el Gizmos

New Study Provides Promising Evidence under Every Student Succeeds Act (ESSA) that Gizmos Supports Science Achievement

STUDY AT A GLANCE

Study Sample:
- Large, urban U.S. school district
- 2022-2023 school year
- Sample included nearly 1,200 8th-grade students across 23 schools
- District student minority enrollment ~70%; ~25% of family income below poverty level

Research Methodology:
- Schools categorized as higher Gizmos usage (n = 12) and lower Gizmos usage (n = 11) based on percentages of enrolled students using Gizmos
- Outcome measure was the percentage of students scoring proficient or advanced on state-wide science assessment
- Correlational analyses that meet ESSA Promising Evidence (Tier 3)

Main Findings:
- Students attending schools with higher Gizmos usage had higher rates of students achieving or exceeding proficiency on science assessment
- No difference in student Socioeconomic Status (SES) between higher and lower Gizmos usage schools

Gizmos online simulations bring the power of inquiry-based learning to teachers and students in grades 3–12. With a library of more than 500 Gizmos, teachers can supplement and enhance students' learning experiences with interactive visualizations of math and science concepts that are tough to teach and tough to understand. Gizmos' approach to learning has been validated by extensive research as a highly effective way to build conceptual understanding (Cholmsky, 2003). Many states adopted NGSS-aligned standards, or utilize assessments that focus heavily on Nature of Science, which call for students to think and work like scientists and engineers — asking questions and learning through investigation and discovery. Gizmos and STEM Cases provide opportunities for students to practice the nature of science by engaging in the practices of scientists, improving their skills and adequately preparing them for these assessments. **The current study looked at whether the usage of Gizmos helped students develop the content and skills that are evaluated in statewide science proficiency assessments.**

Methods

This correlational (ESSA Tier 3) study was conducted by comparing school-level data on the frequency of Gizmos usage and performance on a standards-based state assessment for 8th grade school students in a large, urban district with high levels of ethnic and SES diversity. The sample consisted of nearly 1,200 8th-grade students across 23 schools.

Gizmos usage was defined as "high" or "low" based on a median split of the schools comparing the proportion of students in a school using Gizmos.[1] The number of different Gizmos used and the average views per student within a school were also used as an estimate of the depth and breadth of Gizmos usage both within and across a variety of science content topics.
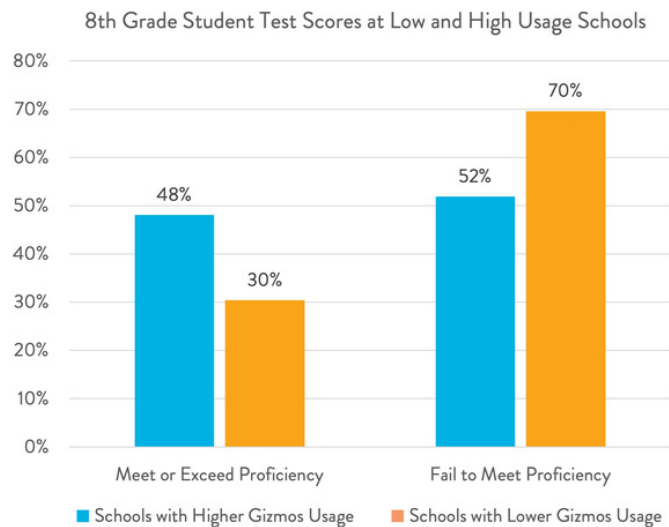
Science performance was measured by scores on the state assessment, a standards-based test that assesses both content and skills. Spring 2023 test scores were retrieved from publicly available data. The metric used was the percentage of Grade 8 students at a school who met or exceeded proficiency standards.

Results

> ## Grade 8 students at schools with higher Gizmos usage were more likely to meet or exceed proficiency standards on a state science assessment compared to schools with lower Gizmos usage

Gizmos usage was significantly related to passing rates. Students at schools with higher Gizmos usage were significantly more likely to meet or exceed standards (proficient + advanced categories) compared to students at schools with lower Gizmos usage.[2] Importantly, Gizmos usage was determined to be unrelated to the variable most commonly correlated with test scores: SES.[3]

> 8th-grade students at schools with higher Gizmos usage were 1.6x more likely to meet or exceed test proficiency standards compared to students at schools with lower Gizmos usage

8th Grade Student Test Scores at Low and High Usage Schools

	Meet or Exceed Proficiency	Fail to Meet Proficiency
Schools with Higher Gizmos Usage	48%	52%
Schools with Lower Gizmos Usage	30%	70%

> ## A dose-response relationship was found: the more widely and frequently Gizmos were used across a school, the more students met or exceeded 8th grade science standards

Additionally, the amount of usage was related to outcomes, with more usage being significantly related to higher achievement. Correlational analyses found that higher numbers of different Gizmos used at a school significantly related to a higher proportion of students meeting or exceeding proficiency standards.[4] Additionally, a greater average number of Gizmos views per student was significantly correlated to a higher proportion of students meeting or exceeding proficiency standards.[5] This dosage response provides greater confidence that Gizmos usage specifically is related to increased science performance.

Conclusions

The current study analyzed the relationship between the use of ExploreLearning Gizmos and students' demonstration of science proficiency via a statewide end-of-year assessment. This study took place within a large, urban public school district in the US with high levels of diversity and a large number of economically disadvantaged families. The results show that increased usage of Gizmos was significantly related to improved student achievement; schools with higher usage of Gizmos had significantly more students meeting or exceeding science achievement standards compared to schools with lower usage, independent of differences in socioeconomic status. Additionally, differences in usage patterns, namely the breadth of usage across topics and the frequency of usage for students, were correlated with meeting or exceeding proficiency, further supporting the conclusion that improvements in achievement are related to product usage specifically. These analyses meet ESSA Tier 3 criteria for Promising Evidence of Gizmos for helping improve proficiency on NGSS-aligned or Nature of Science skills based standardized assessments.

The current findings can help administrators and teachers understand the potential of educational technology to serve as a useful tool for providing all students with relevant experiences and practice needed to succeed in skills-based, NGSS-aligned science assessments.

"In the Gizmo for Plate Tectonics, you can drag the continents around... You're not going to get that out of a book or lab."
-Middle School Teacher

"[The students] were engaged and active. It wasn't like they were just watching something happen... Everybody was doing what they were supposed to be doing almost the whole time."
-Middle School Teacher

"50% of the [state assessment] is Nature of Science questions. It's reading charts and graphs...the Gizmo takes them through that chart...So you come up with an understanding of the graphing...And that's something I always point out. 'If you're looking at this graph, graphs tell a story, what does this [graph] tell about?'...That's something that really correlates with the [state test]"
-Middle School Teacher

Technical Notes

1. Median splits were conducted separately for different school types (K-8, 6-8, 6-12) to account for differences in usage patterns. At lower-usage schools, 31% of enrolled students were active users, compared to 62% of enrolled students at higher-usage schools. Lower-usage schools used an average of 21 different Gizmos, compared to 52 different Gizmos at higher-usage schools. Independent samples t-tests found that both of these differences were significant (both p's < .01).

2. 2x2 chi-square was conducted to analyze the rates of 8th-grade students reaching or exceeding proficiency compared to those failing to meet proficiency across each usage group (higher usage/lower usage). Students in the higher usage group were significantly more likely to meet or exceed proficiency (50%) compared to students in the lower usage group (30%), $p < .001$.

3. An independent samples t-test was conducted looking at the difference in the average percent of students who were categorized as economically disadvantaged across the lower usage schools compared to the higher usage schools and was not significant, $p = .187$.

4. A one-tailed Pearson correlation found a significant, positive correlation between the percentage of students meeting or exceeding proficiency standards at a school and the number of distinct Gizmos used by that school, r(23) = .554, p = .003.

5. A one-tailed Pearson correlation found a significant, positive correlation between the percentage of students meeting or exceeding proficiency standards at a school and the number of Gizmos views per student, r(23) = .347, p = .05.