# Incorporating Project-based Learning into K-12 Science Classrooms in Public Schools

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**Abstract:** In the U.S., majority of public schools follow scripted curriculum and teacher-directed teaching. Although Project Based Learning is apparent in a few schools throughout the U.S, most schools, specifically lower income and urban schools do not have Project Based Learning in their science classrooms. Therefore, students may not have the ability to explore learning content through hands-on experiences and through relatable interest. Yet, according to research, Project Based Learning can improve the skills and learning of students in the classroom and increase test scores. Thus, based on research, this manuscript will discuss information on Project Based Learning and support the claim that Project Based Learning should become the main pedagogy in science classes in K-12 public schools.

## Introduction

*Imagine a study done between two second grade science classrooms learning about animal habitats. One classroom (Group A) uses solely scripted curriculum and teacher-directed methods. The other classroom (Group B) uses Project Based Learning (PBL) methods. Both lessons incorporate state standards and criteria for testing. The animals that were chosen for the project were based on a survey given to group B's entailing which animals and their habitats they would like to learn about.*

*Group A's teacher introduces the topic of lesson through a PowerPoint presentation. The teacher tells the students that they are going to learn about different animal habitats, and at the end of the lesson, they should be able to identify the animals and their habitats. The students watch the PowerPoint slides on the carpet. The teacher asks very few observational questions and only checks for understanding when students engage in a recall session. The PowerPoint slides include labels and pictures that the students can observe. The five animals included are: monkeys, birds, lions, iguana, and hippos. After the presentation is completed, students go back to their desk and begin to work on their packets. Each animal has three pages: a picture of the animal with its name, a picture of the habitat with its name, and a page with three questions to check for understanding. The three questions are: What animals live in (blank) habitat; Where can you find this habitat; and what is the habitat made of? On the first page, students are instructed to color the picture and trace the name of the animal. On the second page, the students are instructed to label the picture as best as they can from what they learned, and color the picture. Afterwards, the teacher asks for the students to come to the carpet for the final summative assessment. The teacher calls on two to three students to share their coloring and their answers. Finally, the teacher collects their packets and repeats the process for the next four days. These students do not engage further in their exploration, and afterwards they move on to the next topic.*

*Group B's teacher uses a zoo website with interactive videos and sounds. The stu-*

*dents explore the same five animals as Group A, though they spend one extra day on each animal. The teacher plays the videos, which are about five to eight minutes long. Throughout the videos, the teacher stops the videos and asks students predictive thinking questions; "what do you think the iguana's habitat is made of?", observations questions; "what differences do you notice between the monkey's habitat versus the bird's habitat?", and formative questions; "where did the zoologist say the monkey's habitat is located?". Following the video, the teacher instructs students to create, color, and label a picture of the habitats based on what they learned. After, the teacher tells the students that they are going to make their own habitats for the animals tomorrow. Additionally, the students are asked to leave their pictures at their table and do a gallery walk. (A gallery walk is where students walk around the classroom and look at their fellow classmates' work). The students are told to observe their classmates' work to see the similarities and differences in their work. After this lesson, the teacher includes a stuffed animal in the classroom to represent the animal they are learning about at that time. During play and exploration time, the teacher encourages the students to engage in imaginary play with the stuffed animals. The next day the teacher reads a book with more facts about the habitats and the animals. They foster questions about the information, as well as have students engage in small group discussions about what they have observed or learned a few times throughout the book. For the remainder of the 40 minutes, students are put into groups of three or four and told to create a 3D habitat together. There are manipulatives and arts and crafts materials ready for the students. The teacher is there for guided support. Afterwards, the students present their projects at day two of writing time because the teacher incorporated a writing piece that required the student to explain individually what they learned about each animal's habitat. At the end of this unit, the students went on a field trip to the zoo as a class to see the animals and explore the habitats in person.*

Based on this information, as the reader, think about who obtained and retained the most information and applied their knowledge to the test better.

## The Issue of Exploring PBL in Science Classrooms

In the current light of our education system, many public schools use scripted curriculums and a teacher-directed approach to learning. The rationale behind these teaching models often used for students is the achievement of higher scores on state standardized testing. The teaching methods often embody the criteria and information needed for standardized testing. Standardized testing scores can determine the renewal of teacher contracts, government funding, school accreditation, adequate yearly progress report, graduation and more. Although these teaching methods have been used for many years within education, these methods are not solely the most effective and beneficial methods for students' skill building and learning. Therefore, I believe public schools should incorporate an alternative teaching method, Project Based Learning (PBL), as its main pedagogy in science classrooms to promote growth, independence, long-term memory of information, and equitable opportunities for success.

### *The Rationale and Background Information for Exploring PBL*

Project Based Learning is a teaching method used in order for students to learn while actively engaging in real world and personally meaningful projects and lessons (PBLWorks, 2021). Through PBL, students will work on projects and lessons for an extended period of time. This process involves solving real-world problems, inquiries, and answering complex questions that demonstrate their knowledge and skills by presenting their knowledge verbally and non-verbally, which fosters higher levels of language. Therefore, the goal of PBL is to "increase students' knowledge as well as critical thinking, collaboration, creativity and communication skills" (PBLWorks, 2021a, para. 2). From the example above, students in group B's science class had an opportunity to collaborate and communicate with peers, as well as critically think about how to make a 3D habitat without direct instruction which exemplifies the main goal of PBL.

On the contrary, especially in lower income or urban school districts, teachers are expected to rely on scripted curriculum materials instead of their students' interests and their own professional judgment due to government funding through standardized testing. Scripted curriculum was designed to give teachers tools to use to foster the learning of students for tested material and state standards (Milner, 2014). As a result, students do not have a lot of opportunities to foster critical thinking skills, engage in higher levels of language, and have hands-on experiences within their learning. Information is given to the students through worksheets, packets, lectures, and repetition games.

### *Recommendations and Lessons for Educators*

For PBL to be implemented in science classrooms, teachers should be equipped with the knowledge to discuss a variety of topics and implement state standards and criteria into large units or projects, as well as equip them with the resources to expand on students' explorations. Educators should attend professional developments or take a class on PBL to equip themselves with the skills and tools needed to implement PBL into the classrooms. Furthermore, they should apply their knowledge and begin to integrate required topics into units of studies, while also leaving room for students to share their own thoughts and opinions.

## Assessing the Ideas and Viewpoints from Both Sides

### *The Side for Project Based Learning*

Regarding the change in pedagogy, those for PBL in science classrooms would argue that making PBL the main pedagogy in the classrooms would help put an end to the achievement gap for lower income and urban schools' districts. Also, they would argue that PBL could enhance learning skills such as effective levels of communication and collaboration that students need for future education and life. According to PBLWorks (2021b)

PBL can be transformative for students, especially those furthest from educa-

> tional opportunity. Now more than ever, we need young people who are ready, willing, and able to tackle the challenges of their lives and the world they will inherit - and nothing prepares them better than Project Based Learning (para. 1).

Also, those for including PBL in science classrooms may agree that incorporating students' interest into the classroom may increase student engagement and exposure which could potentially lead to higher test scores, better student behavior, and better student outcomes.

Those for PBL may argue that the current stakeholders of the issue are school boards, administration, and educators, and they should implement this teaching method into science classrooms. These individuals all play a part in the discussion and decision to make PBL the main pedagogy in science classrooms. With the inclusion of PBL comes the conversations surrounding equity, cultural capital, student interest, retention and testing, closing the "gap", and better opportunities for lower income and urban school districts. Therefore, each member and school will be affected by the inclusion of PBL. According to Giesige's (2017) research:

> Out of five studies that compared project-based learning to didactic teacher-centered learning, three studies showed better results for those using project-based learning and the remaining two showed no statistical difference between the control and treatment groups. No group showed worse academic outcomes for the students engaged in project-based. (p. 65)

This shows that there is a higher probability of success with using PBL, rather than using solely scripted curriculum and teacher-directed learning.

### *The Side Opposed to Project Based Learning*

Regarding those who are opposed to changing the curriculum to PBL in science classroom, this side would argue that having hands-on experiences and longer units of study would hinder the growth of students and efficiency of teachers because the projects take too much time. According to Ribeiro (2011):

> It should be also remarked that not only did PBL consume more of the teacher's total time, but it also raised, however moderately, the time load in a uniform manner throughout the semester and restrained his autonomy to manage his time. This continual increase was due to the fact that PBL made it difficult to produce a thoroughly anticipated syllabus plan. (p. 10)

Based on this information, they would argue that the students could become behind in learning. And because of that, the school would receive lower test scores and federal money. Lower scores would affect the schools' accreditation, enrollment, and resources. Therefore, teachers should stick to the curriculum given to help students learn what is on the test and move quickly through the standards and information.

Also, people against PBL would agree, or partially agree, with the Pedagogy of Poverty ideas from Haberman (1991) found through Giesige's (2017) research:

Four assumptions describe the Pedagogy of Poverty:

- Teaching is what teachers do, learning is what students do. Therefore, students and teachers are engaged in different activities.

- Teachers are in charge and responsible. Students are those who still need to develop appropriate behavior.
- Students represent a wide range of individual differences... therefore ranking of some sort is inevitable.
- Basic skills are a prerequisite for learning and living and students are not necessarily interested in these basic skills. Therefore, directive pedagogy must be used. (p. 83)

These ideas align with teacher-directed teaching methods which a lot of students, especially students in lower income and urban school districts, are exposed to. Thus, these assumptions would allow teachers to teach what the school or they themselves see as vital information, as well control the amount of time given to each topic. Nonetheless, some people on this side may argue that it is okay to deviate from the scripted curriculum a little if the teacher has a concrete purpose, the students will learn the needed information, and the teacher can execute the lesson well.

## The Stance of the Manuscript for PBL

After analyzing this research and other research on Project Based Learning, the stakeholders may conclude that making PBL the main pedagogy in public schools can be beneficial for students' success. It is important for students to develop good critical thinking, communication, independence, higher levels of language, collaboration and creativity skills through the exploration of group work, hands-on activities, and projects that can be implemented in the classroom. Also, it is very important that students receive equity within their education because the one size fits all curriculum has not proven to be exceptional for all students. Creating environments where students are heard, attentive, and learning are essential to the growth of the students, but also the success of the school and its community.

### References

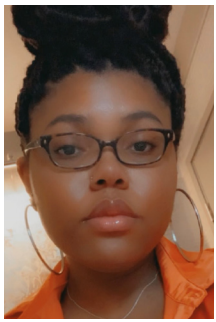
Giesige, S. N. (2017). Project-based learning as an alternative to the pedagogy of poverty in low-income schools. *Learning to Teach Language Arts, Mathematics, Science, and Social Studies Through Research and Practice, 6*(1), 1–6.

Milner, R. H. (2014). Scripted and narrowed curriculum reform in urban schools. *SAGE Journals, 49*(7). https://journals.sagepub.com/doi/full/10.1177/0042085914549685

PBLWorks. (2021a). *What is PBL?* Buick Institute for Learning, PBL Works https://www.pblworks.org/what-is-pbl

PBLWorks. (2021b). *Why PBL?* Buick Institute for Learning, PBL Works https://www.pblworks.org

Ribeiro, L. R. C. (2011). The pros and cons of problem-based learning from the teacher's standpoint. *Journal of University Teaching & Learning Practice, 8*(1), 1-17. https://ro.uow.edu.au/jutlp/vol8/iss1/4



### About the Author

Victoria M. Pope graduated in 2020 from the University of Missouri with a Bachelors of Education specializing in early childhood. She is currently a masters student at the University of Toledo with a focus in early childhood education. She works as a graduate research assistant for the University of Toledo.