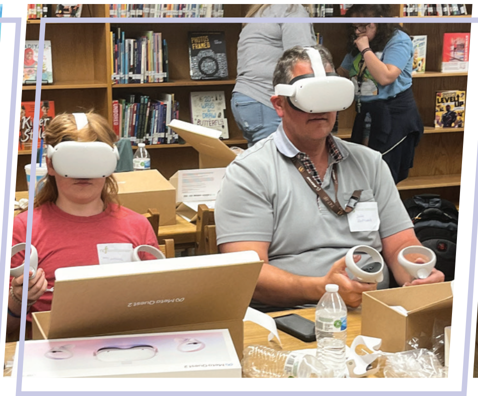
Education Solutions for Families

Family Service Learning in Science

Leveraging Family Engagement through Immersive Technology for Deeper Learning

A Digital Playbook



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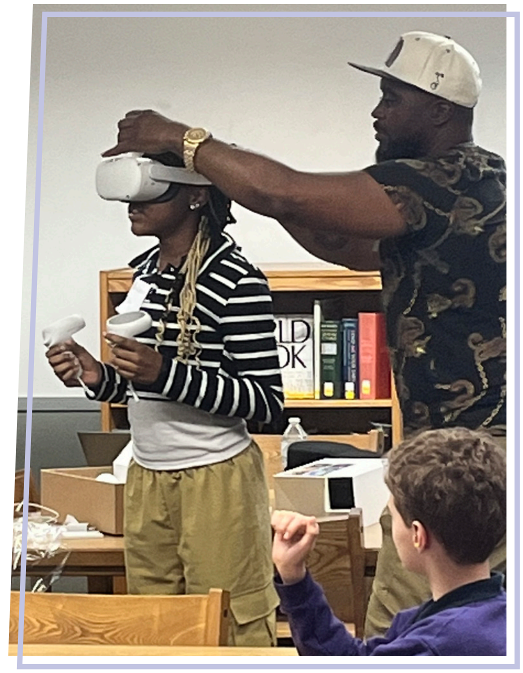
NCFL is a national nonprofit that has worked for more than 35 years to eradicate poverty through education solutions for families. We believe education is a shared, nonpartisan responsibility and that collaboration among families, schools, and community members can lead to powerful learning experiences. NCFL's vision is to establish coordinated and aligned family learning systems in 60 communities by 2030, built with and for families, to increase education and economic outcomes and create thriving communities. For more information on NCFL, visit FamiliesLearning.org. To learn more about our vision or become a Family Learning Community™ partner, visit FamiliesLearning.org/60x30.

Introduction



The National Center for Families Learning (NCFL) developed Family Service Learning in Science (FSLsci) as a research-informed, secondary-level family engagement program that brings together students, parenting adults, and educators through a shared, immersive learning experience. Grounded in the principles of Family Service Learning, this program engages multigenerational teams in investigating local challenges connected to broader science-related themes such as health, climate, and the environment. Through inquiry, collaboration, and reflection, teams identify issues of significance in their communities, conduct research, and explore both individual and systemic solutions to those challenges.

What sets FSLsci apart is its integration of immersive technology—specifically, virtual reality (VR)—as a tool to enhance academic learning and deepen family-school partnerships. With the guidance of a VR architect, participants gain foundational digital literacy skills, from setting up accounts and navigating virtual environments to building interactive scenes. These skills culminate in the co-creation of VR experiences that serve as a powerful medium for sharing their investigations and proposed solutions with peers, educators, and the broader community.

This digital toolkit was designed to increase awareness of this innovative model and to support its adaptation and scalability in schools and districts across the country—particularly those implementing science curricula like OpenSciEd. In addition to offering an overview of the FSLsci program, this toolkit includes practical implementation guidance, lessons learned from NCFL's pilot sites, and adaptable resources for educators, administrators, and community partners. Whether your goal is to foster deeper family engagement, build digital literacy, or expand science learning beyond the classroom, we hope this resource serves as a valuable guide for initiating high-impact learning experiences in your own community.

Throughout this toolkit, NCFL offers promising practices, lessons, and resources centered around three core objectives:

1. **Deepening practitioner understanding** of the research and design principles that ground the FSLsci model;
2. **Identifying key processes and skills** that make up the heart of the program—from co-design to digital literacy to community demonstration; and
3. **Equipping educators and leaders** with adaptable resources, tools, and strategies to begin this work in their own schools and communities.

Background Information

Family Service Learning

Originally developed by NCFL in 2013, Family Service Learning has laid a strong foundation for deepening partnerships among students, families, and practitioners. Family Service Learning is foundational to NCFL's model programming because it helps parenting adults to gain literacy, technology, and communication skills while building social capital and deepening their community connections. When parenting adults grow their leadership capacity and become drivers of change in their neighborhoods, communities are elevated by their influence and ultimately thrive.

Watch this brief video from NCFL to hear more from participants in Family Service Learning programming: [Family Service Learning - Development]

Family Engagement at the Secondary Level

In recent years, family engagement and its impacts on student outcomes and development have been a focus in education. Research suggests that family engagement is strongly related to improved student attendance, better grades, and higher graduation rates (Hill & Tyson, 2009; Mapp et al., 2022). These impacts have been seen across grade levels in elementary, middle, and high schools.

Family engagement benefits secondary students' academic success and their overall wellbeing (Simon, 2004). The key to family engagement in middle and high schools is two-way communication about students' learning. This communication is only possible when educators first take the time to build relationships with families.In FSLsci, educators work collaboratively with students and parenting adults over the course of multiple weeks. A focus of the program is for teams to use co-design principles, including relationship-building.

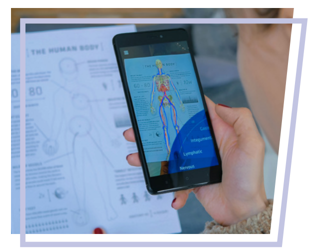
While parenting adults are often most visible as part of school-based activities during the early grades, their engagement does not necessarily diminish as students progress into middle and high school.Instead, their engagement tends to evolve. At this stage, families may continue to support their children in ways that are not always formally recognized within school systems (Smith et al., 2019). As students gain independence and transition into secondary settings—where they interact with multiple teachers and more complex academic content—families may have less access to the information, skills, and collaborative structures needed to navigate these new dynamics and sustain meaningful partnerships. FSLsci leverages the innovative appeal of VR to design a family engagement experience that resonates with secondary students and their families.

At the secondary level, one of the most impactful approaches to family engagement is academic socialization, a home-based strategy that emphasizes conversations between parenting adults and students about the value of education, connections between school and real life, and future aspirations (Hill & Tyson, 2009). To support this form of engagement, educators can create opportunities for families to gain access to relevant information and actively participate in collaborative learning experiences. Through FSLsci, parenting adults engage directly with science curriculum and pedagogy, equipping them to participate in meaningful dialogue about their children's learning and to reinforce academic development beyond the classroom.

FSLsci is grounded in the research on family engagement at the secondary level. Educators and parenting adults are intentionally partnering with students—which honors the growing agency of young adults while also surrounding them with support from both home and school. Relationships and two-way communication are intentional components. However, the program uniquely focuses on academics, adding greater depth to the engagement.

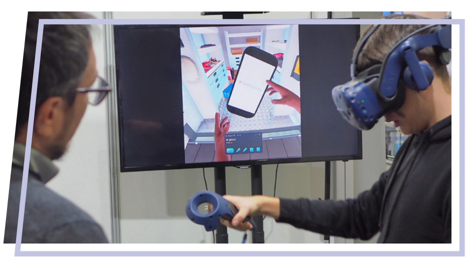
Virtual Reality in Education

Augmented reality and virtual reality are technologies which can be used in educational spaces.



Augmented Reality (AR) enhances the real world by overlaying digital content—such as images, sounds, or interactive elements like 3D objects—onto the physical environment. This is typically done through devices like smartphones, AR glasses, or headsets. AR blends virtual and real-world elements to create interactive experiences without fully immersing the user in a virtual environment.

Virtual Reality (VR) creates a fully immersive digital environment that replaces the real world. Users are transported into interactive, computer-generated spaces. Users access these spaces through VR headsets which enable them to explore and interact with 3D worlds. They are immersed in a completely virtual setting.



With AR, digital content is brought into the user's space through a smart device. For example, a lifesize, 3D image of a panda can be brought into a classroom, so students can compare its size to common objects. In VR, users are immersed in a 360-degree digital environment where they can interact with virtual objects through a VR headset and controllers. A VR user can be transported from their classroom to an Egyptian pyramid where they can pick up and engage with the treasures found there.

Research suggests that using AR and VR technologies in educational settings can increase students' understanding and motivation. Parong and Mayer (2018) found that students who learned through immersive VR experiences had higher recall and understanding of complex concepts compared to those who received traditional instruction. These technologies create more hands-on experiences that allow students to interact with content in new ways. For instance, geometry students can manipulate three-dimensional shapes in an AR environment, rotating and viewing them from multiple perspectives, strengthening spatial reasoning skills (Billinghurst & Dünser, 2012). Similarly, VR-based laboratory simulations in science education allow students to conduct experiments in a risk-free environment, fostering deeper conceptual learning (Makransky, Terkildsen, & Mayer, 2019).

The benefits of VR in education extend beyond the classroom to include family and community engagement. By allowing parenting adults to experience their child's learning environment virtually, these technologies create new opportunities for engagement in education. Research by Kavanagh et al. (2017) suggests that VR fosters collaborative learning experiences that enhance social and emotional connections, making it a valuable tool for inclusive education and family engagement initiatives.

Privacy and Data Protection

While VR and AR technologies have potential in education, many districts and practitioners are concerned about privacy and data security. Schools must select applications that comply with student data protection regulations, including the Family Educational Rights and Privacy Act (FERPA) or Children's Online Privacy Protection Rule (COPPA). In its pilot programs, NCFL used the following applications which meet the organization's and our partner school district's standards for protecting privacy:

- **Engage** – A virtual learning platform that was designed for education and corporate training which offers secure, interactive environments.
- **BrainSTEM Metaversity** – A controlled virtual space for educational institutions that provides safe, immersive learning experiences for students.
- **Google Arts and Culture** – AR field trips students can use to explore historical landmarks, famous artworks, and scientific phenomena in 3D.

As AR and VR evolve, their applications in education will expand. However, educators, policymakers, and tech companies must address privacy concerns so that educators can take advantage of the learning opportunities that these technologies offer.

When determining whether a digital platform is safe for students, school and district leaders should consider the following questions:

1. Does the platform comply with student data protection regulations, such as FERPA or COPPA?
2. How does the platform handle and store student data? Is there clear information on its privacy policies and practices?
3. Are there tools in place for parenting adults to review and consent to how their children's data is used?
4. What measures are taken to ensure student data is protected from unauthorized access or breaches?
5. Are the platform's terms of service and privacy policies written in clear, accessible language for educators and parents?
6. Does the platform provide transparency about the third-party companies it shares data with, if any?

Family Service Learning in Science

In general, Family Service Learning is an approach to family engagement in which parenting adults and their children learn together through the development and implementation of a service project. In this family engagement program, participants follow a set process to engage in hands-on learning that is contextualized to their own communities. The process's six steps, which are explored in greater depth in a later section of this toolkit, are highlighted in Figure 1.

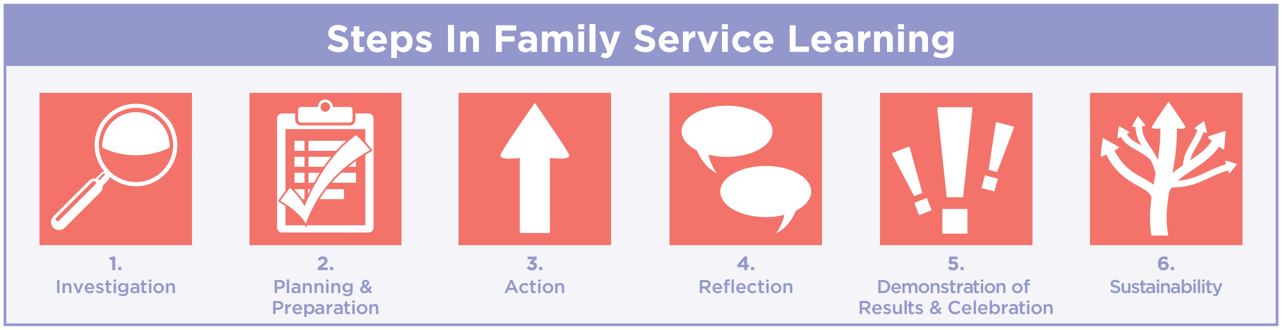


Figure 1

As they move through this experience, students, families, and practitioners engage deeply together around community challenges that matter most to them, and work to co-design solutions. For example, families in a neighborhood with limited access to books worked to build and fill a book exchange box. Through these projects, participants learn and practice a variety of skills in the areas of literacy, leadership, technology, and problem solving (National Center for Families Learning, n.d.).

The FSLsci program builds on the Family Service Learning experience and deepens the links to learning through a focus on science and the use of VR and AR. Parenting adults and their students partner with an educator or a community-based practitioner to form a team. Over the course of several weeks, each team identifies and examines a community issue with some relationship to the sciences. For example, a team might learn more about an abandoned industrial site near their school and the impacts it has on the community. This team would research the identified issue to learn more and then develop an investigation to understand the full scope of the challenge and how it impacts their lived experiences. Based on their research and investigation, teams would propose solutions to the issue in their community.

Through NCFL's most recent implementation of Family Service Learning, teams of families, students, and practitioners, have identified broad issues such as food deserts, water pollution, and climate change. Through the investigative process, the teams refined their learning questions to center on specific challenges that emerged such as hydroponic gardening, lead in drinking water, and urban heat islands. To further their knowledge, teams engaged in a variety of investigations: building models, conducting tests, and doing surveys to review extent data in search of patterns. Students learned how science has real-life applications. Adults learned that community challenges that seem to have simple solutions are often complex and layered.

FSLsci has an intentional focus on family engagement in academics. Parenting adults are learning knowledge and skills that can support them in talking to their children about school. Families learn about the science standards and curriculum that are being used in their students' science classrooms. They are also exposed to strategies and practices for classroom instruction such as collaborative learning and assessment rubrics. In other words, parenting adults are better equipped to engage in academic socialization. With the addition of a teacher or other practitioner to their team, they have the opportunity to ask questions and learn more from educators as well.

In addition to its academic focus—particularly in science—FSLsci incorporates a VR component that enhances engagement and deepens learning. The opportunity to explore and create in VR often serves as an initial draw for educators, students, and families alike. With guidance from a VR architect, teams begin with foundational skills such as operating the headset, connecting to Wi-Fi, and navigating the controllers. Over the course of the program, participants advance to designing immersive scenes that reflect their collaborative investigations. These custom-built VR experiences become powerful demonstrations of learning, culminating in a community showcase where teams present their work to a broader audience in celebration of their shared accomplishments.

Watch as FSLsci participants share their experiences: https://youtu.be/AArqfcQSNms

Link to Learning: Deeper Learning in Science

FSLsci aligns closely with the three dimensions of science learning outlined in the Next Generation Science Standards (NGSS)—crosscutting concepts, science and engineering practices, and disciplinary core ideas (NGSS Lead States, 2013). Several crosscutting concepts are frequently explored by teams, including “Patterns” and “Cause and Effect,” as they analyze community issues and propose solutions. The concept of “Systems and System Models” is often addressed when teams choose to design a model as part of their hands-on investigation. For example, one team constructed a terrarium-based model to demonstrate the heat island effect in urban environments.

In terms of science and engineering practices, teams engage in activities such as “Developing and Using Models,” “Asking Questions and Defining Problems,” “Planning and Carrying Out Investigations,” and “Obtaining, Evaluating, and Communicating Information.” One FSLsci team, for instance, conducted a water quality investigation to test for lead after identifying contamination as a concern in their community. Their findings were shared through a VR experience and presentation, showcasing both their scientific process and communication skills.

The program also has the flexibility to address various disciplinary core ideas depending on the focus of each team’s investigation. For example, teams studying heat islands examined concepts related to weather, geology, and biogeology, while a team exploring cancer rates engaged with ideas related to inheritance and genetics. Through these real-world, investigations, FSLsci meaningfully supports the NGSS framework and fosters the development of critical scientific knowledge and practices.

When asked how FSLsci supported the NGSS, one high school science teacher shared:

> "Students are almost overexposed and overwhelmed with climate news, so they have a hard time making it personal. In my experience with FSLsci, we investigated community issues within science using virtual technology to assist our exploration. FSLsci and our group project made the big picture of human activity real and attainable. It connected students and families to Next Generation Science Standards in a way that can be difficult in a classroom setting."

Some standards may not be covered in depth in the classroom, and yet reflect a broader set of challenges posed by other performance expectations in secondary science instruction. Two NGSS in particular—HS-LS2-7 (Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity) and HS-LS4-6 (Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity)—can be especially difficult to address in traditional classroom settings. These standards require extended time for exploration, opportunities for applied problem-solving, and access to tools that allow for modeling and simulation. FSLsci creates the space for students to engage more deeply with these complex practices by connecting science learning to real-world, community-based issues. Through collaborative investigations, virtual technology, and family engagement, students are able to explore, test, and communicate solutions in ways that are often not feasible within the constraints of regular instructional time. The program not only reinforces content knowledge but also strengthens skills like critical thinking, systems modeling, and scientific communication—deepening exposure to essential science practices that might otherwise receive limited attention.

FSLsci also aligns with the openly licensed OpenSciEd middle and high school science curricula, which are widely used by school districts across the United States (OpenSciEd, n.d.). Because teams select their own topics based on community issues, the connections to specific OpenSciEd units naturally vary from cohort to cohort. For example, one team investigated elevated cancer rates in their community, aligning with the OpenSciEd unit *Inheritance and Variation of Traits*, which explores cancer as a central phenomenon. As part of their project, the team surveyed adults about their use of early cancer screening. Another team examined local challenges related to transportation, bus routes, and pollution, connecting their work to the *Energy from Chemical and Nuclear Reactions* unit, which centers on the question: "Which fuels should we design our next generation of vehicles to use?" While the open-ended nature of FSLsci encourages a wide range of connections, facilitators who wish to align more explicitly with certain units can do so by narrowing the range of topics available for teams to explore.

While science serves as the core focus of the FSLsci program—guiding investigations, community connections, and alignment to standards like NGSS and OpenSciEd—the structure and approach of the program naturally lend themselves to broader STEM learning. By engaging students and families in problem-solving, modeling, data analysis, and technology use, FSLsci cultivates transferable skills that support deeper understanding across science, technology, engineering, and math disciplines.

Co-Design in Practice: A Toolkit for Shared Learning and Collaboration

Overview

As noted in the Dual Capacity-Building Framework for Family-School Partnerships (Mapp & Bergman, 2019), one outcome of impactful family engagement is the ability for families to co-design alongside educators. Co-design is a collaborative approach to developing learning experiences that emphasizes shared ownership, balanced participation, and the recognition of all participants as valued contributors to the design process. In this approach, practitioners "design with, not for, people" (McKercher, 2020, p. 14). Within the FSLsci program, co-design is used to intentionally disrupt traditional hierarchies in education by positioning students, parenting adults, educators, and partners as equal members of a team. Specifically, teams work collaboratively to explore community challenges, design projects, build VR scenes, and present their work to the community. The following principles—drawn from McKercher's (2020) research and field-based implementation—serve as a guide for fostering inclusive, impactful, and sustainable educational design (see Figure 2).

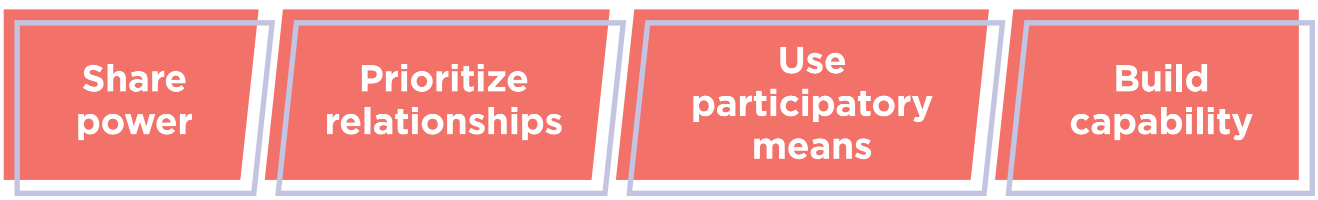


Figure 2 (McKercher, 2020)

Principle 1: Share Power

What it Means

Sharing power requires intentionally disrupting traditional roles, such as educators being the sole authority. Instead, everyone is viewed as an equal partner. This includes respecting and valuing diverse perspectives and actively listening to one another.

FSLsci Practice Example

Facilitators model what it means to share power by co-designing group working agreements with each cohort. At the beginning of the program, facilitators explain that working agreements are shared norms that help create a safe, respectful environment for collaboration. All participants—students, parenting adults, educators, and facilitators—contribute ideas using a virtual bulletin board. The group then votes on the most important contributions, narrowing the list to five or six core agreements. These agreements are revisited in each session to ensure accountability, shared ownership, and a culture of mutual respect.

Implementation Tips

- Establish shared norms for decision-making and collaboration.
- Rotate leadership roles based on interest or skill, not hierarchy.
- Use turn-taking protocols to ensure balanced contributions.

Principle 2: Prioritize Relationships

What it Means

In co-design, strong relationships are just as vital as the final product. Trust, familiarity, and connection among team members—whether educators, parenting adults, students, or partners-create the foundation for authentic collaboration. FSLsci intentionally integrates community-building into each session to support these relationships.

FSLsci Practice Example

Participants shared real or fictional places they would like to visit, leading to a conversation about VR's ability to transport us. Another prompt—"*Are you a planner or more spontaneous?*"—helped teams identify one another's strengths.

Implementation Tips

- Dedicate time in each session for intentional relationship-building.
- Use thoughtful icebreakers or storytelling activities.
- Foster informal moments for check-ins and personal reflection.

Principle 3: Use Participatory Means

What it Means

Effective co-design honors the diverse ways individuals contribute. Participants have different comfort levels and communication styles—some prefer speaking in groups, while others express ideas through writing or visuals. Co-design honors these preferences by offering multiple avenues for contribution. FSLsci sessions are structured to offer multiple, flexible modes of participation to ensure all voices are valued.

FSLsci Practice Example

Participants described their vision for a VR experience using sketches, spoken word, or written narratives.

Implementation Tips

- Use varied tools (e.g., digital whiteboards, shared documents, drawing prompts).
- Invite quiet reflection time before sharing aloud.
- Encourage and validate all forms of expression.

Principle 4: Build Capacity

What it Means

Co-design is not only about collaboration—it is also about growth. Participants are encouraged to build new skills, take on unfamiliar roles, and deepen their understanding of content. FSLsci supports this by providing opportunities for participants to engage in research, writing, public speaking, and immersive technology design through the use of VR. While honoring existing strengths, this experience also encourages learning new skills and stepping into new roles.

FSLsci Practice Example

Participants move from learning about VR and science concepts to designing their own immersive experiences—and eventually teaching them to others.

Implementation Tips

- Set collective goals that combine content and skill development.
- Scaffold opportunities for public speaking, presenting, or technical design.
- Recognize moments of growth and peer mentorship within the team.

The Family Service Learning in Science Program

Program Objectives

In FSLsci, the overarching objectives outlined below represent shared outcomes that all participants—students, parenting adults, and educators or practitioners—are encouraged to pursue collectively.

Participants will:

- Investigate a community science challenge.
- Apply principles and mindsets of co-design to share leadership and act as a team.
- Acquire digital literacy skills by using virtual reality and other collaborative technologies.
- Present the findings from their project by creating a virtual reality experience.

Additionally, parenting adults and practitioners gain knowledge and experience with family engagement strategies that support student learning. Through the use of these strategies, parenting adults and practitioners build relationships and develop ongoing two-way communication—critical components of effective family engagement. Finally, parenting adults build their skills around academic socialization as they gain an understanding of instructional strategies as well as standards and curriculum.

Program Structure: Designing an Immersive Family Engagement Experience

FSLsci is a multi-week, hybrid program that blends in-person and virtual learning to support meaningful collaboration among students, parenting adults, and educators. The program begins with an in-person orientation, where participants are introduced to the core principles of Family Service Learning in Science and gain foundational skills in using VR technology. The orientation also creates space for team-building and establishing shared goals.

Following orientation, participants engage in a series of weekly virtual sessions that combine whole-group learning, team-based project work, and VR skill development. Sessions are structured with consistent routines that promote relationship-building, co-design, content exploration, and hands-on practice in immersive technology. This rhythm allows participants to gain confidence, deepen collaboration, and apply new knowledge over time.

Throughout the program, participants engage in continuous reflection, allowing facilitators to adjust support and ensure all voices are heard. The culminating experience is a community showcase, where teams present their projects—demonstrating both their learning and their immersive VR scenes—to a broader audience of peers, educators, families, and community members.

Resource Alert!

Sample community-building prompts and reflection questions can be found in the Resources section at the end of this toolkit.

Family Service Learning in Science Process

FSLsci is both the name of the program as well as the process that teams use to investigate challenges in their communities. As explained in an early section, it is rooted in NCFL's model for Family Service Learning. The programs both follow the same six-step process, which is described in detail below.

#1 Investigation: Exploring Local Issues through a Scientific Lens

Investigation is the first step in the FSLsci process. During this stage, teams begin exploring science-related issues that are relevant to their communities. Facilitators support participants in narrowing their focus by moving from broad, global topics to specific, localized challenges. For example, a large issue like *air pollution* might be connected to a more immediate community concern such as *high asthma rates*. This modeling helps teams define a focus that is both manageable and meaningful for further inquiry.

Once a general area of interest is selected, teams begin their investigations. This typically involves researching the issue using reputable sources—such as scientific articles, expert interviews, and educational videos—to understand how the problem manifests in their local context. In some cases, teams also engage directly with community members or professionals who are actively working to address the challenge.

Unlike traditional science experiments, which often follow a structured process involving a hypothesis, controlled testing, and analysis, the FSLsci approach allows for a broader range of investigative methods. Participants are not required to follow the scientific method in a formal sense. Instead, they are encouraged to explore the issue using inquiry-based, hands-on strategies that deepen their understanding. These strategies—adapted from *Science Learning Hub* (n.d.)—may include:

- Analyzing existing datasets or visualizing data trends
- Building models to represent concepts or systems
- Observing patterns or behaviors in the environment
- Identifying or classifying materials, organisms, or other objects
- Conducting simple tests or demonstrations to gain new insights

This flexible approach to investigation supports curiosity, collaboration, and creativity while remaining grounded in scientific thinking. It empowers participants to make meaningful connections between local issues and academic content in a way that is accessible and relevant to all members of the team.

Key Points in the Investigation Step

- Brainstorm relevant science-based community challenges
- Conduct online research through credible articles and expert videos
- Interview community members or local experts
- Explore and refining a specific focus for further inquiry
- Identify opportunities for hands-on exploration to inform later phases of the project

Key Outcomes of the Investigation Step

By the end of this phase, each team should have:

- A clearly defined community-based science challenge
- A foundational understanding of the issue supported by research and expert input
- A plan for potential hands-on approaches for deeper investigation in the next phase
- A shared sense of curiosity and purpose rooted in real-world relevance

#2 Planning and Preparation: Laying the Groundwork for Further Investigation

Planning and Preparation is the second step in the FSLsci process. At this stage, teams shift their focus from idea development to outlining the concrete steps required to carry out their investigation. This includes identifying what data or materials they will need, defining roles within the team, and creating a timeline for implementation. The process is highly responsive to the nature of the challenge each team has selected, which means planning looks different from one group to another. Some teams may develop surveys, others may gather materials for testing, while others might begin prototyping or assembling resources for a model.

This stage requires a balance of structure and adaptability. Coaches play a critical role in guiding teams through the planning process while encouraging them to make decisions that align with their goals, available resources, and chosen science topic. The emphasis is on ensuring that each team has a clear, actionable plan that is both feasible and meaningful.

Key Points in the Planning Step

- Draft survey questions or interview protocols
- Source materials for an experiment or model
- Outline a timeline for data collection
- Assign team roles and responsibilities
- Conduct preliminary research to inform the action step

Key Outcomes of the Planning Step

By the end of this phase, each team should have:

- A clearly defined investigation plan aligned with their challenge
- A list of materials, tools, and data sources needed for implementation
- A shared understanding of team roles and responsibilities
- Support from coaches or facilitators to ensure their plan is both realistic and impactful

#3 Action: Applying Scientific Learning through Real-World Action

Action is the third step in the FSLsci process and serves as the moment when planning transitions into purposeful, hands-on implementation. During this phase, teams carry out the activities they have collaboratively designed to investigate and address a science-related community challenge. Just as the design and focus of each project may vary, so too does the nature of each team's action. Whether conducting an experiment, collecting data, or engaging with community members, participants are applying their learning in real-world contexts. The action step is a critical turning point in the program, as it allows teams to generate concrete data, artifacts, or products that not only support deeper understanding of the issue but also inform meaningful and scalable solutions.

Key Points in the Action Step

- Conduct experiments or field research
- Interview community members
- Gather and analyze local data
- Create a public awareness campaign
- Build a prototype or model

Regardless of the format, each team should generate some type of data, artifact, or product that helps deepen their understanding of the issue and informs possible solutions.

Key Outcomes of the Action Step

At the conclusion of this phase, each team should have:

- A tangible product or dataset connected to their challenge
- New insights or findings about the issue they explored
- A foundation for reflection and presentation in the final stages of the program

Implementation Tip

Encourage teams to document their action step as it unfolds—through photos, journals, or short videos. This not only supports reflection and presentation but also builds momentum and pride in the work accomplished.

#4 Reflection

Reflection is an integral, ongoing component of the FSLsci program. Participants engage in structured reflection to assess their growth, deepen their learning, and refine their collaborative efforts. Using a self-assessment rubric, participants evaluate their progress in three key areas: co-design practices, project development, and VR skill acquisition.

Reflection Tools and Approaches

Participants complete a self-assessment rubric to evaluate their progress in the following areas:

- **Co-Design Practices:** How well are they collaborating with their team? Are all voices being heard and respected?
- **Project Development:** How is their investigation progressing? Are their ideas taking shape in meaningful ways?
- **Virtual Reality Skills:** Are they gaining comfort and proficiency with the VR tools and scene-building techniques?

Critical Thinking and Problem-Solving Prompts

Participants are encouraged to use reflection as an opportunity to think more deeply about the science challenge their team is addressing. They are guided to consider:

- **Individual-Level Solutions:** What could individuals do to have a small but meaningful impact on this issue?
- **Systemic-Level Solutions:** What larger changes might be needed to address this challenge at a policy, community, or institutional level?

These prompts help teams connect their learning to real-world action and foster both a sense of agency and social responsibility.

Key Outcomes of the Reflection Step

By the end of the reflection step, participants should have:

- A clearer understanding of their individual and team progress in areas such as co-design, project development, and VR skill acquisition
- Documented insights and feedback that can inform next steps and guide facilitation
- A deeper sense of personal and collective responsibility for addressing the selected science challenge
- The ability to articulate both individual and systemic solutions, connecting their learning to real-world change

Implementation Tip

Build in regular time for reflection at the end of each session. Use a consistent format (rubrics, prompts, open discussions) and ensure that all participants—students and adults—have a voice in the process. Consider collecting reflections to track growth over time and inform facilitation strategies.

#5 Demonstration and Celebration: Showcasing Learning and Community Impact

Demonstration and Celebration is the fifth step in the FSLsci process. At this stage, teams transition from investigation and action to sharing what they have learned with a broader audience. This step reinforces the value of participants' work, strengthens community connections, and highlights the impact of collaborative learning.

As part of this phase, teams begin building their VR experiences to visually and interactively represent the outcomes of their science investigations. These immersive scenes serve as a creative and innovative way for participants to demonstrate their understanding and communicate their findings to others.

In addition to developing their VR presentations, teams also prepare table displays and plan oral presentations for a culminating community showcase. This celebratory event brings together students, parenting adults, educators, community leaders, and other invited guests. It offers each team the opportunity to share their journey, findings, and immersive products while reinforcing the power of family engagement, youth voice, and community-centered science learning.

Key Points in the Demonstration and Celebration Step

- Design and finalize VR scenes that reflect each team's science challenge and solutions
- Prepare physical or digital table displays with artifacts, visuals, or models
- Plan presentations to share learning outcomes and project experiences
- Host and participate in a community showcase with peers and community members

Key Outcomes of the Demonstration and Celebration Step

By the end of this phase, each team should have:

- A completed VR experience that represents their learning
- A curated presentation or display for sharing their project with others
- A sense of pride, accomplishment, and ownership in their contributions

#6 Sustainability

Sustainability is the final step in the FSLsci process. At this stage, teams shift their focus toward ensuring that the work they have done continues to have an impact beyond the duration of the program. After investing significant time and effort into exploring and addressing real-life science challenges in their communities, participants are encouraged to identify ways to keep momentum going and advocate for long-term change.

Throughout the reflection and demonstration phases, participants generate and articulate possible solutions to their selected challenges. In the sustainability step, these solutions are elevated—shared with the broader community not only through presentations and displays at the community showcase, but also through direct communication with local leaders. As part of this step, teams write emails or letters to community stakeholders, sharing their findings and inviting them to attend the showcase.

Key Points in the Sustainability Step

This step may include any or all of the following:

- Share proposed solutions publicly during the community showcase
- Write letters or emails to local leaders to share findings and recommendations
- Discuss potential next steps with school leaders, community partners, or advocacy groups
- Reflect on how participants can continue learning, collaborating, or taking action beyond the program

Key Outcomes of the Sustainability Step

By the end of this phase, each team should have:

- Planned for sharing their learning and solutions with authentic audiences
- Demonstrated how science connects to real-world challenges and civic engagement
- Built awareness and advocacy skills by communicating with community stakeholders
- Developed a deeper understanding of science as a tool for change and action

While the steps in the FSLsci process are presented in a linear format, the work is inherently iterative. Many teams begin thinking about solutions and next steps early on—often as they explore their topics during the investigation or reflection stages. The process is intentionally fluid, allowing teams to return to ideas, refine their thinking, and build upon earlier learning. Ultimately, sustainability ensures that participants see science not only as academic content but as a tool for real-world problem-solving and community transformation.

Resource Alert!

Teams collaboratively complete a Team Project Form as they move through the FSLsci process. A sample version of that form is included in the resources section of this toolkit.

Digital Literacy and Immersive Technology: A Pathway to Deeper Learning

A key component of the FSLsci program is the intentional development of digital literacy skills. While VR serves as a central tool to support immersive learning in the program, FSLsci is grounded in a broader vision of expanding access to digital tools and building essential digital literacy skills that empower all participants to confidently navigate and contribute to digital learning environments as they build capacity for critical thinking. In this context, VR is positioned not as an end goal, but as a powerful tool to enhance learning outcomes, foster collaboration,support engagement, and strengthen communication among students, parenting adults, and educators.

VR is one of many emerging digital tools available within the current educational landscape. FSLsci uses it strategically to support immersive, inquiry-driven learning. However, NCFL recognizes that participants bring varying levels of familiarity and comfort with technology. As such, FSLSci coaches should intentionally meet participants where they are and embed opportunities to strengthen digital skills across multiple platforms and contexts.

For example, weekly sessions are conducted virtually, providing participants with opportunities to build proficiency in videoconferencing technology. In addition, as teams collaborate using shared planning documents—such as the Team Planning Form—they gain experience with file management, shared digital workspaces, and cloud-based tools. During the investigation phase, participants also develop critical thinking within the digital space by evaluating the credibility and reliability of online sources for their independent research.

Additional digital literacy skills are embedded throughout the programmatic experience, such as basic navigation in virtual environments and digital communication etiquette. Participants learn to navigate VR spaces using VR headsets and a laptop computer, including teleportation, interacting with objects, and moving through 3D environments. They also engage in virtual meetings and participate in VR sessions through the use of digital platforms, learning proper digital communication norms such as muting and unmuting, using virtual gestures like hand raising and pointing, and respecting personal space in shared virtual environments.

Participants begin by developing a foundational understanding of VR-specific terminology, including key concepts like locomotion and immersive effects, as well as broader extended reality-related terms such as avatar, spatial audio, and immersive content. They then progress to learning how to operate their headsets, including basic setup, navigation, and platform access. Participants also learn troubleshooting tips for their VR headsets, including connecting to Wi-Fi, adjusting headset fit, pairing controllers, creating online accounts, and adjusting privacy settings.

The most advanced skills developed in the program relate to virtual world-building. Participants first learn how to create basic digital objects then progress to combining those objects into fully constructed scenes. For example, two immersive effects, such as a vehicle and a smoke effect, can be combined to show how vehicles contribute to air pollution. These scenes serve as immersive demonstrations of their collaborative learning and community-based science investigations while also allowing space to demonstrate creativity in problem-solving.

Ultimately, the FSLsci program represents a powerful step toward bridging the digital divide. By providing middle and high school students with hands-on, real-world opportunities to build digital literacy, the program supports their readiness for college and career pathways at a critical stage in their development. Through this intentional integration of technology, FSLsci helps empower all youth to dive deeper into science content while they practice the skills that will enable them to thrive in an increasingly digital workforce.

Key Lessons: Guidance for Implementing and Scaling Immersive Learning Programs

Implementing an immersive, multigenerational learning program that engages families, students, and practitioners requires thoughtful planning, sustained investment, and adaptive implementation. Through NCFL's experience piloting immersive learning models, including FSLSci, we have identified key insights that can support schools, districts, and community organizations in launching similar initiatives. While each context will bring unique challenges and opportunities, the lessons outlined in this section offer practical guidance for setting the groundwork in five critical areas (see figure 3). These recommendations are designed to help educational leaders anticipate needs, avoid common pitfalls, and create high-impact learning experiences for all participants.

Figure 3

Planning for Immersive Learning

Tips for Success:

- **Narrow your focus**. A well-designed program will have a clearly defined and manageable scope.
- **Explore partnerships**. NCFL collaborated with BrainSTEM U, a Kentucky-based organization, to provide the VR architects for FSLsci. If your team lacks in-house VR expertise, identify and engage partners who can fill those gaps.
- **Allow adequate time**. FSLsci pilots have ranged from 7 to 15 weeks. Consider how much time your team has and set realistic expectations for content and skill development.

Reflection Questions:

- What is the core focus of your immersive learning program?
- Who are potential partners in your region that can support content, technology, or facilitation?
- How much time can you commit and what outcomes are possible within that timeframe?

Strategies and Reflection for Effective Recruitment

Tips for Success:

- **Leverage partnerships**. Engage local schools and community-based organizations to support participant recruitment.
- **Set clear expectations**. Multi-week programs require time and commitment. Ensure all participants understand the structure and timeline up front.
- **Offer compensation**. Value the time and expertise of practitioners, families, and students. Stipends often mitigate some of the barriers to participation and deepen the shared investment in the experience.

Reflection Questions:

- How will you engage trusted community partners to assist with recruitment?
- Have you clearly communicated the time commitment to all participants?
- What resources or funding can you allocate to honor participants' contributions?

Setting the Stage for Engagement and Learning through Orientation

Tips for Success:

- **Ensure strong Wi-Fi**. Participants will be using mobile devices and VR headsets; a reliable internet connection is essential.
- **Use small groups for setup**. Splitting participants into smaller rotations allows for more personalized support during VR setup.
- **Prioritize relationship building**. Use orientation to start building trust and connection—this increases retention and sets a positive tone for the virtual sessions.

Reflection Questions:

- Is the orientation space equipped with accessible, high-speed Wi-Fi for multiple devices?
- How can we structure our orientation to balance technical setup with team building?
- What strategies will we use to make participants feel welcomed and supported from day one?

Facilitating with Intention

Tips for Success:

- **Respect participants' time**. Start and end sessions promptly to build trust and consistency.
- **Design for engagement**. Follow co-design principles—use a variety of ways for participants to engage, including verbal, written, and visual methods.
- **Use the "Rule of 15**." Keep each session segment under 15 minutes to maintain participant energy and focus.
- **Stay responsive**. Collect and review feedback after each session through exit slips or informal check-ins, then adjust your approach accordingly.

Reflection Questions:

- Are our virtual sessions structured to balance information sharing, interaction, and hands-on work?
- How are we incorporating multiple modes of participation to support all learners?
- What systems do we have in place to collect and act on participant feedback in real time?

Resource Alert!

Sample reflection questions for exit slips are available in the resources section.

Community Showcase: Demonstration and Celebration of Learning

The community showcase is a culminating event where teams share their learning journeys, science investigations, and immersive VR experiences with a broader audience. This step highlights the importance of public demonstration and community recognition while reinforcing the value of student, family, and practitioner collaboration.

Tips for Success:

- **Honor different forms of participation**. Some teams present their VR experience through a screencast to the entire audience, while others prefer informal table displays for one-on-one conversations. Offering multiple options affirms participants as co-designers and supports their comfort levels.
- **Invite a broad and supportive audience**. Make the showcase meaningful by inviting participants' families, school and organizational leaders, community members, funders, and potential future participants. A well-attended event not only celebrates the current cohort's work—it also lays the groundwork for program sustainability and growth.

Reflection Questions:

- What structures can we put in place to help teams feel supported and successful in presenting their work?
- Are we offering multiple ways for participants to share their learning that reflect their strengths and preferences?
- Who should be in the room to honor this work and sustain momentum for future programming?

Closing Reflection

This digital toolkit represents the culmination of NCFL's efforts to co-design, implement, and document an innovative family engagement program that brings together secondary students, parenting adults, and practitioners through immersive learning. Built on the foundation of Family Service Learning and adapted to include emerging technologies and rigorous academic content, FSLsci illustrates what is possible when families and educators are invited to learn and lead—together.

In a recent report, the National Academies of Sciences, Engineering, and Medicine (2021) noted that science education in the United States is largely passive, textbook-driven, and disconnected from the very life it so elegantly describes. Because of this, many students are left "asking a question that is far too often uttered in American schools: 'What does science have to do with my life?'" (p. 21).

The Family Service Learning model provides an effective means of helping students answer this important question by directly connecting local issues with science topics. At the same time, the use of VR as a tool to explore these topics provides access to interactive and immersive learning experiences that extend beyond the textbook and bring learning to life.

In one community showcase, a high school student shared how excited he was to explore science alongside his mother—an experience that connected their different interests in a shared learning journey. A teacher on the same team later reflected that the program had introduced her to entirely new ways of engaging families. These reflections are a testament to the transformational power of immersive learning.

For districts, schools, and organizations seeking to implement high-impact, research-based programs that engage families in meaningful, academic learning—this toolkit offers both guidance and inspiration. Whether your priority is to increase learning outcomes for students, deepen school-family partnerships, or increase access to immersive learning experiences for secondary students, we encourage you to explore how the strategies and practices shared here can be adapted to your local context. And for those ready to go deeper, NCFL welcomes the opportunity to connect, share expertise, and explore new partnerships that advance this work nationally.

We extend our deepest thanks to the funders who made this work possible: U.S. Department of Education community project funding and Carnegie Corporation of New York. We also thank our community partners—BrainSTEM U and Jefferson County Public Schools—whose collaboration, insight, and commitment were instrumental in bringing this vision to life. Together, we can continue to expand the reach of immersive learning, reimagine family engagement in secondary education, and create lasting pathways for deeper learning—within and beyond the classroom walls.

Resources

Community Builder Prompts

Community builder prompts are a crucial part of FSLSci. They allow space for people to reflect and share about themselves, so that they can make connections. This critical part of co-design encourages participants to prioritize relationships.

Some of the prompts used include:

- If you could visit any place—real or fictional—where would it be? Why?
- What is a topic that you are curious about? What are some questions that you have about that topic?
- What have you learned about yourself through your work in this project? What have you learned about your child/parenting adult/teacher through your work together?
- What does it mean to give someone feedback? How might we receive feedback gracefully?

These are a few of the prompts from NCFL's pilots. If you were facilitating a similar program, what types of prompts might you use to support participants in building relationships with one another?

Reflection Questions

The NCFL recognizes the importance of continuous reflection and improvement. Therefore, FSLSci coaches include opportunities for reflection throughout the program. For example, team members complete individual exit slips at the end of each virtual session.

Some of the questions include:

- What problems in your community might your team be interested in investigating? How might you learn more about them this week?
- What challenges are you having with your VR headset or the VR apps?
- What has your team done well? Where might your team improve?
- Through this experience, what have you learned about addressing issues in your community?

These exit slips allow participants to reflect, but also provide FSLSci coaches and VR architects with valuable information about where teams are making progress and where they might need more support.

Team Project Form

Each team collaborates on a Team Project Form that is kept in a shared digital workspace. All team members, FSLSci coaches, and VR architects have access to the form. It is intended to guide teams through the project step-by-step while also allowing the FSLSci coach to track each team's progress. This sample form is from one of NCFL's pilot projects.

Team Project Form

Team Name: ____

School: ____

Team Members: ____

Part 1: Science Investigation

Your team will plan and carry out an investigation to explore a challenge in the community that is connected to science. Together, you will use the steps in the Family Service Learning in Science (FSLsci) process. This project form will help your team as you plan and record your findings.

You will use the information that you collect here to build out your virtual reality (VR) experience in Part 2.

Investigate: Write a paragraph to briefly describe the challenge that your team is investigating.
Identify: Identify a hands-on activity that your team will use to further investigate this issue and how it impacts people in our community. Examples of activities include doing a survey, building a model, running a test, doing an experiment, or examining data for patterns. (At this point, your team is just naming it. You will add more description in Planning and Preparation below.)

Resources: List any resources that you used to learn more about your team's chosen challenge. Include links to websites, articles, videos, and other resources that you used.
Next Generation Science Standard (NGSS): List the standards that are most closely related to your science challenge. Also include any OpenEdSci units that are related.
Planning and Preparation: In "Identify" above, your team named a hands-on activity that you would do to learn more about your challenge. Describe in detail the investigation that your team will use to learn about your science challenge.
Materials: List the materials that your team needs to carry out your investigation.
Roles: List each team member and their role in the investigation.

Action: Write the results and data from your science investigation. Describe what you did and what happened. Your team can include links to photos, drawings, charts, tables, or anything else to show the results of your investigation.
Reflection: Based on what your team learned, what are possible solutions to the challenge that you investigated. What could individuals do to help solve this issue? How do systems need to change to address this issue on a larger scale? Tell why this issue is important to the broader community.
Demonstration of Results and Celebration: See the VR section below.
Sustainability: Name the local official(s) or leaders that your team is inviting to the community showcase. Include their email address.

Part 2: VR Group Project

Your VR group project will be a virtual reality experience that shares your science challenge and project. Content might include background information on your science challenge, an explanation of your science investigation, sharing of your results, and next steps for addressing this challenge.

Your VR group project should contain:

- **2 to 3 learning stations** where participants will view a resource and/or participate in an activity.
- **3 to 4 external resources** incorporated into your learning stations. Examples include videos, infographics, websites, etc.
- **A quiz** that tests the participants' knowledge of your project as shown in the VR experience you have created.

Brief Summary/Vision of your VR project: What will each of your learning stations be? Are there activities? What will a visitor in your room see and do?
VR Location: In which location do you want your VR experience to be?
Immersive Effects (IFX) to be included: Examples: Objects, Animals, People, Weather, Vehicles, Furniture, etc.

Describe your three stations. For each one, include the IFX and resources that your team will include there. Include any links that you have.

Station 1:

Station 2:

Station 3:

Quiz

Write your quiz questions. If they are multiple choice, include the answer options.

References

Billinghurst, M., & Dünser, A. (2012). Augmented reality in the classroom. *Computer*, *45*(7), 56-63.

Hill N.E. & Tyson D.F. (2009). Parental involvement in middle school: a meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, *45*(3), 740-63. doi: 10.1037/a0015362.

Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A systematic review of virtual reality in education. *Themes in Science & Technology Education*, *10*(2), 85-119.

Mapp, K. L. & Bergman, E. (2019). Dual capacity-building framework for family-school partnerships (Version 2). Dual Capacity. http://www.dualcapacity.org/

Mapp, K. L., Henderson, A. T., Cuevas, S., Franco, M. C., & Ewert, S. (2022). *Everyone Wins! The evidence for family-school partnership and implications for practice*. Scholastic: New York.

McKercher, K.A. (2021). *Beyond Sticky Notes: Doing Co-design for Real: Mindsets, methods and movements*. Inscope books.

National Academies of Sciences, Engineering, and Medicine. 2021. *Call to Action for Science Education: Building Opportunity for the Future*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26152.

National Center for Families Learning. (n.d.) *Family Service Learning Facilitator's Guide*.

NGSS Lead States. (2013). Next Generation Science Standards: For States, By States. https://www.nextgenscience.org/

OpenSciEd (n.d.) Explore the curriculum. https://openscied.org/

Parong, J., & Mayer, R. E. (2018). Learning science in immersive virtual reality: Effects on performance, engagement, and self-efficacy. *Journal of Educational Psychology*, *110*(6), 785-797

Science Learning Hub. (n.d.). Ways of investigating in science. https://www.sciencelearn.org.nz/image_maps/111-ways-of-investigating-in-science

Simon, B. S. (2004). High school outreach and family involvement. *Social Psychology of Education*, 7, 185-209.

Smith, T. E., Reinke, W. M., Herman, K. C., & Huang, F. (2019). Understanding family–school engagement across and within elementary- and middle-school contexts. *School Psychology*, *34*(4), 363–375. https://doi.org/10.1037/spq0000290.

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A Digital Playbook

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