

Research behind Kide Science

KiDE science

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Introduction

This document summarizes the research backing Kide Science.

Kide Science follows four stages of impact evidence.

- 1) A strong foundation based upon previous research and learning theory
- 2) Ongoing studies proving Kide's impact on certain users
- 3) Non-peer reviewed academic research
- 4) Peer reviewed academic research



Kide Science has four levels of impact evidence

Level 3: Non peer reviewed scientific research

In level 3, we present research and studies that are rooted in scientific theory, but are not peer-reviewed

Level 1: Educational theories

The base of our impact evidence lays upon a strong theoretical understanding of learning in ECE, play and inquiry-based learning



Level 4: Peer reviewed scientific research

In level 4, we present the scientific evidence that is published in high-quality, peer reviewed scientific journals

Level 2: Studies that prove the impact on certain users

Here we can present the results of Kide's case studies, usage and user behavior

Outline

This document starts by reviewing previous studies that:

- 1. Prove the importance of early childhood education for general development and learning
- 1. Show the crucial role of early STEAM education for later achievement

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Then this document describes the research results from academic studies into Kide Science's impact. These include

- 1. Impact on children
- 2. Impact on teachers

Children benefit preschool enrollment: from both an academic and behavioral perspective

Preschool enrollment boosts college attendance, as well as SAT test taking and high school graduation. Preschool also decreases high school disciplinary measures including juvenile incarceration (<u>Gray-Lobe et al., 2022</u>).

ECE benefits for children on intelligence quotient (IQ) and sizable long-term effects on school achievement, grade retention, placement in special education, and social adjustment (<u>Barnett, 1995</u>).

Classroom-based ECE programs for children under five can lead to significant and substantial decreases in special education placement and grade retention, and also increases high school graduation rates (McCoy et al., 2017).

Approximately 373,000 youths in the United States drop out of high school each year, with each dropout leading to an estimated \$689,000 reduction in individual lifetime earnings and a \$262,000 cost to the broader economy (McCoy et al., 2017).



However, not all programs are mutually effective

Actually, play-based programs outrule direct teaching.

High quality is connected to specific character of learning, imagination and creativity at an early age. It has been demonstrated that brain development (executive function and self-regulation as main indicators) decisively depend on children's play quality. Play development (advanced forms of social role-play) has been a superior route to higher-level executive functions and self-regulation, compared to all direct training programs (Hakkarainen & Bredikyte, 2010)

Significantly higher learning outcomes were shown for a group of play-based mathematicians, compared to traditional kindergarten.(Vogt et al., 2020)



Play-based programs support achievement and well-being

The benefits of play-based learning outweigh those from traditional teaching methods.

Through play, learning is more meaningful to children and there are health benefits too. Learning can be healthy and the longevity of this play-based method can prove beneficial both academically and for physical wellness (<u>Ali et al., 2018</u>)

When children engage in play-based learning, they show more signs of emotional well-being compared to non-play activities (<u>Howard & McInnes, 2013</u>)



Early science acquisition is mandatory to patch achievement gaps

- Efforts to address science achievement gaps in the United States likely require intensified early intervention efforts, particularly those delivered before the primary grades. If left unaddressed, science achievement gaps emerge by kindergarten and continue until at least the end of eighth grade (<u>Morgan et al., 2016</u>)
- High quality inquiry-focused science produces better learning outcomes in 5th grade (Kaderavek et al., 2020)



Several research findings point out that a lack of science teaching in the early years may be one reason for the lacklustre science achievement in U.S. high schools (<u>Banilower et al., 2018</u>)

Science matters!

When they become adults, children with low levels of science achievement may be less able to understand public policy issues which require ever-greater scientific literacy and reasoning (e.g. climate change, hydraulic fracturing, genetic engineering.)

They may also experience lower employment and prosperity (National Academy of Sciences (<u>National</u> <u>Academy of Engineering, & Institute of Medicine</u> [NASNAEIM], 2010).



Kide Science: the impact on children

K i D E science

Some methodological and ethical considerations of research among preschool children

Kide Science's research involving children follows the idea of a cultural-historical perspective on learning (Rogoff et al., 2003) meaning that learning is a participation into cultural activities. For example, participation into scientific inquiry. Rather than learning from direct teaching, children learn effectively by having an active role and pitching in with collaborative endeavors (Rogoff, 2012). According to that, learning can be observed in children's interaction with people and objects.

Therefore, Kide Science research aims to unfold children's participation and interaction by rigorous observation data - rather than aiming to test children. Surveys or structured interviews have been criticized for silencing children's voices, by restricting children's possibilities to communicate in their natural way (<u>Bucknall, 2014</u>). The presence of a researcher always alters the situation. Therefore, Kide Science research is ethnographically inspired. The researcher spends time with children, getting to know them as a person and as a safe adult (<u>Hammersley & Atkinson, 1983</u>). Rather than researching children, Kide research is research is researching with children.



Kide Science supports children's scientific literacy skills

Kide Science promotes children's scientific literacy skills from three perspectives:

- Operational (science and inquiry skills)
- Cultural (active participation in the existing scientific culture as it occurs in children's life-worlds)
- Critical (questioning and suggesting new viewpoints)

(Vartiainen & Kumpulainen, 2019)

A Playful Inquiry method produces learning by activating positive emotions

- Playful Inquiry activates children's positive emotions throughout the inquiry, which is an essential feature of meaning making and learning <u>(Vartiainen & Kumpulainen, 2020)</u>. → Note: a students' perception of their competence in science remarkably affects their learning results (<u>Rennie & Punch 1991</u>).
- Playful inquiry combines science inquiry and imaginative situations which together, promote a sense of meaningfulness and pushes children to their unique zone of proximal development <u>(Vartiainen & Kumpulainen, 2020)</u>



A Playful Inquiry method appreciates children's culture and ways of being

 Playful Inquiry appreciates children's own cultures, languages, and ways of being. It supports diverse opportunities to engage in science inquiry in meaningful and culturally sensitive ways <u>(Vartiainen & Kumpulainen, 2020)</u>.

 \rightarrow Note: National estimates indicate that the 50th-percentile science scores of eighth graders who are black approximate the 10th-percentile scores of eighth graders who are white (U.S. Department of Education, 2015). The 50th-percentile score of those who are English language learners (ELL) are lower than the 10th-percentile score of those who are non-ELL



Playful Inquiry equips play, allowing children to learn the process of science inquiry and scientific concepts

- Playful inquiry offers children rich opportunities to practice scientific processes, create science-related speech, and use play as a means to develop an understanding of scientific concepts (Vartiainen & Kumpulainen, 2020)
- Note: Children build the idea of scientific concepts by playing with them, acting upon them, and using the concepts in social interaction (<u>Vygotsky, 1962</u>). Conceptual change happens over a long period of time through social interactions.



Kide Science supports children's engagement

Children who have problems concentrating under more traditional methods, concentrate well during Kide activities (Vartiainen & Brezovszky, in press)

Kide Science pedagogy is effective for engaging children in STEAM education from a behavioral, cognitive and emotional dimension. (Lee & Vartiainen, 2021)





Kide Science: the impact on teachers

K i D E science Kide Science fosters teacher confidence and effectiveness in early STEAM education



Kide Science increases teachers' confidence and enjoyment in teaching STEAM

The lesson plans help teachers to become more confident in their STEAM teaching skills (both content knowledge and ability to teach STEAM.) Thus, their enjoyment and motivation to teach STEAM in their everyday classroom practice increases (Vartiainen & Brezovszky, in press)



Kide Science supports teachers' work and professional growth

- Using Kide Science reduces teachers' planning time
- Kide teachers receive a comprehensive package including the story context, handson activities, and also a description of the scientific phenomena, all explained in a clear and understandable language, written by expert teachers. These features help teachers become more confident as they feel they always have resources available.
- Kide Science's playful methodology can increase a teachers' confidence in early STEAM teaching as they are free to take on a new scientist identity. This reduces the stress associated with the role of the teacher, who has to have the right answer to all questions. (Vartiainen & Brezovszky, in press).

