

Preparing Students with Invention and Innovation

Thinking Unconventionally

The 21st century workplace demands more creative thinking and innovation than was expected of workers in the past. As noted by the Association for Supervision and Curriculum Development (ASCD) in their Education Update, "Many of the fastest-growing jobs and emerging industries rely on workers' creative capacity—the ability to think unconventionally, question the herd, imagine new scenarios, and produce astonishing work."^[1] Countless other organizations and industries throughout the country have sounded similar alarms; America's schools are not preparing students for the realities of the twenty-first century, where the ability to invent and innovate are becoming not just critical skills but basic prerequisites for sustained employment.

Top 5 Soft Skills Companies Need Most in 2020^[2]

- 1 Creativity
- 2 Persuasion
- 3 Collaboration
- 4 Adaptability
- 5 Emotional Intelligence

Despite the shift from what you know to what you can do with it, America's education system has largely remained unchanged since the turn of the 19th century. This has led to a growing gap between the skills taught to students and those in demand from today's businesses and industries. Harvard education expert Tony Wagner spoke to this disparity in an interview with *The New York Times*. In his view, today's K-12 education is not "adding the value and teaching the

skills that matter most in the marketplace...because knowledge is available on every Internet-connected device, what you know matters far less than what you can do with what you know.”^[3] This makes critical thinking, communication, and the ability to invent and innovate more important today than ever before. The rote memorization of material one can now “Google” in a matter of seconds - or even much of the well-intentioned integrated subject matter our schools offer today - are simply the skills of yesterday.

How can educators better prepare students for the changing demands of the twenty-first century?

One solution might be to teach the skills of invention and innovation directly, utilizing students’ natural curiosity through project-based learning opportunities. These opportunities allow students to tackle real problems in a hands-on, minds-on learning manner which encourages the development of twenty-first century skills. Unfortunately, many teachers don’t have the tools at their disposal to teach the process behind invention and innovation. They are all too often constrained by a formulaic approach to teaching and learning that doesn’t truly value trial and error, failing forward, and learning through discovery. Teachers today are “busy” with the work of maintaining their current classroom: meeting seat time requirements, bell schedules, and the demands of pacing guides linked to curriculum standards and high-stakes testing. It is perhaps unreasonable to expect individual classroom teachers to, on their own: build, deliver, and champion a curriculum focused on invention and innovation that prepares their students for the challenges of the twenty-first century.

There are dozens of programs available to teachers today that can help with this challenge. However, few, if any, actually provide schools, districts, and teachers with a standards-aligned, resource-rich curriculum based on real world processes. One organization we studied does precisely that. Inventionland, America’s largest invention factory, has taken over 30 years of experience as an industry leader and created a uniquely developed invention-based curriculum that leads students to develop market-ready products. Their curriculum encourages students to develop creative skills through a 9-step method which led to invention and innovation, transforming classrooms across the country and engaging students in meaningful and relevant learning.



[3] Need a Job? Invent It
(https://www.nytimes.com/2013/03/31/opinion/sunday/riedman-need-a-job-invent-it.html?_r=0)

Project-Based Learning and Immersive Environments to Improve Student Learning

Since the 1980s, there has been a push for more project-based learning in the classrooms across the county. In this approach, students learn by completing a long-term project that works to solve a real-world problem, or finds an answer to a complex question.^[4] This shifts the source of knowledge acquisition. Instead of using projects to reinforce information provided by teachers or texts, the project is itself the source of learning. Students discover the skills and knowledge through hands-on interaction and collaboration. Ultimately, this leads to deeper understanding and engagement with the material, promoting life-long learning habits that will serve the student beyond the classroom.^[5]

In looking at thousands of classrooms across the nation, one thing has become crystal clear: traditional classrooms are not conducive to hands-on learning. Rows of desks facing the teacher puts students in a passive role—a recipient of knowledge provided by the teacher. Moving desks, tables, and chairs around into groups begins to break down the traditional classroom dynamic of placing the teacher on stage and students as an audience. Teachers across the country are working to create more immersive environments and furnishings to deliver more active and engaging curriculums in classrooms where students become creators and innovators. A growing body of research supports this approach of blending immersive environments, furnishings, and constructivist learning.



A more immersive, creative environment encourages students to be active participants in their own learning, providing them the agency and space to make their own discoveries and connections. In these unique settings, students who are explicitly taught the processes of invention and innovation are consistently finding success, not just academically, but in other twenty-first century skills such as: communication, collaboration, and team work.

Creating immersive learning environments encourages this hands-on approach and is one key component of Inventionland Institute's programming. Case studies from schools that have implemented immersive environments show the benefits. One such example is Haine Elementary School in the Seneca Valley School District, which converted its library space into the Creative Innovation Research Center (CIRC) in 2017. This shared space provides students access to technology, like 3D Printers and laser cutters, that support their creative learning endeavors. The space becomes a catalyst of innovative thinking.

[4] What is PBL? <https://www.pbworks.org/what-is-pbl>

[5] Project Based Learning & Student Achievement: What Does the Research Tell Us? (Sally Kingdon, 2018)

“The buzz surrounding a unique, creative space travels and gains excitement in the same way as a snowball rolling downhill continues to grow.”

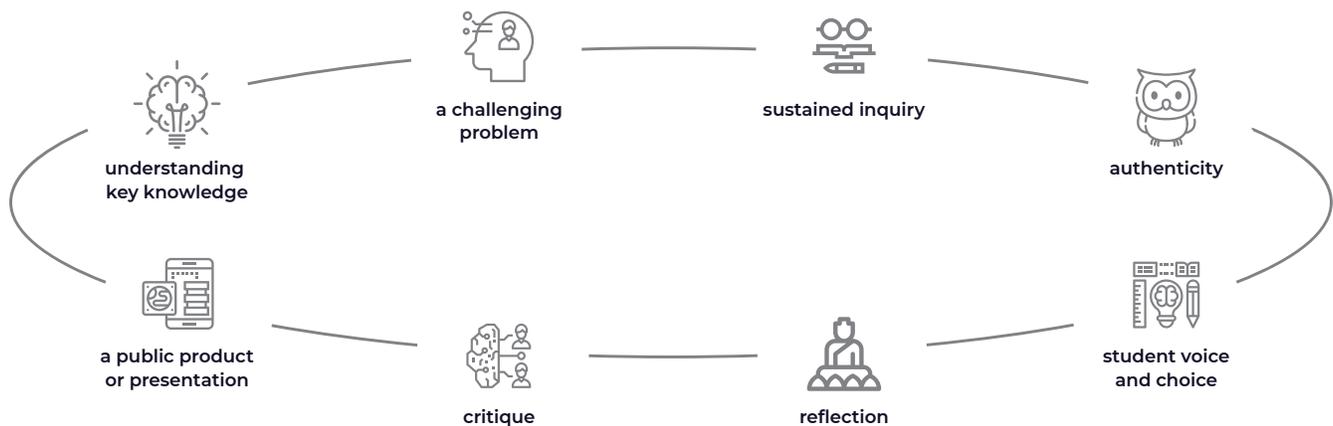
- Haine Elementary School Educator

Similar results can be observed from Leechburg High School, where students voluntarily make use of their storytelling and invention space during their study halls and free time, as well as during class to complete their projects. Learning becomes exciting and entertaining rather than a chore that has to be endured.^[6]

Best Practices for Innovative Learning

Allowing students space to engage with their environments is helpful to encourage creativity, but that alone is not enough to give them the skills needed to excel in their future careers. One potential risk of adding a maker space without guidance is that it will become more of an art class than an innovation center. Successful project-based learning doesn't just ask students to make things but to make them with a purpose: either solving a familiar problem in a new way, addressing a real-world need, or answering a with no clear current answer.

In their article *Student Outcomes from High-Quality Project-Based Learning*, Carla Evans describes eight key criteria for evaluating the quality of a project design:



The ultimate goal is a project with multiple learning outcomes and opportunities for feedback that encourages all students to participate and contribute to their level of ability.

The Inventionland Institute curriculum adheres well to these criteria. It uses a 9-step method based on established, successful practices of working inventors. Classes are broken down into groups of 3-4 students with diverse skills. Each group collaborates over the course of the semester to design a product that addresses a real-world problem or need, culminating in a product pitch presentation.

[6] Both examples taken from Inventionland Institute website (<https://inventionlandinstitute.com/innovation-labs/>)

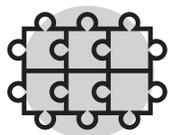
Benefits of Innovative Learning for Students



Development of deeper content knowledge. Numerous case studies contrasting project-based classrooms with traditional instruction indicate higher knowledge retention and better skill development.^[7] This especially holds true in the fields of science and social studies, though studies have indicated improvements in literacy and math as well.^[8]



Increase in engagement and attendance. Students are more engaged with learning when they have some agency and control over their project topic. This improves student attitudes toward learning, creating an environment where education is both meaningful and enjoyable. Studies of economically disadvantaged students show particularly marked improvements in attendance and engagement when they have the option of more innovative learning methods.^[9]



Development of higher-level cognitive and social skills. Success in the post-academic world requires more than raw knowledge and information. Project-based learning encourages the development of skills that are in high demand in the modern workplace, including: time management, teamwork, research, technological literacy, information synthesis, critical thinking, and creative problem solving.^[10]



Better performance on standardized tests. One common concern of administrators considering project-based learning is whether the knowledge will translate to test-based assessment. A study of 8,000 middle school students found statistically significant increases in scores on standardized tests from those who participated in project-based learning. The emphasis on the process of learning, as opposed to the final product, improves student resilience and overall academic achievement that translates to traditional knowledge assessment methods.^[11]



Accommodation of differing learning styles. Evidence suggests the most significant benefits of innovation-based classrooms are for those who struggle to learn via traditional instruction methods.^[12] Collaborative group efforts not only allow for different approaches to learning, but encourage those with diverse backgrounds and experiences to learn from each other which fosters a more inclusive educational environment.

[7] Examining the effect of teachers' adaptations of a middle school science inquiry-oriented curriculum unit on student learning (Fogelman et al., 2011)

[8] Project-Based Learning & Student Achievement: What Does the Research Tell Us? (Sally Kingston, 2018)

[9] A review of research on project-based learning. (J.W. Thomas, 2000)

[10] Student Outcomes from High-Quality Project Learning: A Case Study for PBL Works (Carla M. Evans, 2019)

[11] Project-Based Learning: A Literature Review (Barbara Condliffe, 2017)

[12] Why is Project-Based Learning Important? (<https://www.edutopia.org/project-based-learning-guide-importance>)

Benefits of Innovative Learning for Teachers

While most research focuses on benefits for students, innovative classrooms can also be transformative for the teachers and administrators who work with them. As Edutopia.org notes, “Project-based learning (PBL) is not just a way of learning; it’s a way of working together.” When students are excited to learn it generates contagious creative energy. Teachers are also encouraged to collaborate and share knowledge to improve their classroom experiences, in a similar way to how students collaborate to complete the projects. This builds relationships and breaks down the barriers that isolate teachers to classrooms and administrators to offices.

The transition to an invention-based curriculum can be a time-consuming and difficult process. Overall, however, teachers who have made this switch report the benefits are well worth the effort invested. Teachers of project-based curricula report greater workplace satisfaction and reduced feelings of burn-out. Ultimately, educators who encourage innovation find their work more enjoyable and rewarding than those locked into traditional instruction methods.^[13]



Inspire Creativity Through Invention and Innovation

Inventionland Institute's Innovation Course provides courseware that was invented to cultivate innovative thinking in every type of student in every type of school.

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