

“Kide Science gives the joy of learning”: Teachers’ confidence in teaching STEM after using Kide Science



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Jenni Vartiainen, Boglarka Brezovszky & Naomi Kerr

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Executive Summary

Early STEM education is foundational for strengthening 21st-century skills like critical thinking and problem-solving and teachers play a crucial role in making STEM engaging for young children. However, traditional methods often fail to capture the interest of young children, and teachers struggle with several anxieties connected to early STEM teaching (e.g., lack of content knowledge, classroom management problems, and lack of resources). Kide Science offers playful inquiry-based lesson plans that aim to support teachers in delivering engaging, age-appropriate STEM lessons.

This white paper aims to explore how teachers perceive their self-efficacy in early STEM teaching in general and how the playful inquiry pedagogical model of Kide can impact teachers' confidence in early years' STEM teaching.

Using surveys and interviews, the study identified key themes related to teachers' struggles with early STEM teaching and explored how Kide can support them in these struggles. Based on the data, three key contributing themes were identified related to Kide's impact in strengthening teachers' confidence:

-  **Positive and playful learning environment:** Kide's playful approach creates a fun and engaging atmosphere that supports learning
-  **Shared meaning-making:** Kide lessons support teachers' confidence to let go of control and use scaffolding instead of frontal lecturing, which in turn supports collaborative inquiry learning for both students and teachers
-  **Practical resources:** Kide provides valuable tools for lesson planning and classroom management; Kide pedagogy places emphasis on the process of inquiry learning instead of content knowledge which can reduce teacher's anxiety

Overall, results show that Kide lessons can foster a positive learning environment, enhance teachers' confidence, and reduce their anxiety about STEM teaching. Teachers reported increased enjoyment and effectiveness in teaching STEM, especially with frequent use of Kide lessons.

Background

Researchers have widely recognized the importance of early STEM education as the foundation of developing 21st-century future skills such as critical thinking and creative problem-solving. Placing emphasis on early STEM education can help students develop the foundations of scientific reasoning and foster children's natural curiosity. However, not all STEM programs and approaches are effective among young children. An effective introduction to science applies a holistic approach that encompasses physical, social-emotional, and cognitive development while engaging children in scientific practices and content knowledge relevant to their lives (Larimore, 2020). Early childhood science education should promote meaning-making through ongoing explorations of scientific phenomena, integrating science practices with context-based experiences. This approach, supported by frequent play-based experiences, leverages the strengths of early childhood and science education to enrich children's learning in science.

Teachers play a central role in making it possible for children to learn science in the early years (Larimore, 2020; Chen et al., 2022). Teachers foster a conducive learning environment for science education in preschool settings, and they need to value science learning and embrace a positive attitude toward science (Fleer et al., 2014). However, as a foundational challenge of STEM education, teachers often feel a lack of competence and confidence in STEM subjects to teach STEM to young children. Despite the inclusion of science in educational standards, reality shows that little time is spent on science compared to other content domains (Larimore, 2020). Teachers especially feel that they should focus on language and literacy instruction over science in early years education (Chen et al., 2022). Further, STEM is often approached with learning strategies that are not suitable for young children, which reduces children's interest in STEM (Fleer, 2009.)

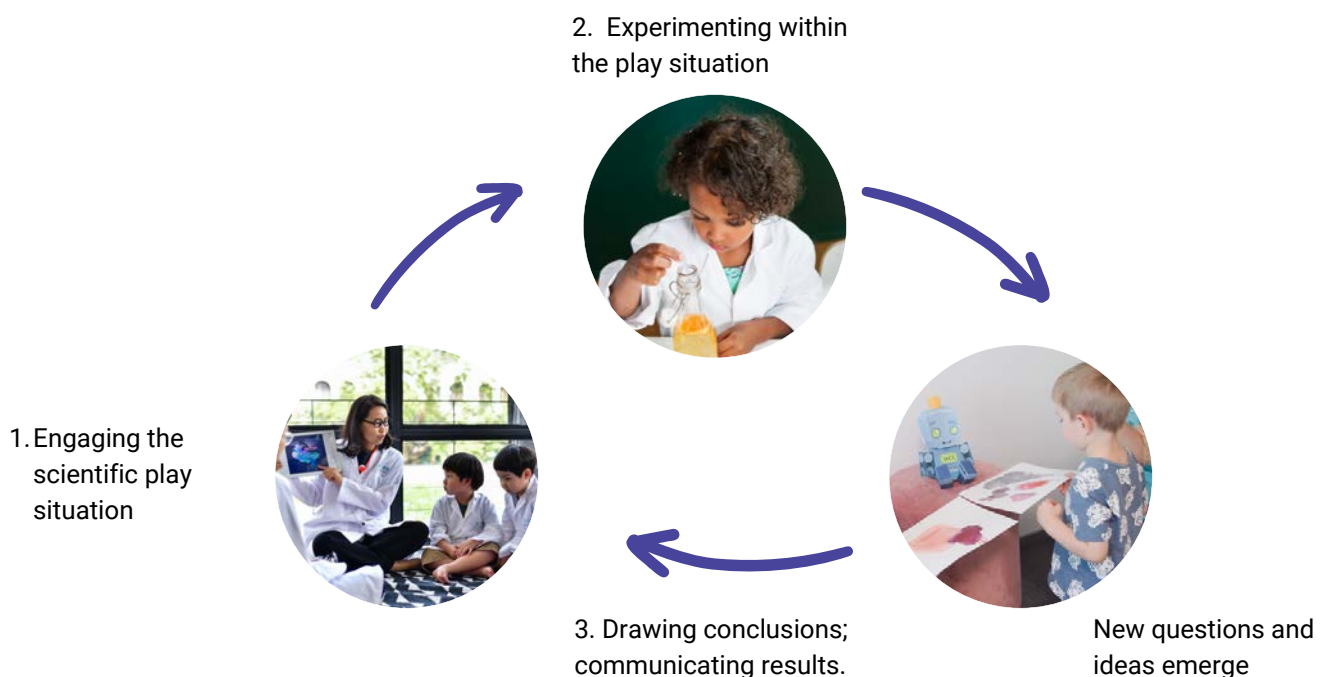
Teachers lack confidence and knowledge in science content and pedagogy, which hinders their ability to effectively teach science (Larimore, 2020). Chen et al. (2022) studied the factors that have an effect on teachers' self-efficacy. The findings indicated that out of four factors, teachers' mastery experience in science teaching had the greatest impact. This was followed by their prior experiences in learning science, support from colleagues and other persons, and their beliefs regarding the significance of science education.

The previous studies have concentrated vastly on factors that explain teachers self-efficacy (Chen et al., 2022), children's learning of science (Abdo & Vidal Carulla, 2020), and children's and teachers' interaction, engagement, and participation in play-based science programs (Fleer, 2009). However, very little is known about how play-based programs affect teachers' self-efficacy and enjoyment in science teaching. To fill this gap in research, this study aims to explore through a mixed-methods case study (Yin, 2009), how teachers perceive their self-efficacy in early STEM teaching after using Kide Science play-based lesson plans which combine STEM education with stories and dramatic play.

About playful inquiry & the Kide method

High-impact STEM programs require a holistic approach that integrates science practices with play-based learning relevant to children's lives. Kide Science lesson plans (<https://teachers.kidescience.com/en>) are designed to answer the need for improved science education training and support for early childhood education teachers.

Kide Science's Playful Inquiry pedagogical model is grounded on rigorous scientific research (Vartiainen, 2016; Vartiainen & Kumpulainen, 2019, 2020) and offers a pedagogical model that focuses on exploring science through a hands-on, inquiry-based approach (Minner et al., 2010). This method is rooted in the socio-cultural learning theory (Vygotsky, 1978), emphasizing learning through social interaction and cultural context.



Inquiry-based learning in science involves engaging with the scientific process itself, encouraging children not just to learn facts but to understand how scientific knowledge is generated, evaluated, and applied. Vygotsky highlighted the importance of play in learning, suggesting that imaginative play creates a space where children can stretch and grow their abilities. Building on this, Kide Science incorporates scientific play into its curriculum, using stories and props to spark children's imagination and curiosity in science.

The philosophy behind Kide Science is a comprehensive "hands-on, heads-on, and hearts-on" strategy. This means that while children gain important science and critical thinking skills, their emotional engagement and the meaningfulness of their learning are also considered. Using a play-based pedagogical approach is often an effective solution as it creates an environment that reduces stress (Wenner, 2009) and opens up opportunities for exploration without the fear of failure.

To support educators, Kide Science offers an online platform that provides resources for integrating play-based STEM education into classrooms. Kide offers teachers professional development resources and a wide range of lesson plans that align with the Kide Science teaching approach. For the kids, the learning experience is brought to life through storytelling and interactive activities using common classroom or home items.



Aims & methods of this study

This white paper aims to **investigate how teachers perceive their self-efficacy in early STEM teaching and how Kide's playful inquiry model can support their confidence.**

Participants were early childhood teachers from the USA, UK, and Finland who used Kide in pre-kindergarten or kindergarten classrooms. To ensure reliability and validity, we employed a mixed-methods approach, combining quantitative and qualitative data. Data from two different surveys was combined for quantitative analysis. The first survey explored Early Years' Teachers' Self-efficacy (n = 116) in Finland and internationally. The second survey explored teachers' everyday teaching practices (Kide Experience Survey) after using Kide Science between 3 months to 2 years (n = 37) around the world. From both surveys, only questions related to teachers' confidence in teaching STEM were considered for the current study.

In the second survey, teachers were also provided with space for open-ended feedback. Teachers' responses on this open-ended feedback question (n = 21) were used for a qualitative thematic analysis of the main patterns related to teachers' confidence and enjoyment of STEM teaching. To enhance the validity of this thematic analyses, additional interview data from the user insights database of Kide Science company was used.

The main themes observed in the explorative phase of the study were addressed in interviews during a six-month research collaboration with Kide and a partner school. In this study, Kide lesson plans were used daily in a kindergarten classroom in the UK, and interviews related to teachers' confidence were done with the classroom teacher after two months of using Kide and at the end of the study after six months of using Kide.

Results & discussion

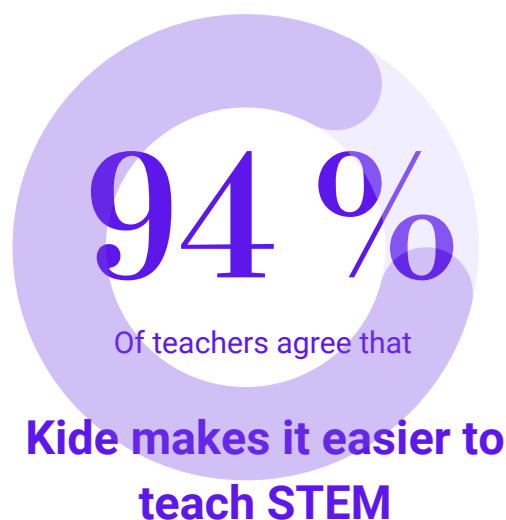
Main findings

Overall, the data strongly suggests that using Kide lessons can help create a positive mood in teachers and thus increase their confidence in teaching science. In line with the relevant literature (e.g., Fleeer, 2009, Vartiainen & Kumpulainen, 2019, 2020), results show the following main aspects to be related to strengthening teachers' confidence in teaching early STEM: a positive and playful learning space that allows experimentation without the fear of failure, shared learning and meaning-making with students, and practical resources in materials, lesson planning and classroom management. The following section will discuss these themes in more detail.

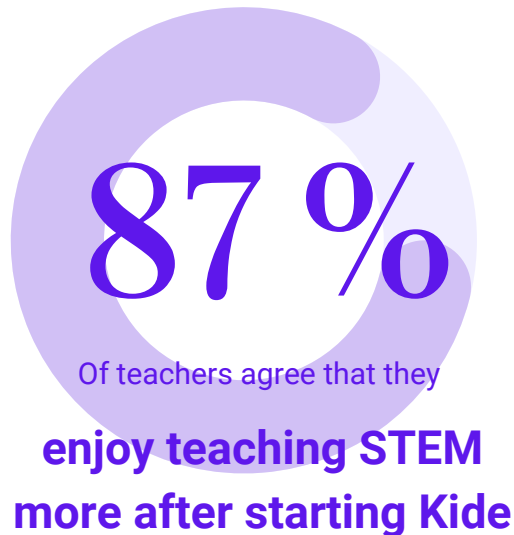
Playful lesson plans create positive attitudes towards learning and teaching STEM

Our quantitative and qualitative findings suggest that Kide can create an overall positive attitude towards science learning, both in teachers and students, reduce negative feelings and fear of STEM subjects, and thus create a positive learning space.

Results of the Early Years Teachers' Self-efficacy survey show that 89 % of the teachers agreed with the statement that **doing inquiry-based activities with children makes them cheerful**, while only 56% of teachers who did not use Kide agreed with this statement. Additionally, 79 % of teachers agreed with the statement that they **enjoy using Kide lesson plans**, and 94 % of teachers agreed that **Kide makes it easier for them to teach STEM**.



Similarly, the Kide Experience Survey also showed high agreement amongst teachers in relation to the **enjoyment and positive effect** of STEM teaching, especially when Kide lessons were used on a frequent basis. The result showed that 87 % of teachers agree that they **enjoy teaching STEM more after starting using Kide Science**, which number rose to 95 % if only long-time and frequent Kide users were considered for analyses (e.g., from six months to more than a year of use, using Kide on weekly and/or monthly basis).



The most common theme in teachers' open-ended comments was related to **positive attitudes toward science learning in children** (8/21) and **joy of STEM teaching in teachers** (3/21). Overall, the main themes showed that for students, Kide lessons can create positive attitudes in science learning and thus improve engagement and enable the transfer of learning experiences to the home and other contexts as well. For example: "Kide Science gives the joy of learning to the preschool group." For teachers, the most prominent themes were: a positive attitude and joy in STEM teaching as a result of using Kide lessons in their teaching practices.

The playful methodology and the process of shared meaning-making reduce negative feelings associated with STEM teaching

Teachers face many anxieties connected to STEM teaching (van Aalderen-Smeets et al., 2011). Kide's playful pedagogical methodology can help teachers reduce these anxieties, as during play, teachers are free to explore new identities. Taking off the "teacher hat" in the traditional sense (e.g., a teacher who has to know the answer to all questions) is an important part of developing a teacher's self-confidence while using Kide lessons. This point is illustrated in the following comment, left by a teacher after using Kide for the first time in her lessons: "I'm so excited to have found this curriculum. I really enjoy the training videos which show, for example, how you can just **put on a different pair of glasses, turn around and the kids will be engaged in that. It gave me more confidence to teach science.**" In this comment, "putting on a different pair of glasses" is both a symbolic and a practical expression, as the participant was referring to an actual video on the Kide website which illustrates a teacher putting on a "pair of scientist glasses" and starting the Kide activities, and in the same time her own experience with the play-based methodology. Putting on a "different pair of glasses" is like experimenting with different roles as a teacher, and engaging in scientific thinking and open-ended exploration without the fear of failure.

As Vartiainen and Kumpulainen (2020) point out, children's shared imaginative activities and play within science inquiry foster children's meaning-making about the scientific phenomenon: thus triggering concept formation. Results suggest that during Kide lessons, not only students but also teachers become part of this imaginary playful world and create meaning together through shared experiences of exploring and wondering about phenomena and scientific processes.



This section provides an additional example to illustrate the same point:

“Kide activities have engaged the children, and myself as well, in actively observing the environment and phenomena. We have also come up with many research topics in our everyday lives, developed methods for exploring them, and taken time to wonder together. The activity has delighted everyone, regardless of age (1-5 years), including us caregivers and the children's parents. Thank you!”

Finally, the same ideas were expressed in a concise way in the following comment of a Finnish teacher who used Kide for more than a year: “Children and educators learn great new things through experiments”.

This teacher feedback shows how learning becomes a process of co-creation between student and teacher. Thus, learning becomes a shared experience, which can further explain why Kide teachers have more positive feelings related to STEM teaching. In this process, the teacher does not need to know all the answers but is free to wander and explore together with the child, which on the other hand, can strengthen teachers’ confidence in STEM teaching.

Practical help in teachers’ everyday life (resources, classroom management, lesson planning) increases teachers’ confidence

A more practical reason for strengthening teachers’ confidence in STEM teaching could be related to the very comprehensive list of materials that teachers receive with Kide lesson plans. Many teacher comments refer to the idea of a “one-stop shop.” In comparison to other products or resources that teachers use (e.g., teacher resource websites, YouTube, Pinterest), with Kide, teachers receive a comprehensive package. This includes a background story, hands-on activities, and also a description of the scientific phenomena explained in clear and understandable language written by expert teachers for teachers.

All these features could help teachers become more confident as they feel they always have resources to fall back on. The following comment illustrates the previous point in detail:

“The material has actually reduced the planning time, freeing up time for other things. While I have always been excited about science stuff, I have also learned a lot myself, and we often discuss new things with the children. It's nice to be able to explain without always searching for answers on the internet.”

Additionally, having a comprehensive package reduces time on lesson planning and frees up time for other activities, as illustrated partly in the previous and, more specifically in the following comment: “lesson plans have made my life so much easier, because they are **ready to use and the planning is fast and easy**”.

Finally, the playful Kide methodology can also help teachers with classroom management and thus boost their feelings of competence and confidence. As the following comments show, even children who have problems concentrating under more traditional methods, do well during Kide activities:

“I have noticed that during Kide sessions, even children who struggle with concentration are much more enduring. They patiently wait for their turn, get excited about the experiments, and experience the joy of success to the fullest. Everyone loves Hoseli, and they talk to it, sharing what they are doing and what they have learned. The experiments/tasks are easily adaptable to suit our own group.”

Additionally, ordinary daily activities can become more motivating as children relate to and engage with the imaginary characters from Kide. For example: “Hoseli also helps us figure out our daily routines. Dressing up and handwashing programs were also a big joy.”

Interview on teacher confidence after using Kide for six months

In line with the initial thematic and survey analyses, our in-depth teacher interviews also showed a similar pattern: Kide's main impact on early years teachers' confidence in STEM is found in the playful methodology, which helps teachers let go of control associated with traditional expectations and focus on the process of experimentation and learning together with the students.

Our in-depth interviews showed the following main patterns of how the playful-inquiry pedagogical model of Kide can support teachers' confidence:

1. Reduced teachers' concerns about their STEM content knowledge by focusing on the **process of exploring and learning together with students**

"And from what we've seen, the thing I like the best is that there's no desired outcome, it took me sort of three or four weeks to get to that point where I was happy to be like, okay, come on, stop over-teaching, like teaching the point, just let them do it...I was like, okay, this is what we're doing, go! And I didn't really get involved. And then they created just the most incredible structures...And I think that's one of the joys of Kide Science, that there's no right or wrong... That confidence that we are giving them is what's needed."

2. Encouraged the teacher to **support students' learning through scaffolding rather than traditional lecturing**

"So I've definitely noticed progress in their confidence, in the way that they aren't looking at me to provide the answers, they know during Hoseli time that they are the drivers that I'm there to help them, that Hoseli has posed a problem and they're the scientists that are solving that. And so when we're in Hoseli time, we're always referring to them as scientists and say: some scientists are gonna come there, some scientists are coming over here. So they know that, and they'll quite often say that to each other."

3. The most prominent theme of the interviews was that the Kide pedagogical model **helped the teacher feel comfortable making mistakes, become confident with not having all the answers, and adopt a growth mindset** of continuous reflection and learning. This is a compelling outcome as a growth mindset can be independent of the context, so it might support teachers' general perception of professional self-efficacy, not only specific feelings related to Kide and STEM.

"And I sort of had an understanding that, the water goes into the paper and it makes it unfold, but my science knowledge wasn't there to back that up necessarily. So I said, well let's watch and see what happens...And we again, got our paper towels and looked at that, screwing them up. Did they unfold?...Would it do it with the card? Would it be slower or quicker with the card?...I thought right, I don't quite have all of the science knowledge here, but that's almost empowering for them (students) as well. You shouldn't have all the answers all the time. You should say, I actually don't know. Let's find out more together!"



Conclusions

This white paper explored how the playful methodology of Kide lessons can strengthen teachers' confidence in teaching early STEM. Survey results showed high levels of agreement among teachers regarding the enjoyment and effectiveness of Kide lessons in teaching STEM, especially for frequent users. Based on the data, three key contributing themes were identified related to strengthening teachers' confidence in early STEM teaching: creating a positive and playful learning environment, shared meaning-making with students, and practical resources for lesson planning and classroom management.

The playful pedagogical approach of Kide allows teachers to explore new teaching identities, fostering self-confidence by removing the pressure of always having the right answers. Teachers and students engage in shared imaginative activities, fostering concept formation and meaning-making about scientific phenomena. Finally, practical resources provided with Kide lesson plans can ease the burden of lesson planning contributing to a sense of competence and confidence among teachers. Classroom management also benefits from the playful approach, as children exhibit increased engagement during Kide activities.



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