

Enhancing Engagement in Science among Diverse Learners

Every day, teachers across the United States enter science classrooms where students represent a rich tapestry of languages, learning abilities, and academic backgrounds. Some students eagerly raise their hands, while others sit quietly, wondering whether they belong in science discussions.

Each learner brings unique strengths and faces distinct challenges in accessing science content. Teachers strive to create engaging experiences that inspire every learner, meet their diverse needs, and ensure full class participation and equitable engagement in science activities.

When science instruction relies primarily on a single delivery modality, such as verbal and written communication, it creates barriers for students. For example, when students cannot demonstrate their prior knowledge, teachers miss opportunities to recognize and build upon students' diverse strengths and points of view. What if new pathways were opened to showcase knowledge and thinking that traditional approaches might lack? In addition to verbal and written communication, students could demonstrate their understanding of science concepts through hands-on creation and collaborative problem-solving.

Hands-on science learning promotes engagement and learning for all students by offering opportunities for multimodal instruction, encouraging student choice and autonomy, and providing a variety of ways for students to decode new information and connect prior knowledge to new learning.

Testing a New Approach: Standards-aligned Science Lessons with Joyful, Hands-on Learning

Recognizing these challenges, we at LEGO® Education wondered: what would happen to inclusivity and engagement if science class had joyful, hands-on experiences that connected students to standards-aligned learning in new ways? Was it possible to engage the whole classroom and leverage the impact of learning through play to unlock 'aha' moments for every student?

The answer may lie in reimagining science education through inquiry-based, hands-on, collaborative approaches that meet students where they are. A recent study exploring the implementation of LEGO® Education Science in diverse classrooms across the US provides compelling insights.

LEGO Education Science offers students in grades K–8 a robust approach to learning designed to address these challenges through student-led, hands-on, inquiry-based experiences. This program aligns with state standards to cover four domains of science, including Physical Science, Life Science, Earth and Space Science, and Engineering Design.

At the heart of our approach lies the learning through play methodology.¹ LEGO Education champions this research-backed pedagogy. When students [learn through play](#), they experience joyful, interactive experiences that develop not only academic knowledge and skills, but also creativity, collaboration, and problem-solving skills that help them grow and thrive. This approach ensures learning is:

- **Joyful:** The joy of discovery increases dopamine that makes the learning process feel enjoyable.
- **Meaningful:** By linking new experiences to prior knowledge, students expand their grasp of the world and build new connections in the brain.
- **Actively engaging:** When children take charge of their learning, they develop executive control skills like focusing, planning, remembering instructions, and prioritizing tasks.
- **Iterative:** Adapting and improving creations helps students develop flexible, innovative thinking.
- **Socially interactive:** Building collaborative relationships helps improve students' mental health and teaches them how to collaborate and build empathy.

In addition to learning through play, these three frameworks inform the design of LEGO Education Science:

- **Constructivism and constructionism:** Knowledge is constructed through hands-on activities and meaningful creation of physical models with peer interaction and teacher guidance.
- **Guided inquiry with the 5E model:** Scientific phenomena investigations follow the Engage, Explore, Explain, Elaborate, and Evaluate instructional model to build understanding gradually.
- **Universal Design for Learning:** Lessons are created to include multiple modes of representation, engagement, and expression that support accessibility and flexibility for all students.

The LEGO Education Science program integrates playful learning into 120 standards-aligned lessons, supported by an online teacher portal with ready-to-use teaching resources and hands-on materials including LEGO® bricks and wireless hardware. The program offers structured collaborative learning experiences in which students work in groups of four with defined roles, driving collaboration, communication, and engagement.

During the development of LEGO Education Science, it was incredibly important to ensure teachers found the program intuitive and supportive. We tested LEGO Education Science in K–8 science classrooms across the United States. The aim was to explore teacher perspectives on program quality, impact on teaching confidence, ease of preparation, and integration into existing science curricula, and the results were telling.

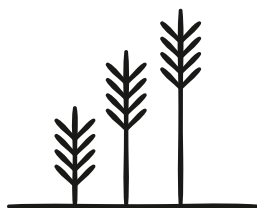


Key Results: LEGO Education Science Engages Every Learner

- **Enhanced engagement:** 100% of teachers rated student engagement as significantly higher with LEGO Education Science than during regular science lessons.²
- **Increased critical thinking:** 8 out of 9 teachers reported in their lesson evaluations and interviews that they observed “much more” or “extremely more” student critical thinking with LEGO Education Science lessons compared to typical science lessons.
- **Heightened creativity:** On a five-point scale, 100% of teachers observed “much more” or “extremely more” instances of student creativity while experiencing LEGO Education Science than in regular science instruction.
- **Support for diverse learners:** Teachers indicated in 93% of lesson evaluations that the lessons met “most” to “almost all or all” needs of students with diverse learning profiles in their classrooms.

The Case Study

LEGO Education research partners conducted a case study to evaluate the impact of LEGO Education Science in real-world contexts.³ Teachers implemented the program in diverse classrooms across three states. Using the assessment tools indicated in the Case Study Snapshot to the right, the study examined teacher’s perceptions of the usability and feasibility of using LEGO Education Science in their classrooms, its influence on student learning outcomes, and its capacity to meet students’ diverse learning needs..



Case Study Snapshot

- **Timeframe:** Spring 2025 (2.5 months)
- **Districts:**
 - Compton Unified School District, CA
 - Irving Independent School District, TX
 - Northeastern School District, PA
- **School profiles:** Title 1 schools with large populations of multilingual learners, students receiving special education services⁴, and those eligible for free or reduced-price lunch
- **Participants:**
 - 9 teachers with varied experience
 - » 3 -31 years of science teaching experience
 - » 5 generalists; 4 departmentalized
 - 201 students
 - » 64 in grades 1–2,
 - » 64 in grades 3–4, and
 - » 73 in grades 6–7
- **Data collection methods:**
 - At the beginning and end of the study:
 - » Teachers completed the T-STEM Science Scale assessing science teaching self-confidence.
 - After each lesson:
 - » Teachers completed post lesson evaluations of lesson usability, effectiveness, and modifications made using 5-point rating scales.
 - At the end of the study:
 - » Teachers completed a survey assessing their overall perceptions of LEGO Education Science and how it compared to traditional science lessons using 5-point rating scales and multiple-choice questions.
 - » Teachers also participated in interviews exploring their teaching experiences with LEGO Education Science.

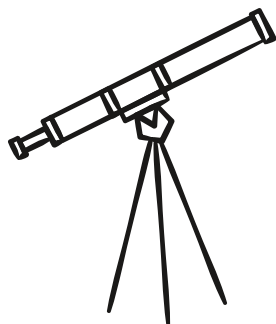
Research Findings: Inclusive, Collaborative Science Learning Experiences

The case study results paint an optimistic picture of learners who are confident and highly engaged in science learning when experiencing LEGO Education Science lessons. Elizabeth Wolff (Grade 2 teacher, PA) observed student behaviors that indicate how LEGO Education Science could transform the way students engage in science classrooms. She shared that typically quiet students became more vocal and assertive during the lessons saying, “They were able to stand up and say, ‘This is what I think we should do, and here’s why.’”

Throughout the case study, teachers observed similar transformative moments as students who typically struggle in traditional science lessons became engaged problem-solvers and creative thinkers.

Teachers also reported that LEGO Education Science lessons—particularly during the Elaborate section of the lesson and subsequent reflection—prompted students to test ideas, refine designs, and articulate their reasoning. In the post-study survey, 89% of respondents rated critical thinking as much higher than in regular science lessons, and interview data echoed these findings, describing “aha” moments and persistent, self-directed problem-solving.

Additionally, teachers consistently observed high levels of originality and ownership in student work. On the post-study survey, creativity received the highest comparative rating. Lesson evaluations and interviews reinforced this impression, describing how students routinely personalized and extended their builds—demonstrating imaginative thinking and functional design.



The visual and tactile nature of the lessons reduced language barriers and allowed students to demonstrate understanding in nonverbal ways and the structured roles and collaborative format ensured active participation.

“All hands were busy. All hands were on deck. Everybody had a role.”

—Elizabeth Wolff
Grade 2 teacher in Pennsylvania

Consistently High Student Engagement Across All Grades

Perhaps most encouraging was how student engagement consistently exceeded that of regular science lessons, across all grade levels, with particularly strong results in grades 1–4. The hands-on, inquiry-driven format encouraged broad participation and sustained interest, especially among students typically less engaged in science class.



Hands-on experiences provided students with opportunities to develop and share their creative ideas.

“One group showcased creativity by constructing their own light [structures] using LEGO® pieces. During our closing discussion, several students shared that they enjoyed collaborating, exchanging ideas, and problem-solving together.”

—Courtney Miller
Grade 4 teacher in Pennsylvania

Students were eager to participate, including those who typically struggle with academic tasks.

“There wasn’t a single person who sat back and said, ‘I don’t want to do this.’”

—Margaret McCullar
Grade 2 teacher in Texas

Increased Critical and Creative Thinking

Teachers reported in their interviews that the lessons’ open-ended design encouraged students to:

- Test, refine, and justify their design choices during Elaboration phases.
- Reason through challenges with meaningful “aha” moments.
- Take ownership of their learning through personalized, self-directed problem-solving.

Creativity also proved to be a standout feature across all grades. Teachers consistently observed high levels of originality in student work, with creativity receiving the highest ratings from 100% of teachers on post-study surveys. Student groups routinely iterated on their builds to develop unique solutions, distinguished between decorative and functional design choices, and showed increased risk-taking during problem-solving.

Accessible and Adaptable Sciences Lessons

The design of the LEGO Education Science program prioritizes accessibility and adaptability, allowing teachers to easily modify lessons to be more accessible to all students while maintaining learning objectives. The adaptability of the plug-and-play curriculum provided flexible options for supporting diverse student populations.

In surveys, teachers consistently assigned a high rating to the inclusivity and adaptability of the program:

- 93% of teachers' lesson evaluations rated the program as "very" or "extremely" effective in meeting diverse learner needs.
- Teachers rated developmental appropriateness highly across all grades (96% gave the highest ratings), with particularly strong results in grades 1–2.
- Teachers adapted one-third of lessons to accommodate student needs, rating these adaptations as "easy to implement" in 89% of evaluations.

When asked to provide specific examples of inclusivity in action during interviews, teachers described how the hands-on, visual design of LEGO Education Science transformed participation patterns. They reported particular success with multilingual learners, students utilizing individualized education plans, and those typically less confident in science.

Teachers observed that the lessons encouraged student voice and agency, often transforming quieter students into active contributors. For students with reading difficulties, the program provided alternative pathways to demonstrate understanding. Teachers praised the visual, tactile nature of the materials, which reduced language barriers and enabled students to participate meaningfully. Structured group roles and peer support strategies fostered confidence, collaboration, and a sense of success. Margaret McCullar (Grade 2 teacher, TX), said her students "were able to express what they learned, and that made them feel so successful."

The hands-on tasks removed language barriers that language learners often face, empowering them to show their knowledge through building and demonstration rather than written or verbal explanation alone.



The hands-on format supported participation from students with language barriers or diverse learning needs.

"It was awesome to see students [who] do not know the language be able to participate with their peers."

—Amber Holloway
Grade 7 teacher in California

Implementation Considerations

The few challenges teachers reported related to implementation were primarily pedagogical: managing time, addressing knowledge gaps, and supporting concept transfer.

While most teachers delivered each lesson using only the provided resources, others chose to adapt lessons in some way. In a post-study survey, 100% of teachers rated the teaching resources as “very” or “extremely” sufficient for implementing LEGO Education Science lessons. Still, in 33% of post-lesson evaluations, teachers reported making modifications to the lesson. Teachers who chose to adapt lessons did so to incorporate supplemental resources and extensions.

Additionally, while two-thirds of teachers were able to complete the lessons in the 45–60-minute blocks, some teachers chose to extend the lessons. In post-study interviews, these teachers attributed their longer lesson times to a variety of reasons including opportunities for strong cross-curricular extensions, and students being so deeply engaged in the lesson that teachers did not want to interrupt the learning.

Conclusions and Implications

All teachers who participated in the case study noted they were extremely likely to recommend LEGO Education Science to another teacher. Their enthusiasm centered on the science program’s strong fit with instructional goals and its ability to engage and support diverse learners.

Teachers consistently described the program as engaging, inclusive, and impactful for diverse learners, teacher-friendly, and a valuable supplemental resource. Elizabeth Wolff (Grade 2 teacher, PA) captured the transformation well: “It flips the classroom to the way it should be—the student doing the bulk of the work.” When students have opportunities to create and collaborate, remarkable things happen.

This case study demonstrates that hands-on, inclusive science education can transform both student engagement and learning outcomes in science. For educators seeking to move beyond traditional science instruction while supporting all learners, LEGO Education Science offers a research-backed pathway forward—one built on the simple yet powerful idea that every student can actively participate and succeed in science.



LEGO Education Science helped all students understand real-life science phenomena by providing joyful, authentic learning experiences that feel like play.

“That’s the best part of learning—when you don’t know you’re learning.”

—Amber Holloway
Grade 7 teacher in California



1. "Learning through play: what the science says." The LEGO Foundation, 2025. <https://learningthroughplay.com/explore-the-research/the-scientific-case-for-learning-through-play> (accessed 3 September 2025).

2. In a post-study survey, teachers rated the extent to which LES had a greater impact on key learning outcomes compared to their typical science lessons on a 5-point scale: 1 – Not at all, 2 – A little more, 3 – Somewhat more, 4 – Much more, and 5 – Extremely more. To gauge the strength of satisfaction or support, the percentage of teachers who selected 4 or 5 to showcase proportion of sample who had strongest positive perceptions were calculated.

3. The information presented here is part of a larger case study that evaluates the effectiveness of LEGO Education Science in diverse K–8 classrooms across the United States. This study focused on evaluating the extent that LEGO Education Science provided access to quality science learning for all, a program that is flexible and intuitive to implement, the extent of students understanding of science concepts, and the level of student engagement and collaboration.

4. "Office of Special Education Programs (OSEP)." U.S. Department of Education. U.S. Department of Education, October 24, 2024. <https://www.ed.gov/about/ed-offices/osers/osep> (accessed 3 September 2025).