



# Using EdTech to Foster Critical Thinking and Problem-Solving Skills

Transforming Classrooms into a Hub of Critical Thinkers and Innovative Problem-Solvers





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# Empowering the Future Thinkers and Problem Solvers

Information today is ubiquitous, to the point of overload. To navigate and use this abundance of data and knowledge, students must develop higher-order thinking skills, such as critical thinking and problem-solving. These skills are essential for success both within the classroom and beyond, enabling students to make informed decisions and solve complex problems.

Educational technology (EdTech) can help teachers nurture these higher-order thinking skills in their students. By integrating digital tools and resources into the learning process, educators can create dynamic and interactive experiences that engage students in deeper learning and critical analysis.

This e-book highlights the advantages of using EdTech for critical thinking and problem-solving. It also provides examples of EdTech tools and best practices for adopting them. Educators reading this will gain practical insights into enhancing their teaching strategies and effectively preparing students for the challenges of the modern world.







# Understanding Critical Thinking and Problem-Solving

## Critical Thinking

Critical thinking is the ability to come to good conclusions or decisions and to clearly explain the reasons behind those<sup>1</sup>.

Critical thinking benefits students in many ways.

- It enhances **general decision-making**—for example, choosing what model of laptop to buy with their allowance.
- Because critical thinking is an interdependent and cross-disciplinary learning skill, it correlates positively with getting **better grades and test scores**.
- It develops **information and media literacy**, allowing students to discern biased and prejudiced thinking and representation.

<sup>1</sup> Joy Egbert, "Supporting Students' Critical Thinking," in *Methods of Education Technology: Principles, Practice, and Tools* (Montreal: Pressbooks, 2017), <https://opentext.wsu.edu/tchlrn445/chapter/chapter-4-supporting-students-critical-thinking/>.



## Problem-Solving

Problem-solving is the process of coming up with solutions to difficulties. A central component of problem-solving is inquiry or research. Through a systematic investigation—which involves identifying and contextualizing the problem, designing solving strategies, and generating and testing hypotheses—students can develop well-founded solutions<sup>2</sup>.

When taught problem-solving effectively, students gain

- **independence** as they learn to seek out information and direct their learning,
- a **deeper understanding** of concepts by engaging with the material in meaningful ways, and
- **confidence** in approaching new and complex problems and adapting to various situations.

### JOHN BRANSFORD & BARRY STEIN'S IDEAL MODEL FOR PROBLEM-SOLVING

- **I**dentify the problem.
- **D**efine the problem (through drawing or visualization).
- **E**xplore possible strategies.
- **A**ct on the strategies.
- **L**ook back and evaluate the results of your actions.

<sup>2</sup> Egbert, "Supporting Student Problem-Solving," <https://opentext.wsu.edu/tchlrn445/chapter/chapter-6-supporting-student-problem-solving/>.





# Challenges in Developing Critical Thinking and Problem-Solving Skills

Humans try to arrive at sound decisions and solutions every day. However, some are not as skilled in critical thinking and problem-solving as others.

One reason is that traditional instruction does not promote higher-order thinking. It focuses on memorizing and repeating information instead of analyzing, synthesizing, and evaluating it, which stimulates thinking<sup>3</sup>.

As a result, students fail to apply theoretical knowledge in practical situations. Because they learn *what* to think instead of *how* to think, they struggle to adapt their knowledge to problems they don't encounter in their coursework. It hampers their ability to overcome real-world challenges where solutions aren't always clear-cut.

Educational technology holds significant promise in bridging the gap between theory and practice. The integration of technology in education has the potential to transform traditional instructional methods, empowering students to develop the essential skills they need to thrive in a rapidly evolving world.


<sup>3</sup> Lisa Gueldenzoph Snyder and Mark J. Snyder, "Teaching Critical Thinking and Problem Solving Skills," *The Journal of Research in Business Education* 50, no. 2 (2008): 90, [https://dme.childrenshospital.org/wp-content/uploads/2019/02/Optional\\_-\\_Teaching-Critical-Thinking-and-Problem-Solving-Skills.pdf](https://dme.childrenshospital.org/wp-content/uploads/2019/02/Optional_-_Teaching-Critical-Thinking-and-Problem-Solving-Skills.pdf)



# Benefits of Using EdTech for Critical Thinking and Problem-Solving

## Interactive Learning

Interactive learning involves active student participation with respect to not only the teacher but also each other<sup>4</sup>. In traditional, passive learning, students typically reinforce existing knowledge through rote memorization and repetition. In contrast, interactive learning encourages dialogue and interaction, through which students build upon existing knowledge by integrating new information and concepts. EdTech creates environments that enable dynamic interactions, encouraging students to explore, experiment, and apply concepts in innovative ways.




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<sup>4</sup> Madona Giorgdze and Marine Dgebuadze, "Interactive teaching methods: challenges and perspectives," *International E-Journal of Advances in Education* 3, no. 9 (2017): 544-548, <http://ijaedu.ocerintjournals.org/en/download/article-file/390165>.



## Personalized Learning

As learning becomes interactive, the focus shifts from being teacher-centered to student-centered. This approach empowers students to take ownership of their education and caters to their individual needs, abilities, and interests<sup>4</sup>. EdTech can adapt to each student's learning pace and style, providing customized content and resources. It can also analyze student performance, offering personalized feedback and targeted interventions so that each learner receives the support they need to succeed.

A group of diverse students, including a young boy in a plaid shirt and a girl in a grey tank top, are looking at a screen. Other students are visible in the background.

Collaboration provides students with mentorship and a sense of community, supporting their learning and development outside the classroom.



## Collaborative Platforms

Working in groups is another characteristic of interactive learning. Collaboration allows students to bounce ideas off one another, broadening their perspectives. Furthermore, it provides students with mentorship and a sense of community, supporting their learning and development outside the classroom<sup>5</sup>. EdTech tools enable students to work together seamlessly, regardless of their physical location. These platforms streamline communication and provide various resources and functionalities that enhance group projects and collaborative learning experiences.

<sup>5</sup> Melissa Mallon and Suzanne Bernsten, "Collaborative Learning Technologies," *Tips and Trends* (Winter 2015), <https://acrl.ala.org/IS/wp-content/uploads/2014/05/winter2015.pdf>.



## Gamified Learning

Gamification is the use of game elements like points, badges, leaderboards, and time constraints in non-game contexts. Its positive effects on education include making learning rewarding in itself (intrinsic motivation), fostering student engagement, and boosting knowledge retention<sup>6</sup>. Modern education technology integrates game elements seamlessly into curricula. These tools track progress and create personalized challenges, making it easier for educators to implement gamified strategies effectively.

<sup>6</sup> Lisa-Maria Putz and Horst Treiblmaier, "Increasing Knowledge Retention Through Gamified Workshops: Findings from a Longitudinal Study and Identification of Moderating Variables," (paper presented at the 52nd Hawaii International Conference on System Sciences, Maui, Hawaii, January 2019), <https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/ba9fd7c6-3085-47eb-aabe-147f306b160e/content>.

<sup>7</sup> Christo Dichev, Darina Dicheva, Galia Angelova, and Gennady Agre, "From Gamification to Gameful Design and Gameful Experience in Learning," *Cybernetics and Information Technologies* 14, no. 4 (2014): 80-100, <https://www.wssu.edu/profiles/dichevc/cit-2014-dichev.pdf>.

## Real-Time Feedback

Feedback is crucial in learning. Teachers can improve feedback mechanisms using gamified EdTech tools. They provide almost instant feedback. Also, feedback in a game setting is informative—it explains on the spot why a response is right or wrong, preventing error repetition and reinforcing learning<sup>7</sup>. In contrast, traditional grading systems are summative assessments—they come at the end of a grading period and provide little to no information on where and how students can improve.





# Examples of EdTech Tools Promoting Critical Thinking and Problem-Solving

## Virtual Labs and Interactive Simulations in Science Education

Science education includes laboratory activities because they give students the chance to see scientific laws and theories in action. However, not all schools can afford to build laboratories. Keeping students out of harm while performing experiments is also a concern.

Providing interactive simulations of real objects, virtual laboratories allow students to experiment in a safer and more cost-effective environment. Students also receive instant feedback in a virtual laboratory and can redo experiments multiple times until they understand the concept.

A meta-analysis of 15 studies showed that virtual laboratories have a positive effect on science education to a medium degree. They are particularly impactful when implemented at the secondary level and in the subject areas of chemistry and physics<sup>8</sup>.

<sup>8</sup> Marc Lancer Santos and Maricar Prudente, "Effectiveness of Virtual Laboratories in Science Education: A Meta-analysis," *International Journal of Information and Education Technology* 12, no. 2 (2022): 150-156, <https://www.ijiet.org/vol12/1598-IJiet-3079.pdf>.



Discover the transformative power of virtual science labs with the help of S3 Technologies. When faced with the challenge of utilizing a grant for STEAM (science, technology, engineering, art, math) initiatives, South Side Academy in Youngstown, Ohio, turned to us and found a partner who was as committed to their success as they were.

R

Russell Brown

1 review

★★★★★

a week ago

NEW

I was presented with a Grant for our school that needed to be used in the fields of STEAM(Science, Technology, Engineering, Art, Math). Reaching out to S3 Technologies turned out to be the best decision I could have made. The Educational Technology Coach, Kati Reolfi and her team helped us out every step of our journey. Someone was always available to answer any questions I had and really took the time to explain the whole process. From the purchase of our Merge Cubes, our VR headsets, and our entire room of Video Production Equipment. The S3 technology team spent time working with our students and staff to make sure they understood every piece of equipment. This partnership has enabled our students an entire new way to learn and has helped our school to be the leading STEAM Academy in our community.

- Russ Brown - Marketing Specialist - South Side Academy, Youngstown, OH

👍

Like





## Coding Platforms and Programming Challenges for Logical Problem-Solving

Teaching computer programming in K-12 is beneficial not only because of the high demand for computer programming jobs but also because it enhances problem-solving. Coding platforms such as Code.org offer interactive environments where students can practice coding in a structured yet flexible manner. They provide a range of problems that require students to apply logic, think critically, and develop algorithms to find solutions.

A quasi-experimental study investigated the effects of Scratch, a free visual programming language developed by the Massachusetts Institute of Technology, on sixth-grade Taiwanese students' problem-solving and reasoning skills. It found that the students who used Scratch showed significant improvements in problem-solving skills compared to those who used Adobe Flash<sup>9</sup>.

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<sup>9</sup> Ah-Fur Lai and Shu-Ming Yang, "The Learning Effect of Visualized Programming Learning on 6th Graders' Problem Solving and Logical Reasoning Abilities," (paper presented at the 2011 International Conference on Electrical and Control Engineering, Yichang, China, September 2011), 6940–6944.





## Online Debate and Discussion Forums for Honing Argumentative Skills

Students need to be adept at arguing since it helps them reach logical conclusions on a wide range of topics, such as climate change, technology ethics, and healthcare access, preparing them to participate in the shaping of society's future. Though helpful, classroom discussions have time limits. Also, a few vocal students tend to dominate them, and learners who are more reserved may not feel comfortable sharing their perspectives<sup>10</sup>.

Online discussion forums address these challenges by allowing for asynchronous participation, which accommodates students' diverse schedules and encourages thoughtful reflection before responding. A case study involving Malaysian undergraduate students delved into using an online discussion forum to learn English and develop other 21st century skills. The participants perceived the tool as beneficial in enhancing the continuity of their arguments and giving them diverse perspectives that enriched their own arguments<sup>11</sup>.

Though helpful, classroom discussions have time limits, and a few vocal students tend to dominate them. Online discussion forums address these challenges by allowing for asynchronous participation and encouraging thoughtful reflection before responding.

<sup>10</sup> Whitney G. Blankenship, "Talking It Out: Online Discussion Forums in the Social Studies Classroom," *Social Studies Research and Practice* 11, no. 1 (2016): 136-157, <https://www.emerald.com/insight/content/doi/10.1108/SSRP-01-2016-B0009/full/html>.

<sup>11</sup> Mazura Jamali and Pramela Krish, "Fostering 21st Century Skills Using an Online Discussion Forum in an English for Specific Purpose Course," *Malaysian Journal of Learning and Instruction* 18, no. 1 (2021): 219-240, <https://files.eric.ed.gov/fulltext/EJ1290229.pdf>.



## Augmented Reality Apps for Immersive Historical and Cultural Experiences

Augmented reality, which enhances the real world with computer-generated elements, has seen a variety of applications, including history and culture education. A review of 35 studies showed that using augmented reality to learn history resulted in higher test scores, heightened emotional understanding of the topic, longer information retention, and more autonomy in learning<sup>12</sup>.

<sup>12</sup> Jennifer Challenor and Minhua Ma, "A Review of Augmented Reality Applications for History Education and Heritage Visualisation," *Multimodal Technologies and Interaction* 3, no. 2 (2019): 39, <https://pdfs.semanticscholar.org/1d26/c8efd5e36a7632be509226eaf110cbd02ae3.pdf>.



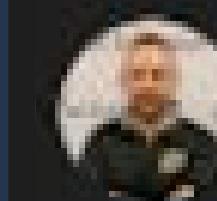


# Best Practices for Educators

## Training Teachers to Utilize EdTech Tools Effectively

Effective integration of education technology begins with comprehensive teacher training. Educators need to be well-versed in the latest tools and platforms, understanding their functionalities and potential benefits to enhance student engagement and learning outcomes.

Elevate your teachers' EdTech proficiency with S3 Technologies' exceptional training support. Our free TechU workshops are designed to be more than just learning sessions—they are dynamic discussions that spark creativity and collaboration.



**Alex Oris**

1 review

★★★★★ a year ago

As a technology integration specialist, I'm always looking for new and interesting ideas to bring back to my staff. S3 technologies hosts free TechU workshops that have been fantastic round table discussions. Not only have I learned so much, but I've established some great relationships there.



1



# Encouraging a Growth Mindset Among Students

Teaching students to view challenges and failures as opportunities for growth fosters resilience and a growth mindset. By normalizing setbacks as part of the learning process, educators help students persist in developing higher-order thinking skills.

# Balancing EdTech Use with Traditional Teaching Methods

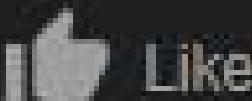
While EdTech offers many benefits, it should complement rather than replace traditional teaching methods. The Technology Integration Matrix (TIM) provides a framework for using education technology to make learning more student-centered and focused on higher-order thinking than is possible with traditional instruction. By using the TIM model, educators can strategically integrate technology to enhance traditional instructional approaches, ensuring a balanced and comprehensive educational experience.



**Corrine Mack**  
3 reviews

★★★★★ 2 weeks ago **NEW**

Amazing company! Tricia's resources, ideas and leadership have changed the trajectory of my career and the learning of many students in the area. Their knowledge of Technology and school integration is second to none. Looking forward to working with you again in August!



Like

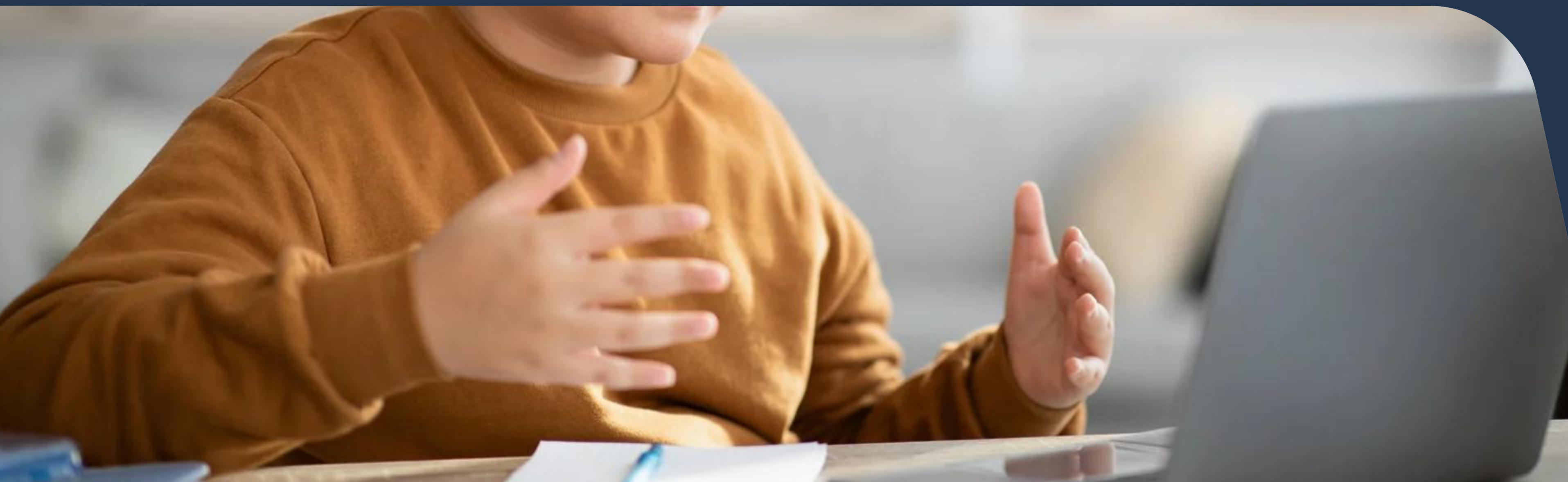




## Continuous Assessment and Adaptation of EdTech Tools

Regularly solicit and incorporate student feedback to ensure that EdTech tools meet learners' needs. Continuous assessment allows educators to make necessary adjustments, optimizing the technology's impact on student engagement, comprehension, and overall academic performance.

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## Takeaway

Critical thinking abilities and skills are essential for students to be successful innovators and lifelong learners. EdTech for critical thinking and problem-solving can help build these skills by making learning interactive, personalized, collaborative, fun, and constructive.

We at S3 Technologies are a unique blend of educators and tech experts. We deliver and support comprehensive educational technology solutions, tailor-made to meet your school's unique needs. We specialize in professional development, security, door access control, digital signs, audiovisual, networking, and emerging tech. With a deep understanding of EdTech benefits, we help schools enhance their existing tech to boost student engagement, creativity, and limitless learning.

Call (330) 648-5408 today to discover how we can help transform your school.





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