

Implementing Problem-Based Learning

In study after study, problem-based learning yields higher results in terms of student engagement, critical thinking, creativity, academic achievement, and longer retention of concepts and skills. It narrows the achievement gap between socioeconomic and racial groups and across genders. Problem-based learning, also referred to as inquiry-based learning or project-based learning, is a student-centered approach with the intent of stimulating students to cultivate their creative and critical thinking. In addition, problem-based learning also helps students to transfer ideas across different settings and situations and challenges students to integrate knowledge across disciplines. Through the problem-based learning approach, students become more flexible in diverse modes of thinking from big picture to minute detail, from considering others' ideas to generating new ideas, from responding to others' questions to generating new inquiries.

Guidelines for Using Problem-Based Learning	Additional Strategies	Digital Tools and Resources
Inquiry is a central part of problem-based learning.	<ul style="list-style-type: none"> • In a student centered, problem-based learning classroom, students are able to employ critical and creative thinking skills, and learn by doing. • Students are given ample inquiry opportunities where they pose, investigate and answer questions they have about the academic content and the ill-structured problem they are studying within it. • They are presented with ill-structured problems within content-related contexts and then often work in small collaborative groups to create and revise hypotheses, ultimately finding solutions to those problems. • Research skills are as important as learning the content in problem-based learning as both help students demonstrate the knowledge they gleaned from their research and the answers they found to their questions. The acquisition of knowledge and the application of knowledge are the central goals of problem-based learning. • Finding answers to their inquiry happens when students are able to create and store memories of the process and the outcome. Students make associations and connections with what they already know and what they learn. In order for that to happen teachers in problem-based learning environments must 	Problem-Based Learning from Stanford Project-Based Learning Steps to Problem-Based Learning Learning Through Inquiry from Kamm Solutions

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	<ul style="list-style-type: none"> ○ Provide and introduce to students new skills and techniques, ○ Provide a problem, or help students identify a problem, so that students can use those new skills and techniques to try to solve it, ○ Help students retain those new skills so that they can retrieve and use them in other experiences throughout the course. ● Students who engage in this type of learning are asked to solve open-ended, real-world problems by clarifying their inquiry, designing their plan of action, and organizing their research. For example, students might explore solutions to a problem suggested by the following questions: <ul style="list-style-type: none"> ○ How can our city best prepare for a possible natural disaster? ○ What can our school do to conserve water? ○ How can revolutions be resolved without loss of human life? ● Students work in multiple content areas and generally follow these steps in problem-based learning: <ul style="list-style-type: none"> ○ Explore the issue, gathering information. ○ Determine what is known about the issue based on the gathered information. ○ Establish their research question(s) and clearly define the issue or the specific problem. ○ Continue researching to find the answers to questions that will help formulate possible solutions. ○ Investigate possible solutions to determine which is the most viable. ○ Create and present a solution in the form of an artifact. ○ Evaluate the performance and the experience. 	

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<p>In problem-based learning, guided activities take the place of traditional instructional activities.</p>	<ul style="list-style-type: none"> • Teachers take on different roles in problem-based classrooms, where, rather than use traditional instructional activities, they lead guided activities that promote inquiry and students' curiosity. • Teachers need to play an active role in problem-based learning by outlining clear steps and expectations for the process, providing rubrics and models for what they expect students to accomplish, and coaching students' collaboration and research efforts. <ul style="list-style-type: none"> ○ Note that research shows that teachers are most successful in implemented problem-based learning when the following factors are present: <ul style="list-style-type: none"> ■ They have time to collaborate with each other. ■ They experience specific professional training in problem-based learning. ■ They have continued resources and support from their teams, department heads, administrators, and district. • There are many options for guided activities in problem-based learning, but it is important to use activities that are student-centered, where the teacher is an activator and where the students discover by asking questions, by making connections to prior knowledge, and by collaborating with each other to actively learn. 	<p>Problem-Based Learning Resources and Activities from Stanford</p>
<p>In problem-based learning, students may work individually, but often they work in collaborative groups.</p>	<ul style="list-style-type: none"> • In problem/solution-based learning students are encouraged to work in learning communities where raising questions about the content and developing new and innovative ideas are the norm. • Specifically, in problem-based learning groups, students must learn to communicate, negotiate, and collaborate, developing important skills and qualities for solving real-life problems and challenges.. • In order for collaborative groups to be successful, students must be thoughtfully 	<p>Collaboration in Project-Based Learning from Edutopia (video)</p> <p>Resource List: Collaboration in</p>

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	<p>placed in each group and the processes the group follows must be carefully designed and clear to each group member.</p> <ul style="list-style-type: none"> • High quality group processes are characterized by the following descriptors: <ul style="list-style-type: none"> ◦ <i>Positive interdependence</i> where each group member needs the others to succeed. This may be accomplished through shared learning goals, specific group roles, joint rewards, and more. ◦ <i>Individual accountability</i> requires that each member of the group be responsible for part of the group work. The contributions of each member of the group are evident and the group is evaluated collectively and individually. ◦ <i>Equal participation</i> demands that each member of the group, regardless of achievement level, has an equal share of the workload. ◦ <i>Social Skills</i> such as trust building, decision-making, negotiation, compromise and compassion are vital to the success of a group. • It is important for teachers to monitor the group processes and redirect students when they are not collaborating effectively or productively. • Students should be asked to evaluate and reflect on their experience with the group. This formative self-evaluation should not only focus on how well students met their learning goals, but also how they worked together as a group. Consider some of the following questions for the evaluation: <ul style="list-style-type: none"> ◦ How well did members of your group communicate with one another? Did everyone know what was expected during the process? ◦ How well did members of the group negotiate? How were conflicts resolved? ◦ How well did your group collaborate? Did everyone contribute? 	<p>Problem-Based Learning</p> <p>Collaboration is Key to Problem-Based Learning</p> <p>The Collaborative Curriculum from Kamm Solutions</p> <p>Collaborating with Others from Kamm Solutions</p> <p>Assessment and Formative Learning from Kamm Solutions</p>

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<p>Community collaboration is an important part of the problem-based learning model.</p>	<ul style="list-style-type: none"> Considering the fact that many of the problems or issues students will research come directly from the community in which they live, it makes sense to connect students to community-based organizations. Consider making connections with: <ul style="list-style-type: none"> Big Brother/Big Sister chapters Local charities and community service organizations City employees Libraries Arts or other cultural organizations Museums Law enforcement and court systems Connections to such organizations allow students to research local issues in real time and with real people and engage in meaningful service projects. Guest speakers from the community are also valuable resources for students. 	<p>Community Based Learning</p>
<p>In problem-based learning, the emphasis on finding a viable solution encourages students to use information in more meaningful ways and to become more deeply engaged in the learning.</p>	<ul style="list-style-type: none"> Because teachers of problem-based learning classrooms often present students with authentic cases, problems or inquiry related to the subject they are studying, students are more engaged. For example, if a student were to investigate the question “How can we ensure that our city is well prepared in the case of a natural disaster?” there is likely a great deal of information to be perused and evaluated. Students would be expected to generate several questions under the umbrella of the initial question: <ul style="list-style-type: none"> What are the potential natural disasters that threaten my city? What is the plan to respond to a disaster? Where can city residents find that plan? How is that information disseminated to the residents? Do the residents know what the plan is or where to go in case of a natural disaster? Do the residents know what to have in an emergency preparedness kit? What else needs to be done to heighten residents’ awareness? <p>In order to answer those questions students would need to employ research skills</p>	<p>A Task-based Approach for Teaching English</p> <p>Task-oriented Math Instruction</p> <p>Self-Directed Learning in Problem-Based Learning</p>

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	<p>such as searching, selecting, and evaluating resources, all of which foster greater critical thinking skills and higher levels of information literacy.</p> <ul style="list-style-type: none"> Students not only work in groups in this type of learning approach, but also find much success when they work individually or autonomously. Self-directed or autonomous learning requires that students employ self-direction, self-motivation, high-level reasoning and evaluation as they search out the solutions to their problem or inquiry. In the solution oriented learning approach, students examine authentic cases. Research shows that this type of case-based approach helps students learn more deeply than what they might glean from a lecture and retain what they learned. The teacher's role in problem/solution-based learning is to ask students probing questions that help them think more critically about the problem, and activate the group processes more efficiently. 	
<p>Information literacy is a vitally important skill in research that should be ongoing and recursive and in the problem-based learning classroom.</p>	<ul style="list-style-type: none"> Because students are expected to research their cases, inquiry, or problem, it is vitally important that they have access to a myriad of resources. Much of what students might need should be found online, which requires that students have ample and flexible access to the Internet and online databases full of articles. Likewise, students need to be able to evaluate online resources for credibility in order to find the best and most accurate information about their case. There is abundant information--and misinformation--online and students need to be able to discern the difference. Information literacy skills (coupled with collaborative, group-centered and task-oriented practices) enable students to evaluate, interpret and synthesize the information they encounter about their subject of study. Sessions in the school library with the librarian guiding a problem-based learning activity have proven to be an excellent way for students to increase their information literacy. The goal of these sessions is to provide students with opportunities to not only develop information-gathering skills, but more importantly, 	<p>Developing Research and Information Literacy</p> <p>Resources for Problem-Based Learning</p> <p>Criteria to Help You Evaluate the Credibility of Online Resources</p> <p>How to Search and Determine Credible</p>

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	<p>critical thinking skills within the context of information literacy.</p> <ul style="list-style-type: none"> ● Consider having the following activities in library sessions: <ul style="list-style-type: none"> ○ Provide an overview of the library and its resources, ○ Have students practice using the library resources by finding a general, overview article about the topic of their inquiry: <ul style="list-style-type: none"> ■ Discuss the components of an overview article. ■ Examine the information contained in an overview article that might lead to further research. ■ Explain how to use the citations in an article to find further information. ○ Ask students to search for and identify appropriate sources related to their line of inquiry, ○ Ask students to evaluate the sources they found for credibility and bias: <ul style="list-style-type: none"> ■ Identify sources that range from credible and unbiased, to credible and biased, to non-credible. ■ Evaluate specific word choice used by authors when evaluating credibility and bias (i.e. The difference between “Obamacare” vs. “The Affordable Care Act” or “undocumented citizen” vs. “illegal alien”). ■ Examine the partiality of a source, which is also an indicator of bias. If a topic is not covered objectively or thoroughly, if multiple viewpoints are not conveyed, if unsubstantiated claims are made, if the language is too intense, if the message conflicts with other credible sources, etc. then biases are likely present. 	<p>Credible vs. Non-Credible Resources</p> <p>Evaluating Sources from Purdue</p> <p>Introduction to Research from Cornell</p>

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<p>Abundant research has been conducted to study problem-based learning, and the findings have been positive and have substantiated it as an effective learning model.</p>	<ul style="list-style-type: none"> Some researchers have posed the query: If problem-based learning is simply another means to achieve the same student progress, then why is it worth the extra time, effort and resources to plan and execute it? The answer is that when it is well implemented (student-centered, authentic problems, small groups, teacher as facilitator, self-directed learning, etc.) student achievement often exceeds that of students in classrooms with traditional instructional methods. Overall, research indicates that students in PBL classrooms perform well when they are able to: <ul style="list-style-type: none"> Engage in complex, open-ended instructional activities Make choices that affect what they learn Evaluate themselves and others Reflect about their learning experiences In particular, research shows that students in problem-based learning classrooms retain what they've learned for longer periods of time. Students also tend to find the problem-based learning environment more enjoyable and more nurturing. Their attitudes toward the content and the experience are much more positive. Likewise, students tend to choose to study certain topics or concepts, not because they want to earn a good grade, but rather because they are curious about it, or they seek out the challenge of learning it, even mastering it. In other words, their intrinsic motivation in a problem based learning course is increased. Students in problem-based learning classrooms also experience an increase in their ability to self-regulate their learning. Their ability to elaborate, critically think, reflect and use metacognition, and increase their effort and attention is significantly greater than their peers in a traditional instruction scenario. Research has also found that it is critical that students in problem-based learning environments must be taught and assessed by analyzing and solving problems rather than more traditional assessment such as multiple-choice exams. In other words, the assessment should match the practice. The assessments should be authentic and novel and not only consider the 	<p>Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning</p> <p>Self-Directed Learning in Problem-Based Learning and its Relationships with Self-Regulated Learning</p> <p>Effects of Problem-Based Learning: A Meta-Analysis From the Angle of Assessment</p>

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	students' knowledge base but also their problem solving skills. Students should be able to apply their previous knowledge to the new problem. This requires that students be able to define or describe the central concepts of the content being studied and the assessments should measure that knowledge or lack thereof.	

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