

Science4Us Logic Model

INTRODUCTION

Science4Us is a blended-learning solution designed to provide K-2nd grade students with a solid foundation in fundamental science concepts. *Science4Us* includes more than 350 online activities and 1,000 offline, hands-on activities. The content is organized into 28 instructional modules. Each module, or unit, includes approximately two weeks' worth of teaching material for four daily lessons/week that can be implemented in less than 30 minutes a day, covering a total of three years' worth of science activities, lessons, games, and videos. The modules fall into one of four science disciplines (inquiry, physical science, life science, earth and space science), support the 5E Model, and are aligned to NGSS standards. K-2 educators have the flexibility to assign specific activities to meet the varying needs of all students as well as track data on student usage and progress.

The current paper has the following objectives:

1. Define the logic model and foundational research base for the design of the *Science4Us* product
2. Outline plans for additional research on *Science4Us*

Together, these objectives satisfy the *Demonstrating a Rationale (Tier 4)* level of evidence for the effectiveness of an educational program as described by the Every Student Succeeds Act (ESSA).

PREVIOUS RESEARCH

Early elementary curriculum is often focused heavily on math and literacy, leaving considerably less time for science instruction. In fact, instructional time for science in the elementary grades decreased from 1990 to 2010 (Blank, 2012). This decreased instructional time is also correlated with lower science achievement scores (Blank, 2012). Early deficits in science achievement appear to persist; one longitudinal study conducted with almost 8,000 children found that science achievement gaps in kindergarten and first grade reliably predict children's science achievement as late as eighth grade (Morgan et al., 2016). Given that fewer than 1 in 4 high school seniors and around a third of 8th graders performed proficiently in science in 2019 (U.S. Department of Education, 2019), early science instruction is a potential solution to a national educational concern.

Additional challenges to high-quality early science instruction include a lack of support. Since accountability standards are usually focused on math and ELA, there are fewer resources available for science instruction. Additionally, teachers themselves are under-prepared; one survey found that only about a third of teachers feel very prepared to teach elementary science and only one-quarter feel very prepared to use inquiry teaching strategies (Dorph et al., 2011).

Science4Us aims to improve science instruction by providing K-2 teachers with embedded, aligned, and on-demand professional development (PD) that increases their capacity to address

misconceptions and prior knowledge, deepen their science content knowledge, and provide them with sound pedagogy for science instruction. The program also aims to support student outcomes in science with interactive and innovative hybrid learning experiences that provide opportunities to control their own learning, communicate and challenge ideas and claims, and revise their ideas.

LOGIC MODEL

A logic model illustrates the underlying logic of the program. It is a road map that visually illustrates the resources available to support the program (*inputs*), the action components of the program (*activities*), the products of those activities (*outputs*), and the short- and long-term changes that come out of successful implementation (*outcomes*). The *Science4Us* logic model will also serve as the foundation for additional “promising,” “moderate,” or “strong” evidence for the effectiveness of the program.

Inputs	Activities	Outputs	Outcomes		
			Short-Term	Intermediate	Long-Term
28 modules of online and offline materials for K-2 that cover inquiry, physical science, life science, earth and space science Teacher Dashboard for student reporting School-level admin dashboard Professional Development (PD) training (live and on-demand) Teacher Virtual Learning Communities SSO integration Internet-enabled devices (<i>school provided</i>)	Program Features: -Students complete individual activities assigned by their teacher -Students use a digital notebook to record their ideas -Student completed a summative assessment in the “evaluate” activity at the end of each module -Students receive feedback on correct and incorrect answers Program Implementation: -Students participate in offline activities as led by teacher -Teachers use teacher guide with questions that support students reasoning -Teachers monitor student progress on dashboard -Teachers provide standards-aligned supplementary instruction to students	Student Usage: -Number of times logged into Science4Us -Amount of time spent in Science4Us -Number of activities opened -Number of activities completed -Student notebook activities saved Student Accuracy: -Number of summative questions correct (“evaluate” section of the module) Teacher Engagement: -Number of teacher logins to Science4Us -Amount of teacher time spent in Science4Us -Number of views of supplementary resources -Professional Development attended	Demonstrate mastery of the learning objectives for the specific Science4Us module used Demonstrate mastery of grade-level science standards objectives relevant to the specific Science4Us module used	Synthesize and apply knowledge to other classroom activities and assessments Apply the process of science, including hypothesis generation, experimental design, quantitative analysis, and data interpretation Improved performance on related standardized tests and assessments of science (e.g., state NGSS assessment)	Students are more likely to succeed in STEM curriculum in later grades Increased self-efficacy in STEM learning Increased engagement and interest in STEM curriculum/topics Increased interest in STEM careers

STUDY DESIGN FOR SCIENCE4US EVALUATION

ExploreLearning is currently developing a study design to satisfy the ESSA *Strong Evidence (Tier 1)* level of evidence and test the logic model described here. An experimental design will be used to compare learning outcomes of a treatment group of students who are assigned a specific *Science4Us* module over the course of two weeks and a comparison group of students within the same school district who have instruction as normal. The predicted short-term outcome from the above logic model, that students will demonstrate “Demonstrate mastery of the learning objective” will be tested by comparing scores on the “Evaluate” assessment across the treatment and control groups.

REFERENCES

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