-based learning through this project. Alborada strives to provide students with a holistic education. Their vision notes the importance of creating a dynamic learning community and promoting daily improvement in all aspects of life.

Alborada’s mission is to help “students develop a greater understanding and appreciation of the world around them and develop skills that include teamwork, collaboration and resilience” (Alborada, n.d.). There is a strong focus on educating the whole person, as reflected in what one of the teachers said during an interview: “if you do not learn, you do not live.”

The schedule at Alborada gives students a balance between learning in the classroom and exploring the world around them, with art and athletics classes complementing the core curricular and project classes to challenge students in all areas. Students, teachers, and faculty foster a caring community that provides support to promote growth. From this community, as one teacher mentioned in an interview, students learn values like autonomy and respect that “build the[m] ... not only academically, but as human beings as well.”

We identified that the attitude toward learning at Alborada is positive as students are eager to learn and teachers are excited to share their knowledge. Our first day at Alborada made it clear that students were enthusiastic to be at school and learn alongside their peers.

Finding 1: Understanding & Partial Incorporation of Project-Based Learning

With the current teaching practices at Alborada, it was evident that teachers understood the role that engagement plays in their students’ learning. Through classroom observation, we discovered that most teachers used an active lecturing technique that promoted student engagement, with an observed average engagement of 86%. All teachers understood the importance of “arrive[ing to class] with energy and speak [ing] with passion” as it increases student engagement and therefore their retention of information.
Despite the fact that the faculty at Alborada understands the importance of engagement and uses elements of project-based learning, they do not fully incorporate projects into their three stages of lesson plans. From lesson plan evaluations, we identified that they used a three-part activity framework that included stages for anticipation, knowledge construction, and consolidation. The consolidation phase often included project elements as a review activity. Their projects were frequently shorter activities as opposed to long-term projects. For example, in social studies class, students created a poster on famous Ecuadorians and presented them in the same class period. They did not have a driving question that required research; instead, teachers gave students necessary information in the prior lesson stages and then tasked them with creating a project to represent what they had learned. We observed that overall, 54% of class time was spent participating in project-based learning activities such as group work, poster presentations, and active lecturing.

**Finding 2: Positive Skill Development & Continuation of Project-Based Learning**

Our implementation of project-based learning resulted in overall positive trends in engagement and skill development. From team-led activity classroom observations, we found that engagement increased with the use of project-based learning. The overall average engagement during our project implementation was 79.2%, with engagement increasing by 10% each week. We discovered that when students were creating something new or making decisions, especially during the main design phase of the project, they had the highest engagement levels. The hands-on activity phase had the highest engagement, with an average of 86.7%. We found that project phases that relied on lecturing had lower engagement levels. There was a consistent decrease in engagement between the discussion & check for understanding phase and the ticket-to-leave phase. In addition, the instruction period and ticket-to-leave phases had the lowest levels of engagement out of all of the phases, with an average engagement of 73% each. Figure 4 depicts the level of engagement during each phase.

During implementation, we also found from the perspectives of both the teachers and students’ skill development improved with project use. Our post-implementation surveys showed that students felt that their skills grew over the four weeks;
82.7% of all students, including 91% of sixth graders and 74% of seventh graders, reported an improvement in their skills. Teachers also felt that their students’ skills improved, with average rankings of 4.4 out of five, with five being high improvement and four being some improvement. Students commented on how working with their peers allowed them to share ideas and learn with one another. Figure 5 highlights self-reflected skill improvement of the students.

<table>
<thead>
<tr>
<th>Improved Skill</th>
<th>Percentage of Sixth Graders</th>
<th>Percentage of Seventh Graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>group work</td>
<td>87.9</td>
<td>78.5</td>
</tr>
<tr>
<td>problem-solving</td>
<td>81.8</td>
<td>73</td>
</tr>
<tr>
<td>written communication</td>
<td>62.5</td>
<td>78.5</td>
</tr>
<tr>
<td>verbal communication</td>
<td>63.3</td>
<td>68.3</td>
</tr>
<tr>
<td>comfort sharing ideas</td>
<td>70</td>
<td>72</td>
</tr>
</tbody>
</table>

*Figure 16: Percentage of Students that Felt Their Skill Improved*

Overall, we found that there was a positive reaction to the projects and students reported that they preferred them over their regular lessons; 81.6% of students wanted to have more projects in their classes and 79.1% said that they learned more with projects rather than without. They said, “we learn more and collaborate more with projects” and “we should use projects for more time in all classes.” Students commented that working with their peers allowed them to share ideas and learn with one another, and recommended that we implement project-based learning in other schools as well.

Teachers felt that project-based learning had a positive impact on their students and that they should continue with its incorporation into the curriculum, especially through collaboration by utilizing group or partner work “as this develops their ability to socialize and work with everyone,” which supported their students’ opinions. Teachers liked the real-world applicability of project-based learning and how it develops students’ soft skills by encouraging them to solve their own problems and share their ideas respectfully. All teachers communicated that our project delivered the concepts in a better way than their lesson plans would have and that they would want to use our projects in their future classes. One teacher commented that they hoped to “increase the incorporation of projects into all three phases of their lessons, not only at the end of the project.” Others recommended that students should begin “working with projects from fifth grade because they grow with this method of learning” and noted that “motivation increased with the projects.”

**Finding 3: Current Limitations**

Teachers were eager to incorporate project-based learning; however, they noted several limiting factors. They commented on a need to improve the school’s current infrastructure, specifically with their classroom setup, access to materials, and the presence of technology. The current classroom setup has students lined up in standard rows, which requires the reorganization of desks into clusters when they participate in group work. Additionally, projects often require physical materials for the construction or creation of a final product. Teachers commented that lack of materials is one of the top three factors restricting their implementation. During our observations, we noticed that the poor WiFi caused some issues when a teacher tried using a YouTube video for her lesson and it was unable to load. In addition, students did not utilize the computer lab for research as it did not have internet connection.

Students commented that working with their peers allowed them to share ideas and learn with one another, and recommended we implement project-based learning in other schools as well.”

As project-based learning frequently incorporates additional research or work outside the classroom, teachers have received pushback from parents saying “teacher, please, no homework” in regards to students working on assignments at home. Another challenge
teachers face is with classroom management and discipline due to the freedom associated with students collaborating on project work. They noted that students need to understand that “when it’s time to work, it’s time to work” for project-based learning to be most effective.

Finally, although teachers are eager to continue to use project-based learning, they would like more professional development opportunities to receive necessary training. Teachers noted that management of student behavior and the confines of the schedule were other limiting factors. They felt that they would most benefit from continued training and a sharing site for project lesson plans. We have categorized these limitations into three categories: infrastructure, cultural issues, and a need for professional development.
Discussion & Research Limitations

Engagement

While teachers understand the importance of engagement in the classroom and how it is a key factor of students’ learning and retention, we determined that it is important to create projects that appeal to all types of students. As we observed the teachers using an active lecturing technique, we noticed that the reserved students did not participate while the extroverts tended to dominate the conversation with their eager responses. Acknowledging the difference in personalities and learning styles, we created projects that appealed to students ranging from those who were eager to present to the class to those who preferred to express their ideas by creating a tangible product ("Overview of learning styles,” n.d.). The effectiveness of the active lecturing technique in promoting high engagement was dependent on the teacher’s personality and relationship with their students, which aligns with our prior knowledge that “students stay more engaged when they feel that others are respecting and emotionally validating them” (Banner & Cannon, 1997).

Our implementation data supported the benefits of group work and design in project-based learning. We found that students showed high engagement with the practice & review and hands-on activity phases. As supported by research, when teachers prompt students to make decisions for themselves, there is a “deeper student investment in the learning process” (D’Ambra, 2014, p. 89). Though this high engagement is a positive indicator of the benefits gained with teamwork and interactive activities, we did not have any form of evaluation to check their understanding of the content.

By analyzing projects with the highest and lowest engagement, we determined that a major factor in student engagement was the presence and participation of the teacher in the classroom. The project with the highest overall engagement was the Sea Animals & Activities project. During this project, the teacher was present and active, helping us lead the project and participating in activities with the students. The emotional environment created by the active involvement of the teacher along with their passion for teaching fostered a sense of inquisition and curiosity which helped students connect more with the material (Banner & Cannon, 1997). The teacher helped the students structure the English sentences necessary for the headbands activity and played a part in an example skit we performed in front of the students. This involvement helped to keep up the level of participation in the class and motivated the students to try their best. During the fractions project, the teacher sat back while we delivered the project and even left the room. We noticed that this negatively affected the engagement of the students, since they did not recognize that they should behave in the same manner as during a regular class.

There was higher engagement during our initial classroom observations than while we implemented our project-based learning lessons. As we spent more time at the school and began to interact with the instructors, we concluded that the students had likely been told to be on their best behavior during our observa-
tions. Additionally, the role of an observer in a classroom influences student behavior, which would explain why we initially observed such high levels of engagement (“Classroom Observation,” n.d.). During pre-implementation teacher interviews, they confided in us the issues they had with discipline in the classroom, which confirmed our hypothesis. We need to identify more information on the challenges of discipline within project work. Project-based learning gives students more freedom than they usually have in a typical curriculum, so it is essential to establish clear expectations early on to improve student behavior and their response to new information (Banner & Cannon, 1997). In project-based learning, students become the authors of their education and work independently to seek knowledge. To ensure that they achieve the outlined learning objectives, students need to feel a sense of responsibility and accountability for their learning. Managing discipline with the freedom and flexibility of project work requires a change in mindset for both students and teachers.

Teachers commented that the physical setup and lack of access to WiFi were two of the current limitations to using project-based learning. The classroom environment directly affects students’ learning and students thrive in classrooms that promote collaboration; however, Alborada classrooms are currently set up in a traditional grid layout (Miller & Cunningham, 2011). The benefit of using collaborative classrooms is that students can more easily talk with one another to assist in each other’s learning. Any restrictions due to accessible materials were addressed in the projects we implemented and proposed by creating projects that used readily available materials such as recycled goods. Without reliable WiFi, specifically in the computer lab, teachers are unable to give assignments that require students to perform independent research, limiting the situated inquiry phase.

As noted in the findings, we were unable to confirm the parents’ opposition to homework and thus, further data collection is necessary. Parental support directly impacts students’ learning, and without this support, they can negatively affect the success of project-based learning (“How Parent Involvement Leads to Student Success,” 2018). Parents increase the likelihood of the program being properly implemented when they act as resources for their children (Schwalm & Tylek, 2012). The situated inquiry phase of project-based learning requires students to seek out the information they need to develop solutions (Lee & Galindo, 2018). This student-led approach to learning may call for additional work at home which will require an adjustment for the teachers, students, and parents.

Figure 20: Students Learning How to Innovate by Designing Newton’s Cradles

Implementation

The teachers at Alborada have an understanding of what project-based learning is but are still developing the best ways in which they can incorporate it into their lessons. Teachers shaped lessons around real-world problems such as environmental and social consciousness but commented on schedule limitations and the classroom environment hindering them from fully integrating project-based learning into their lessons. By focusing our projects on three-day lessons with a variety of subjects, teachers began to realize the versatility of using projects. Instead of only using projects as a method of a review, instructors can incorporate projects as a way of teaching material throughout the three phases. By understanding the role of the four main elements of project-based learning, teachers can lead the students to learn throughout project work (Krajcik & Blumenfeld, 2005 & Lee & Galindo, 2018).
**Research Limitations**

The implementation of project-based learning achieved the goal of enhancing students’ skills. Both the teachers and students felt that the projects improved the skills of the students in every category. Though this feedback affirms the benefit of project-based learning for student development, this form of data collection still had some drawbacks. Both the teachers and students have cultural beliefs that restrain them from being critical because they consider it to be disrespectful. Oftentimes while we were in the classroom, the teachers would try to regain the students’ attention by saying, “they came all the way from another country to teach you, so please be respectful.” Behavior like this led us to believe that the culture and our presence may have skewed the survey and lesson evaluation results.

Issues with the data collection process did have an effect on our implementation of project-based learning; during the last week especially, we were unable to fully implement three-day lessons, which may have led to inaccurate data. In general, we did not collect as much data for the third day as compared to other days due to early release, exams, and other activities, which prevented us from completing our lessons and distorted our data towards the beginning phases. When we taught project lessons over several days, the separation along with the time of day affected engagement. We assume that since the student survey data was solely from self-reflection, students may have given feedback that was different from the truth. However, when compared with data from teachers and our observations, we could draw more reliable conclusions. The high student engagement from the first week was hard to match during our project implementation and, based on our data, we think that student engagement levels became more accurate as they became accustomed to our presence.

The projects that we implemented gave us the information we needed to further expand project-based learning into Alborada’s curriculum. Opinions about the use and effectiveness of projects from the perspectives of students and teachers would need to be further evaluated without the bias of our relationships with their implementation to gain the most accurate data. Additionally, to confirm that the projects are delivering concepts in better ways than current lessons, there should be an assessment of students’ comprehension of subject topics.

*Figure 21: Team Member Allison Working to Engage Students During the Headbands Activity*
Table of Contents:

- Recommendations
- For the Alborada Administration
- For the Alborada Teachers
- For Future Collaborators
- Conclusion
Recommendations

With the current incorporation of project-based learning at Alborada and the aforementioned limitations, we have identified areas of potential growth. The key stakeholders for the continued success of this initiative include the administration, parents, students, and teachers. With this in mind, we developed recommendations for Alborada and future collaborators.

For the Alborada Administration

- Organize information nights for parents so that they can better understand the reasoning behind this change to support their students.
- Provide professional development opportunities and workshops where teachers have specified time to continue learning new strategies as they begin to incorporate this change in their teaching style.
- Consider shifting the classroom set-up from desks to tables to foster collaboration as well as investing in materials such as posters, research books, and art supplies with the growth of a project-based learning curriculum.
- Set up reliable WiFi for the computer lab and promote its use so that it can be a resource for students and allow for more in-depth research projects.

For the Alborada Teachers

- Introduce students to communication and interpersonal skills through peer revisions, team charters, and peer evaluations.
- Use projects in all phases of learning:
  1. Anticipation: provide the framework for students to learn research techniques through situated inquiry
  2. Knowledge construction: reinforce the topics and allow students to share ideas with one another
  3. Consolidation: give an alternate method of evaluation for the specific content as well as the development of skills
- Collaborate with one another to plan intercurricular projects that span longer time frames and combine lessons from various subject areas. Adopt a team teaching methodology to lead and facilitate these projects

For Future Collaborators

- Communicate early and often with the teachers and faculty at Alborada to make sure they will be able to complete the project during the class period as well as to ensure that the class has achieved the prior learning objectives that the lesson plans outline.
- Request lesson plans in advance of arrival to allow more time to develop projects that align with the learning objectives.
- Propose ideas for intercurricular projects to determine if they are possible within the confines of the already-determined schedule.
- Be flexible and adaptable as change is the only constant when working with students.

Figure 22: The Current Middle School Classroom Set-up
Conclusion

For the past thirty years, the Ecuadorian education system has been working to focus on preparing students for their lives beyond their education. Ecuador’s proposed reformations have inspired the Unidad Educativa Particular Alborada in Cuenca, Ecuador, to work towards implementing curriculum changes centered on the development of critical thinking and problem-solving skills through the use of project-based learning. The primary goal of our project was to assist the Alborada school in the development of this curriculum for sixth- and seventh-grade students to supplement their current lesson plans. To ensure the sustained success of our project and to make it more accessible, we also published our guidebook as an online resource.

We found that Alborada teachers were already familiar with project-based learning and used elements of it in their lessons, but they did not fully incorporate projects into their curriculum. Analysis of our project implementation resulted in generally positive trends in student engagement and skill development, and teachers as well as students want to continue using this style. However, there are some restrictions in their resources and capacity to continue to expand project-based learning.

Based on our findings, we made recommendations for the administration, teachers, and future collaborators. We recommended that the administration should educate parents on curriculum changes, invest in school infrastructure, and provide training for teachers. The teachers should introduce students to the interpersonal skills that are necessary for project work, use projects in all stages of their lesson plans, and collaborate with one another to create long-term intercurricular projects. Future collaborators should communicate often with the teachers at Alborada and propose ideas for intercurricular projects in advance.

We submitted our final deliverable, a guidebook containing an introduction to project-based learning, lesson plans, group work management tools, and evaluation rubrics, to our sponsor at the conclusion of our time in Cuenca. We included lesson plans that directly outline their alignment with the Ministry of Education’s national learning objectives. Future collaborators should also consider the possibility of implementing this project-based learning curriculum in the public school system. The guidebook contains lessons that we implemented over the course of the four weeks and other lesson plans relating to Alborada’s required curriculum that we developed after receiving feedback from teachers. In addition, there is an explanation of project-based learning and a sample lesson plan methodology that teachers will be able to use when designing their own project-based learning lessons. To create a resource for teachers at Alborada and beyond, we posted our guidebook online to serve as a database for educators. They will be able to use this to view lesson plans for projects and a framework for project-based learning.

In our last week, we were informed that after reviewing the results of our implementation of project-based learning, the school has decided to expand these curriculum changes. Alborada will begin implementing a project-based learning curriculum beginning at the second grade level and has created an action plan with a teacher serving as the leader of this adaptation to track the progress. With this announcement, we hope that with the guidebook that we left at Alborada and the online compilation of resources, educators will be able to recreate the lessons we taught and expand upon what we were able to do during our short time at the school. We are excited to continue to receive updates about the continued progress of this curriculum change and our goal is that the teachers continue to educate their students to think critically and solve problems through project-based learning.

Figure 23: Students Presenting their Invention at the End of the Recycling Project
References


Kizkapan, O., & Bektas, O., (2017). The Effect of Project Based Learning on Seventh Grade Students’ Academic Achievement. International Journal of Instruction, 10(1), 37-54.


Appendices
Appendix A – Sample Lesson Plan

**Purpose:** To provide an outline for the steps of project-based learning providing a template with a specific example

<table>
<thead>
<tr>
<th>Allotted Time (minutes)</th>
<th>Activity Stage</th>
<th>Activity Details</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Question</td>
<td>Introduce the question: How can we design a potato chip container to best protect the chips inside?</td>
<td>• Cardboard (3” by 3” squares for each team)</td>
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<td></td>
<td></td>
<td></td>
<td>• 1 roll of packing tape</td>
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<td></td>
<td></td>
<td></td>
<td>• 1 ball of yarn (1 foot per team)</td>
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<td></td>
<td></td>
<td></td>
<td>• 1 bag of potato chips</td>
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<td></td>
<td></td>
<td></td>
<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
</tr>
<tr>
<td>5</td>
<td>Foundation</td>
<td>Show students what different types of material they have access to.</td>
<td>(3” by 3” squares for each team)</td>
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<td></td>
<td></td>
<td></td>
<td>• 1 roll of packing tape</td>
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<td>• 1 ball of yarn (1 foot per team)</td>
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<td>• 1 bag of potato chips</td>
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<td></td>
<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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<tr>
<td>5</td>
<td>Brain Activation</td>
<td>Allow students to ask clarifying questions, and inquire more into the project. Ask if any students have any preliminary ideas.</td>
<td>• Video of a model rocket taking off and falling to the ground</td>
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<td></td>
<td></td>
<td></td>
<td>• Images of model rockets and their payloads</td>
</tr>
<tr>
<td>5</td>
<td>Instruction Period</td>
<td>As an example, show how model rockets design their payloads to survive great falls.</td>
<td>(3” by 3” squares for each team)</td>
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<td>• 1 roll of packing tape</td>
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<td>• 1 bag of potato chips</td>
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<td></td>
<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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<tr>
<td>5</td>
<td>Hands-On Activity</td>
<td>Have students individually come up with rough designs on paper.</td>
<td>(3” by 3” squares for each team)</td>
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<td>• 1 roll of packing tape</td>
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<td>• 1 bag of potato chips</td>
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<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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<tr>
<td>15</td>
<td>Practice &amp; Review</td>
<td>Have students share their paper designs in teams and create one chip container with all of their input</td>
<td>(3” by 3” squares for each team)</td>
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<td></td>
<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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<tr>
<td>5</td>
<td>Discussion &amp; Check for Understanding</td>
<td>Teams show off their designs and perform two tests: Test 1 - drop the package at arm level to the ground and determine if it breaks Test 2 - put a heavy object on top for 10 seconds and determine if the chip broke</td>
<td>(3” by 3” squares for each team)</td>
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<td>• 1 bag of potato chips</td>
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<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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<tr>
<td>5</td>
<td>Ticket-to-Leave</td>
<td>Short discussion and writeup describing what did and did not work in their design</td>
<td>(3” by 3” squares for each team)</td>
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<td>• 1 roll of packing tape</td>
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<td>• 1 roll of aluminum foil (6” by 6” squares for each team)</td>
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Appendix B – Lesson Plan Evaluation

Purpose: To understand the current teaching strategies used in Alborada to determine strengths and weaknesses within teachers’ lesson plans. *Drawn from Bono, 2016.*

Name of Researcher:  
Teacher:  
Topic:  

1. Are the learning objectives clearly stated?  
   Yes  No  

2. Is there a question used to introduce the topic of each lesson?  
   Yes  No  

3. Are students given time to reflect and discuss?  
   Yes  No  

4. How many stages are in the lesson plan? Refer to Appendix A as an example of stages in a lesson plan.  

5. Are there any group activities?  
   Yes  No  

6. Is a real-world problem addressed?  
   Yes  No  
   If yes, please note the problem.  

7. Are students required to approach problems from multiple perspectives?  
   Yes  No  

8. Is there any evidence of project-based learning methods? (Do the lessons have students engage in teamwork, communicate their ideas, or solve real-world problems, etc.?)  
   Yes  No  
   What evidence?  

9. Are diverse learning styles represented by the lesson plans?  
   Audio: Yes  No  
   Visual: Yes  No  
   Kinesthetic: Yes  No
Appendix C – Classroom Observation Protocol

Observer 1

Purpose: To identify the incorporation of aspects of project-based learning in the classroom. Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet specifies the responsibilities of specific observation to different observers. Drawn from Daytiono, 2011.

Name: Classroom: Topic: Date: Time:

Further criteria for the following questions are outlined on page 3.

1. What percentage of students are engaged?
   - 0% 25% 50% 75% 100%
     ___ Stage 1: question
     ___ Stage 2: foundation
     ___ Stage 3: brain activation
     ___ Stage 4: instruction period
     ___ Stage 5: hands-on activity
     ___ Stage 6: practice and review
     ___ Stage 7: discussion and check for understanding
     ___ Stage 8: ticket to leave

     ___Calculated Average = total percentage ÷ 8

   Indicators of engagement:

   Indicators of disengagement:

2. Were probing questions used?
   - Yes No
     If yes, please note examples.
Appendix C – Classroom Observation Protocol
Observer 2

Purpose: To identify the incorporation of aspects of project-based learning in the classroom.

Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet specifies the responsibilities of specific observation to different observers.

Name:                        Classroom:              Topic:                             Date:                       Time:

*Further criteria for the following questions are outlined on page 3.*

3. Was collaboration used?
   Yes     No
   If yes, please note what collaborative methods were used and the size of student groups.

4. Time spent lecturing (minutes): ___

5. Time spent doing activities (minutes): ___
   Description of activities conducted:

6. Describe the physical setup of the classroom.
   Arrangement of the classroom:

   Resources available (research tools, materials for projects, etc.):
Appendix C – Classroom Observation Protocol
Observer 3

**Purpose:** To identify the incorporation of aspects of project-based learning in the classroom.

Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet specifies the responsibilities of specific observation to different observers.

Name:              Classroom:              Topic:              Date:              Time:

**Observer 3:**

3. What percentage of students ask questions?
   
   0%       25%       50%       75%       100%

4. How frequently do students ask questions for five-minute periods? Tally the number of questions for each time interval.

   ____ 0-5 minutes
   ____ 5-10 minutes
   ____ 10-15 minutes
   ____ 15-20 minutes
   ____ 20-25 minutes
   ____ 25-30 minutes
   ____ 30-35 minutes
   ____ 35-40 minutes
Appendix C – Classroom Observation Protocol

Observer 4

Purpose: To identify the incorporation of aspects of project-based learning in the classroom.

Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet specifies the responsibilities of specific observation to different observers.

Name:                      Classroom:          Topic:                             Date:                       Time:

Observer 4:

5. Is a project used?
   Yes   No

6. Are real-world problems addressed?
   Yes   No

7. Is research incorporated into the activity?
   Yes   No

   If yes, please note what research is conducted.

8. Are students encouraged to discuss?
   Yes   No
Appendix C – Classroom Observation Protocol

1. **Engagement Level**
   The level of engagement will be determined based on a general description of the classroom as the lesson progresses to identify how engagement changes throughout the lesson. Observers will look for indicators of engagement such as eye contact, note-taking, hand-raising, and head nodding. The level of disengagement will be determined based on a general description of the classroom as the lesson progresses to examine student disengagement. Observers will look for indicators of disengagement such as looking elsewhere during the lesson, drawing, side conversations, dozing off, etc.

2. **Probing Questions**
   A probing question is a clarifying question that allows for people to express personal opinions and think critically about their answer so that they can form more in depth analyses.

3. **Collaborative Methods**
   Methods for fostering collaboration in the classroom include group discussions, team assignments, peer reviewing and editing, etc. Observers will determine if the instructors used collaborative methods in the classroom and identify which were used.
Appendix D – Pre-Implementation Teacher Interview

Purpose: To identify the current practices teachers are using and their perspective on aspects of project-based learning

Welcome to our interview! Before we begin, we want you to know that you are not obligated to answer any questions; if you do not want to answer a question, please indicate this to the interviewer. We are a team of Worcester Polytechnic Institute students working to adapt project-based learning lessons into your curriculum. This interview will be approximately 40 minutes long. With your permission, we will tape this discussion, but it is completely anonymous. After the tapes are transcribed, they will promptly be destroyed. Please try to be as truthful as possible knowing that this is only to improve the lessons. The purpose of this interview is to elicit first-hand opinions from you, as a teacher at the Alborada school, to identify the current practices teachers are using and their perspective on aspects of project-based learning. This research will ultimately be published in the archives of Worcester Polytechnic Institute. All information will be anonymous as names will be redacted. Before we begin, do you have any questions?

IRB Manager: Ruth McKeogh 508-831-6699 irb@wpi.edu
Human Protection Administrator: Gabriel Johnson 508-831-4989 gjohnson@wpi.edu
Advisor: Courtney Kurlanska cbkurlanska@wpi.edu
Team Contact: gr-alboradaC20@wpi.edu

Objetivo: Identificar los estilos de enseñanza que los maestros están usando y sus perspectivos en los aspectos

¡Bienvenidos a nuestra entrevista! Antes de comenzar, tenemos algunos puntos de clarificación. No está obligado a responder a ninguna pregunta; si no desea responder a una pregunta, por favor indíca al entrevistador. Somos un equipo de estudiantes del Instituto Politécnico de Worcester que trabajan para adaptar las lecciones del aprendizaje basado en proyectos a su plan de estudios. Esta entrevista durará aproximadamente 40 minutos. Con su permiso, vamos a grabar esta discusión, pero es completamente anónimo. Después de que las cintas sean transcritas, serán destruidas inmediatamente. Por favor, trate de ser lo más veraz posible sabiendo que esto es sólo para mejorar las lecciones. El propósito de esta entrevista es obtener opiniones de profesores en la escuela Alborada para identificar las prácticas actuales que los profesores están usando y su perspectiva sobre aspectos del aprendizaje basado en proyectos. Esta investigación se publicará en los archivos del Instituto Politécnico de Worcester. Toda la información va a ser anónima y los nombres serán redactados. Antes de empezar, ¿tiene algunas preguntas para nosotros?

Director del IRB: Ruth McKeogh 508-831-6699 irb@wpi.edu
Administrador de Protección Humana: Gabriel Johnson 508-831-4989 gjohnson@wpi.edu
Contacto de Equipo: gr-alboradaC20@wpi.edu
Intro/Warm-Up Questions

1. How long have you been teaching? ¿Cuántos años ha estado enseñando?

2. What is your favorite part about teaching? ¿Cuál es su parte favorita sobre enseñanza?

3. What’s your favorite teaching memory? ¿Cuál es su memoria favorita de enseñanza?

Teaching Styles

4. Please describe your teaching philosophy. Por favor describe su filosofía de enseñanza.

5. Please describe your teaching style. Por favor describe su estilo de enseñanza.

6. Describe a typical day in the classroom. Describe un día típico en su clase.

7. How do you motivate your students? ¿Cómo motiva sus estudiantes?
8. Do you use hands-on activities in your classroom? ¿Usa actividades prácticas en su clase?

   If yes,

   a. What activities do you include in your classroom? ¿Qué actividades usted incluye en su clase?

   b. How do students respond to the hands-on activities? ¿Cómo responden los estudiantes a las actividades?

   If no,

   a. What is your opinion about hands-on activities? ¿Qué es su opinión sobre actividades prácticas?

   b. Would you be open to using them in the future? ¿Estaría dispuesto a utilizarlas en el futuro?

9. What real-world problems do you address in your classroom? ¿Qué problemas reales del mundo se discuten en clase?
10. Do your students participate in group activities in the classroom? ¿Sus estudiantes participan en las actividades de grupo en la clase?

If yes,

a. Please describe some examples of group activities that you use in your class. Por favor describe algunos ejemplos de actividades de grupo que usa en su clase.

b. Why do you use these group activities? ¿Por qué usa estas actividades de grupos?

If no,

a. Please describe the forms of collaboration that you use with your students. Por favor describe las formas de colaboración que usted usa con sus estudiantes.

b. Would you be open to including more group activities in the future? ¿Estaría dispuesto a incluir más actividades de grupo en el futuro?

11. What practical skills do you want your students to develop in your classroom? ¿Cuáles habilidades prácticas quiere que sus estudiantes desarrollar en su clase?
12. Please describe the best strategies you use in the classroom. *Por favor describe las estrategias mejores que usa en su clase.*

13. If you could change anything about your teaching strategy what would it be? *¿Si pudiera cambiar algo de su estrategia de enseñanza cuál sería?*

14. What aspects of lessons have the highest levels of engagement? *¿Cuáles aspectos de sus lecciones enganchan más a los estudiantes?*

Project-Based Learning Specific Questions

15. Are you familiar with project-based learning? If so, do you use it? Why or why not? *¿Está familiarizado con el aprendizaje basado en proyectos? ¿Si está, lo usa? ¿Por qué or por qué no?*

16. What project-based learning methods do you currently implement in your curriculum? Please describe how you use this to teach concepts. *¿Qué métodos de aprendizaje basado en proyectos implementa actualmente en su plan de estudios? Por favor describe cómo utiliza estos proyectos para enseñar los conceptos.*

17. Please describe your thoughts on a project-based curriculum. What are the advantages and disadvantages of them? (Compare to lecture) *Por favor describe sus pensamientos en un currículo basado en proyectos. ¿Qué son las ventajas o desventajas? (Compara a la conferencia)*
Appendix E – Anonymous Lesson Evaluation (English)

Purpose: To receive feedback from students for each of the activities we have developed.

The purpose of these sheets is to get honest feedback about our lessons. With honest feedback, we can better our lessons. If you did not enjoy a lesson, that is alright because we only want your ideas. All responses will remain anonymous and you do not need to put your name on this paper nor indicate your identity.

1. Rate how much you enjoyed the lesson today by circling one of the faces below:

![Smiley faces rating scale]

2. Please circle your favorite part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)

3. Please circle your least favorite part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 1)
   c. Activity 3 (Day 3)

4. Rate your level of engagement. (Were you paying attention during the lesson?)

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<tr>
<td>not engaged at all</td>
<td>barely engaged</td>
<td>neutral</td>
<td>somewhat engaged</td>
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5. Please circle the most engaging part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)
6. Please circle the least engaging part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)

7. Rate how challenging this project was for you.

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<tr>
<td></td>
<td>not challenged at all</td>
<td>barely challenged</td>
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<td>somewhat engaged</td>
<td>very engaged</td>
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8. Rate how comfortable you felt sharing your ideas during class.

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<td>not comfortable at all</td>
<td>barely comfortable</td>
<td>neutral</td>
<td>somewhat comfortable</td>
<td>very comfortable</td>
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9. Rate your experience working with your group today.

10. Please circle one of the options: Would you prefer to keep working...
   a. in groups
   b. by yourself
   c. no preference

11. Do you have any comments on how the project can be improved?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

An * indicates that this will be specified for each lesson.
Appendix E – Anonymous Lesson Evaluation (Spanish)

Propósito: Recibir comentarios de los estudiantes sobre las actividades que hemos desarrollado.

El propósito de esta forma es para obtener comentarios honestos sobre nuestras lecciones. Con comentarios, podemos mejorar nuestras lecciones. Si no se disfruta una lección, está bien porque solo queremos sus ideas. Todas las respuestas va a permanecer anónimo y no necesitas poner tu nombre en este papel ni indica tu identidad.

1. Encierra una de las caras siguientes que describo el disfrute de la lección hoy:

![Smiley faces]

2. Encierra la respuesta correcta para tu parte favorita de la lección*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

3. Encierra su parte menos favorita de la lección*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

4. Califica cuanto llamó tu atención (¿Estabas prestando atención durante las lecciones?)

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<td>sin interesado</td>
<td>apenas interesado</td>
<td>neutral</td>
<td>algo interesado</td>
<td>muy interesando</td>
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5. Por favor encierra la parte más interesante de la lección*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)
6. Por favor encierra la parte menos interesante de la lección*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

7. Califica el nivel de desafío de este proyecto para usted.

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<td>sin desafió</td>
<td>apenas desafiado</td>
<td>neutral</td>
<td>algo desafiante</td>
<td>muy desafiante</td>
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8. Califica tu comodidad con compartiendo sus ideas durante clase.

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<tr>
<td>incómodo</td>
<td>apenas cómodo</td>
<td>neutral</td>
<td>algo cómodo</td>
<td>muy cómodo</td>
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9. Encierra una de las caras siguientes que describir su experiencia trabajando con tu grupo hoy:

10. Encierra una de las opciones siguientes: prefieres trabajar…
    a. en grupos
    b. por ti mismo
    c. sin preferencia

11. ¿Tiene algunos comentarios sobre cómo se puede mejorar el proyecto?

   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________
   ___________________________________________________________________________

* Indica que esto se especificará para cada lección.
Appendix F – Team-Led Activity Observation Protocol
Observer 1

**Purpose:** To identify the students’ reactions to project-based learning

Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet has given the responsibility of specific observation to different observers.

Name:                        Classroom:              Topic:                             Date:                       Time:

1. What percentage of students are engaged?

   0%    25%    50%    75%    100%

   **Activity 1**
   _____: question
   _____: foundation
   _____: brain activation
   _____ Calculated Average = total percentage ÷ 3

   **Activity 2**
   _____: instruction period
   _____: hands-on activity
   _____ Calculated Average = total percentage ÷ 2

   **Activity 3**
   _____: practice and review
   _____: discussion and check for understanding
   _____: ticket to leave

   _____ Overall Calculated Average = total percentage ÷ 3

Indicators of Engagement:
Indicators of Disengagement:

2. Did students collaborate?
   
   Yes No
   
   If yes, please note what collaborative methods were used and the size of student groups.

3. Time spent lecturing (minutes): ____

4. Time spent doing activities (minutes): ____
   
   Description of activities conducted:

5. Are students making connections to other disciplines?
   
   Yes No
   
   List the disciplines that students are making connections to.

6. Are the students making decisions for themselves?
   
   Yes No
   
   List any observations of the decision-making process.
Appendix F – Team-Led Activity Observation Protocol
Observer 2

Purpose: To identify the students’ reactions to project-based learning

Due to the large amount of observations needed to be completed within the 40-minute lesson, this sheet has given the responsibility of specific observation to different observers.

Name:                        Classroom:              Topic:                        Date:                      Time:

7. How many questions do students ask during each of the following stages?
   
   **Activity 1**
   
   ____ : question
   ____ : foundation
   ____ : brain activation
   
   **Activity 2**
   
   ____ : instruction period
   ____ : hands-on activity
   
   **Activity 3**
   
   ____ : practice and review
   ____ : discussion and check for understanding
   ____ : ticket to leave

Please list questions that students asked.

8. Are the students identifying real-world problems?
   
   Yes   No

   Which did they identify? How?
9. Is contextual evidence provided for the problem?
   Yes   No
   Explain the context.

10. Are the students conducting research?
    Yes   No
    Describe how.

11. Are students discussing?
    Yes   No
    Topics of discussion:

12. Were students able to redesign in the time they were given to do so?
    Yes   No
    Explain how much time was provided and the effect.
Appendix G – Teacher Lesson Evaluation (English)

**Purpose:** To obtain honest comments from the teachers about our projects. With these comments, we can improve our lessons. Thank you for help and support in all the lessons.

1. I think that this project delivered the concepts in a _______ way than the lesson plans did.

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<tr>
<td></td>
<td>much worse</td>
<td>worse</td>
<td>neutral</td>
<td>better</td>
<td>much better</td>
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2. Please circle your favorite part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)

3. Please circle your least favorite part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)

4. Rate the level of engagement of the class. (Were the students paying attention during the lesson?)

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<tr>
<td></td>
<td>not engaged at all</td>
<td>barely engaged</td>
<td>neutral</td>
<td>somewhat engaged</td>
<td>very engaged</td>
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5. Please circle the most engaging part of the lesson for the students*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)

6. Please circle the least engaging part of the lesson*:
   a. Activity 1 (Day 1)
   b. Activity 2 (Day 2)
   c. Activity 3 (Day 3)
7. Rate how challenging this project was for you.

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<tr>
<td></td>
<td>not challenged at all</td>
<td>barely challenged</td>
<td>neutral</td>
<td>somewhat challenged</td>
<td>very challenged</td>
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8. Do you think the amount of time we used for the project was…

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<tr>
<td></td>
<td>really short</td>
<td>short</td>
<td>just enough</td>
<td>more than necessary</td>
<td>too much time</td>
</tr>
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</table>

9. Which elements of project-based learning do you think the project included? (Please choose all that apply)
   a. real-world problems
   b. evidence for the problem
   c. group discussions
   d. investigation
   e. other(s): _____________________________________________

10. Circle one of the following options: for this project, do you think that the students should keep working...
    a. in groups
    b. in pairs
    c. individual
    d. no opinion

11. Do you think that you would use this project in your class in the future?
    a. yes
    b. no
    c. I don’t know

12. Please write any suggestions you have for improving this project in the future.
    _____________________________________________
    _____________________________________________
    _____________________________________________
    _____________________________________________
    _____________________________________________
    _____________________________________________

* Indica que esto se especificará para cada lección.
Appendix G – Teacher Lesson Evaluation (Spanish)


1. Piensa que con este proyecto se logró el objetivo planteado de una _______ manera de lo que usted tenía planificado

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<tr>
<td></td>
<td>peor</td>
<td>casi semejante</td>
<td>misma</td>
<td>mejor</td>
<td>mucho mejor</td>
</tr>
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</table>

2. Encierra en un círculo la actividad favorita de la lección*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

3. Encierra en un círculo la actividad fue de menos interés*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

4. Califica el nivel de compromiso para la clase (?Los estudiantes estaban enganchados durante las lecciones?)

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<td>apenas comprometido</td>
<td>neutral</td>
<td>algo comprometido</td>
<td>comprometido</td>
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5. Encierra en un círculo la actividad en la cuál los estudiantes se engancharon más*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)

6. Encierra en un círculo en la actividad en la cuál los estudiantes no se engancharon*
   a. Actividad 1 (Primer Día)
   b. Actividad 2 (Segundo Día)
   c. Actividad 3 (Tercer Día)
7. Califica el nivel de desafío de este proyecto para sus estudiantes.

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<td></td>
<td>no desafiante</td>
<td>apenas desafiado</td>
<td>neutral</td>
<td>algo desafiante</td>
<td>muy desafiante</td>
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8. La cantidad de tiempo que nosotros usamos piensa que era...

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<tr>
<td></td>
<td>muy poco tiempo</td>
<td>casi suficiente</td>
<td>suficiente</td>
<td>más de lo necesario</td>
<td>demasiado tiempo</td>
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9. ¿Cuáles elementos de aprendizaje basado en proyectos piensa que estuvo incluyendo (por favor elige todo que aplica)
   a. problemas del mundo real
   b. evidencia para el problema
   c. discusión en grupos
   d. investigaciones
   e. otros: _____________________________________

10. Encierra en un círculo una de las siguientes opciones: para este proyecto piensa que los estudiantes deben continuar trabajando...
   a. en grupos
   b. en parejas
   c. por ti mismo
   d. de cualquier manera

11. Piensa que usted usaría este proyecto en su clase
   a. sí
   b. no
   c. no sé

12. Por favor si tiene sugerencias para mejorar el proyecto por favor escribelas

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

* Indica que esto se especificará para cada lección.
Appendix H – Teacher Survey (English)

**Purpose:** To identify the teachers’ opinions about changes in students’ skills since the incorporation of project-based learning and understand how this project can develop in the future specifically what tools the teachers would need.

1. Rate the changes in students’ abilities to work in teams:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

2. Rate the changes in students’ abilities to solve problems:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

3. Rate the changes in students’ written communication skills:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

4. Rate the changes in students’ verbal communication skills:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

5. How likely is it that you would implement project-based learning into your classroom?

<table>
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<tr>
<th>1</th>
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<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>unlikely</td>
<td>neutral</td>
<td>likely</td>
<td>very likely</td>
</tr>
</tbody>
</table>
6. Please rank the following factors as the most restrictive of your implementation of project-based learning activities (rank from 1-5, with 1 being the most significant and 5 being the least significant).

   ___ lack of training
   ___ lack of alignment with curriculum standards
   ___ lack of materials for projects
   ___ lack of interest from students
   ___ management of student behavior (discipline, rules, etc.)
   ___ not enough time in course schedule to implement

7. How could you see this being implemented in the future at Alborada? Select all that apply:

   ___ within your classroom
   ___ within sixth and seventh grade
   ___ within the middle school
   ___ within the whole school
   ___ N/A cannot see implementation as a feasible step

8. Please rank what tools would be helpful going forward with the implementation of a project-based learning curriculum. Rank the options from 1-4, with 1 being the least helpful and 4 being the most helpful or select N/A as you see fit.

   ___ a sharing site of lesson plans for projects to collaborate with other teachers globally
   ___ a workbook with various types of projects
   ___ a toolkit with lesson plans and all necessary materials included
   ___ training for teachers on project-based learning
   ___ N/A cannot see implementation as a feasible step

9. What would you like to be changed or modified in the lessons?

10. Do you have any comments or suggestions to help improve this program?
Appendix H – Teacher Survey (Spanish)

Propósito: Identificar opiniones de los maestros sobre los cambios en las habilidades de los estudiantes desde la incorporación del aprendizaje basado en proyecto y entender cómo este proyecto puede desarrollar en el futuro específicamente las herramientas que los maestros necesitarán.

1. Califica cómo cambiaron las habilidades de los estudiantes de trabajar en grupos:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyeron mucho</td>
<td>lo disminuyeron un poco</td>
<td>neutral</td>
<td>lo mejoraron un poco</td>
<td>lo mejoraron mucho</td>
</tr>
</tbody>
</table>

2. Califica cómo cambiaron las habilidades de los estudiantes de solucionar problemas:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyeron mucho</td>
<td>lo disminuyeron un poco</td>
<td>neutral</td>
<td>lo mejoraron un poco</td>
<td>lo mejoraron mucho</td>
</tr>
</tbody>
</table>

3. Califica cómo cambiaron las habilidades de los estudiantes de comunicación escrito:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyeron mucho</td>
<td>lo disminuyeron un poco</td>
<td>neutral</td>
<td>lo mejoraron un poco</td>
<td>lo mejoraron mucho</td>
</tr>
</tbody>
</table>

4. Califica cómo cambiaron las habilidades de los estudiantes de comunicación verbal:

<table>
<thead>
<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyeron mucho</td>
<td>lo disminuyeron un poco</td>
<td>neutral</td>
<td>lo mejoraron un poco</td>
<td>lo mejoraron mucho</td>
</tr>
</tbody>
</table>
5. ¿Qué tan probable es que implemente el aprendizaje basado en proyectos en su aula de clases?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>muy improbable</td>
<td>improbable</td>
<td>neutral</td>
<td>probable</td>
<td>muy probable</td>
</tr>
</tbody>
</table>

6. Por favor clasificar los factores siguientes como el aspecto más restrictivo de su implementación de actividades de aprendizaje basado en proyectos (Clasifica 1-6 con uno siendo el más significativo y seis siendo el menos significativo.)

- ___ falta de entrenamiento
- ___ falta de alineación con los estándares del currículo
- ___ falta de materias para los proyectos
- ___ falta de interés de los estudiantes
- ___ el manejo de los comportamientos de los estudiantes (disciplina, reglas, etc.)
- ___ no hay tiempo suficiente en el horario de la clase para implementar

7. ¿Cómo podría ver que esto se implementa en el futuro en Alborada? Seleccione todas las que aplican:

- ___ dentro su clase
- ___ dentro los grados sexto y séptimo
- ___ dentro de la escuela secundaria
- ___ dentro de toda la escuela total
- ___ N/A no puede ver la implementación como un paso factible

8. Por favor, clasifique qué herramientas serían útiles en el futuro con la implementación de un plan de estudios de aprendizaje basado en proyectos. Clasifica las opciones de 1-4, siendo 1 el menos útil y 4 el más útil, o selecciona N/A como mejor te parezca.

- ___ un sitio compartido de planes de lecciones para que los proyectos colaboren con otros profesores a nivel mundial
- ___ un cuaderno de ejercicios con diversos tipos de proyectos
- ___ una caja de herramientas con proyectos de la lección y todos los materiales necesarios incluida
- ___ formación para profesores sobre el aprendizaje basado en proyectos
- ___ N/A no puede ver la implementación como un paso factible
9. ¿Qué le gustaría que se cambiara o modificara en las lecciones?

10. ¿Tiene algún comentario o sugerencia para ayudar a mejorar este programa?
Appendix I – Student Survey (English)

Objective: To identify students’ opinions about changes in their skills since the incorporation of project-based learning. This will help us understand how this curriculum change (with the incorporation of project-based learning) impacted the students.

1. Rate the changes in your ability to work in groups:

<table>
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<tr>
<th>1</th>
<th>2</th>
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<th>5</th>
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</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

2. Rate the changes in your ability to solve problems:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<th>5</th>
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<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
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</tbody>
</table>

3. Rate the changes in your written communication skills:

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<tr>
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<th>5</th>
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<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

4. Rate the changes in your verbal communication skills:

<table>
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<tr>
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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>

5. Rate the changes in your comfort sharing ideas:

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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreased a lot</td>
<td>decreased a little</td>
<td>neutral</td>
<td>improved a little</td>
<td>improved a lot</td>
</tr>
</tbody>
</table>
6. I want ______ projects in the future in my classes
   a. more
   b. less
   c. the same amount
   d. I don’t care

7. I felt that with the projects I learned ______ than without projects
   a. more
   b. less
   c. the same amount

8. Describe your favorite part of doing project work.
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

9. How can we improve the projects?
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
Appendix I – Student Survey (Spanish)

**Propósito:** Identificar opiniones de los estudiantes sobre los cambios en sus habilidades desde la incorporación del aprendizaje basado en proyectos. Nos ayudará a ver cómo el cambio de sus actividades diarias (con la incorporación de aprendizaje basado en proyectos) afectó los estudiantes.

1. Califica cómo cambió sus habilidades de trabajar en grupos:

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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyó mucho</td>
<td>lo disminuyó poco</td>
<td>neutral</td>
<td>lo mejoró poco</td>
<td>lo mejoró mucho</td>
<td></td>
</tr>
</tbody>
</table>

2. Califica cómo cambió sus habilidades de solucionar problemas:

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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyó mucho</td>
<td>lo disminuyó poco</td>
<td>neutral</td>
<td>lo mejoró poco</td>
<td>lo mejoró mucho</td>
<td></td>
</tr>
</tbody>
</table>

3. Califica cómo cambió sus habilidades de comunicación escrito:

<table>
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<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyó mucho</td>
<td>lo disminuyó poco</td>
<td>neutral</td>
<td>lo mejoró poco</td>
<td>lo mejoró mucho</td>
<td></td>
</tr>
</tbody>
</table>

4. Califica cómo cambió sus habilidades de comunicación verbal:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyó mucho</td>
<td>lo disminuyó poco</td>
<td>neutral</td>
<td>lo mejoró poco</td>
<td>lo mejoró mucho</td>
<td></td>
</tr>
</tbody>
</table>

5. Califica cómo cambió su comodidad compartiendo sus ideas:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>lo disminuyó mucho</td>
<td>lo disminuyó poco</td>
<td>neutral</td>
<td>lo mejoró poco</td>
<td>lo mejoró mucho</td>
<td></td>
</tr>
</tbody>
</table>
6. Quiero ______ proyectos en el futuro en mis clases.
   a. más
   b. menos
   c. lo mismo
   d. no me importa

7. Con los proyectos, pienso que aprendí ______ que sin proyectos.
   a. más
   b. menos
   c. lo mismo

8. Describe su parte favorita de trabajando con proyectos.
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

9. ¿Cómo podemos mejorar los proyectos?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Appendix J – Post-Implementation Teacher Interview

Purpose: To get information on what the teachers thought the students’ responses were to the activities implemented and understand how this could continue to be developed moving forward.

Welcome to our interview! Before we begin we want you to know that we ask that you please answer all questions asked but you are not obligated to answer any questions; if you do not want to answer a question, please indicate this to the interviewer. We are a team of Worcester Polytechnic Institute students working to adapt project-based learning lessons into your curriculum. This interview will be approximately 40 minutes long. With your permission, we will tape this discussion, but it is completely anonymous. After the tapes are transcribed, they will promptly be destroyed. The purpose of this interview is to get information on what you thought the students’ responses were to the activities implemented and understand how this could continue to be developed moving forward. This research will ultimately be published in the archives of Worcester Polytechnic Institute. All information will be anonymous as names will be redacted. Before we begin, do you have any questions?

IRB Manager: Ruth McKeogh 508-831-6699 irb@wpi.edu
Human Protection Administrator: Gabriel Johnson 508-831-4989 gjohnson@wpi.edu
Advisor: Courtney Kurlanska cbkurlanska@wpi.edu
Team Contact: gr-alboradaC20@wpi.edu

Propósito: Obtener información de los maestros sobre los pensamientos sobre el efecto de las actividades en sus estudiantes y entender cómo este proyecto puede desarrollar en el futuro.

¡Bienvenidos a nuestra entrevista! Antes de comenzar, tenemos algunos puntos de clarificación. No está obligado a responder a ninguna pregunta; si no desea responder a una pregunta, por favor indica al entrevistador. Somos un equipo de estudiantes del Instituto Politécnico de Worcester que trabajan para adaptar las lecciones del aprendizaje basado en proyectos a su plan de estudios. Esta entrevista durará aproximadamente 40 minutos. Con su permiso, vamos a grabar esta discusión, pero es completamente anónimo. Después de que las cintas sean transcritas, serán destruidas inmediatamente. Por favor, trate de ser lo más veraz posible sabiendo que esto es sólo para mejorar las lecciones. El propósito de esta entrevista es obtener información de los maestros sobre los pensamientos sobre el efecto de las actividades en sus estudiantes y entender cómo este proyecto puede desarrollar en el futuro. Esta investigación se publicará en los archivos del Instituto Politécnico de Worcester. Toda la información va a ser anónima y los nombres serán redactados. Antes de empezar, ¿tiene algunas preguntas para nosotros?

Director del IRB: Ruth McKeogh 508-831-6699 irb@wpi.edu
Administrador de Protección Humana: Gabriel Johnson 508-831-4989 gjohnson@wpi.edu
Contacto de Equipo: gr-alboradaC20@wpi.edu
Materials: Printouts of all our lesson plans will be included so that teachers can reference them while answering the following questions.

1. From your perspective, how did the students respond to our lessons? ¿Cómo respondieron los estudiantes a las lecciones?

2. Did you notice any changes in the students’ attitudes towards learning? ¿Observó cambios en las actitudes hacia el aprendizaje?

3. Was there a specific project that you felt benefitted the students the most? ¿Hay un proyecto específico que piensa se más beneficiaron los estudiantes?

4. Do you think that our lesson plans and activities were effective in teaching concepts to your students? ¿Piensa que nuestros planes de clases y actividades eran efectivos como una manera para enseñar los conceptos a los estudiantes?

5. In your opinion, what can we do to improve our lesson plans? ¿En su opinión, qué podemos hacer para mejorar los nuestros planes de clase?

6. Would you implement these projects in your classroom? Why or why not? ¿Va a implementar estos proyectos en sus clases? ¿Por qué o por qué no?
7. Do you feel like the lesson plans implemented can be easily continued after we leave? Why or why not? ¿Siente que los planes pueden ser fácilmente continuó después de salimos? ¿Por qué o por qué no?

8. Is there anything you would require to implement the lesson plans (professional development, specific materials, etc.)? ¿Hay algo que requiere para implementar los planes de clases (el desarrollo profesional, materiales específicos, etc.)?