




RISE

Readiness through Integrative Science and Engineering (RISE)

Professional Development Guide and Materials

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Acknowledgments

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Introduction to the RISE Professional Guide

This Professional Guide has been developed to use in conjunction with the **RISE website (http://rise.as.tufts.edu/)**. The Guide is structured to provide the theoretical framework and professional development steps involved in implementing the RISE program. It is divided into three sections:

a. a co-constructive approach to professional development;
b. a home-to-school approach to family engagement that levels the roles of teachers and parents, while increasing their agency in co-constructing inclusive school experiences for all children, and
c. a framework-based approach to teaching science, technology, and engineering (STE) that energizes and engages everyone in the classroom.

The Guide is followed by a Professional Materials section designed to provide easy-to-use, printable tools for teachers to use with parents and in the classroom. Throughout this manuscript, underlined text indicates the presence of hyperlinks to professional and audio-visual materials co-constructed by teachers and coaches to bring the RISE approach to the classroom.

In keeping with our commitment to ensuring equity and belonging, we have used gender-inclusive pronouns throughout the Guide. For those who may not be familiar with this form, the pronoun “they” and its derivatives “them/their/themselves” are used in the third-person singular instead of gender-specific pronouns such as “she/her/hers/herself” and “he/him/his/himself”.

The RISE Professional Development Approach

Introduction

RISE is a comprehensive approach to teacher professional development (PD) designed to support science, technology, and engineering (STE) curricula in preschool classrooms. The approach is informed by best practices in professional development, best practices in preschool STE teaching/pedagogy, and an innovative home-to-school process consistent with strengths-based and sociocultural perspectives. This comprehensive PD approach was created for the benefit of dual language learning (DLL) children's transition from home and family into the formal early education setting and leverages an area of curriculum that is particularly well-suited for engaging all children. Through the combined use of professional development workshops, individualized coaching, and peer learning communities, the RISE PD approach places an emphasis on dignity-affirming teacher supports and the promotion of children's sense of belonging within the preschool classroom community.

Teachers, coaches and a community connector listen to an exchange between teachers about structures for moving water in different parts of the world.

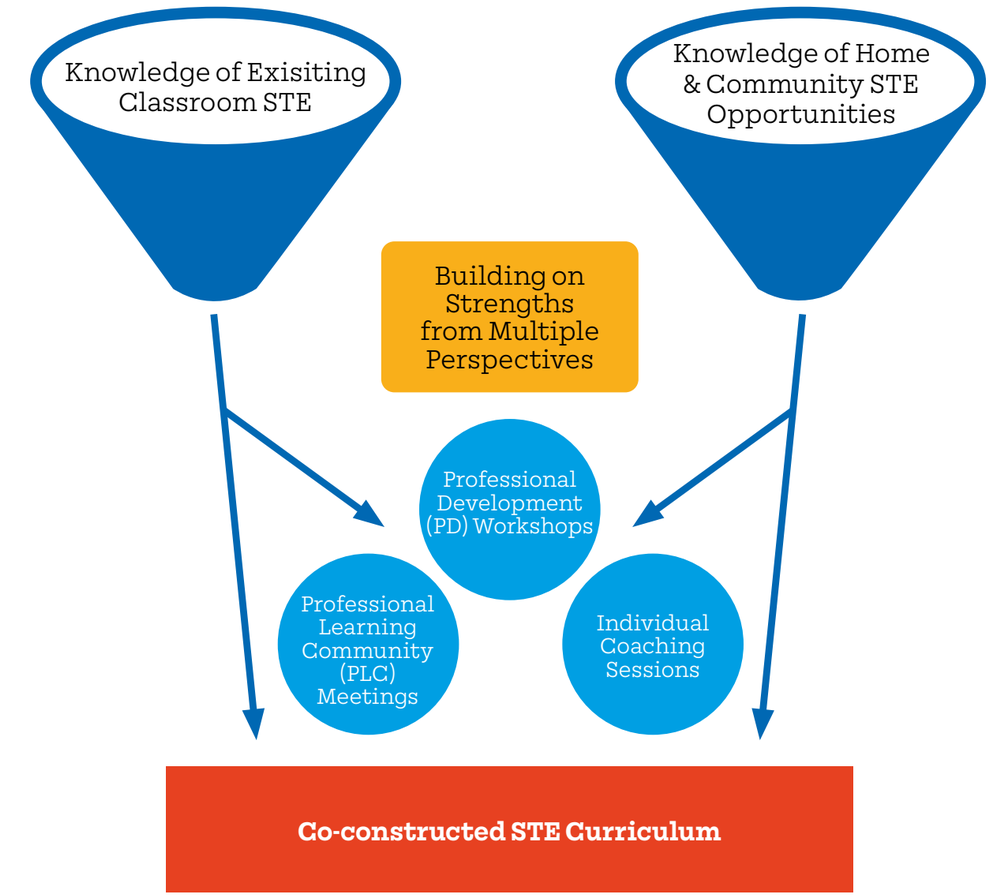
Informed by the field of early childhood education (e.g., Chen & McCray, 2012), RISE espouses that effective PD processes are those that are:

- ***multidimensional***
  (focus on teacher attitudes, knowledge, and practice),
- ***integrated***
  (work within teachers' existing curriculum),
- ***developmental***
  (recognize the importance of providing differentiated adult support and acknowledge multiple trajectories for growth), and
- ***contextualized***
  (establish communities of practice built on trust among peers as well as with administration, recognizing each other as powerful sources of support).

Thus, the RISE program conceptualizes high quality PD as an on-going process involving collaborative participation, composed of tailored training to specific teacher needs and hands-on opportunities for teachers to construct new knowledge. Essential to this approach are intensive PD experiences across time, individualized support via coaches, and on-going support from peers and administrators.

FIGURE 1

RISE PD Approach



The RISE Model of Co-construction

Co-construction in RISE is conceptualized as a process of mutual and reciprocal engagement by researchers, teachers, coaches, parents and members of the community to develop curriculum that empowers teachers and incorporates home and community funds of knowledge. The process of co-construction implemented in RISE is based on key assumptions derived from models of collaborative research partnerships (see Fantuzzo, McWayne, & Childs, 2006). These models propose an equal view of team members whose expertise and skill levels may differ, but whose contributions are equally encouraged and valued as important to the success of the team. Collaborative partnerships rest on three premises:

1. Every member of the working team has expertise to offer;
2. Relational dynamics need to be reciprocal and non-hierarchical;
3. Shared language, goals, and actions are imperative.

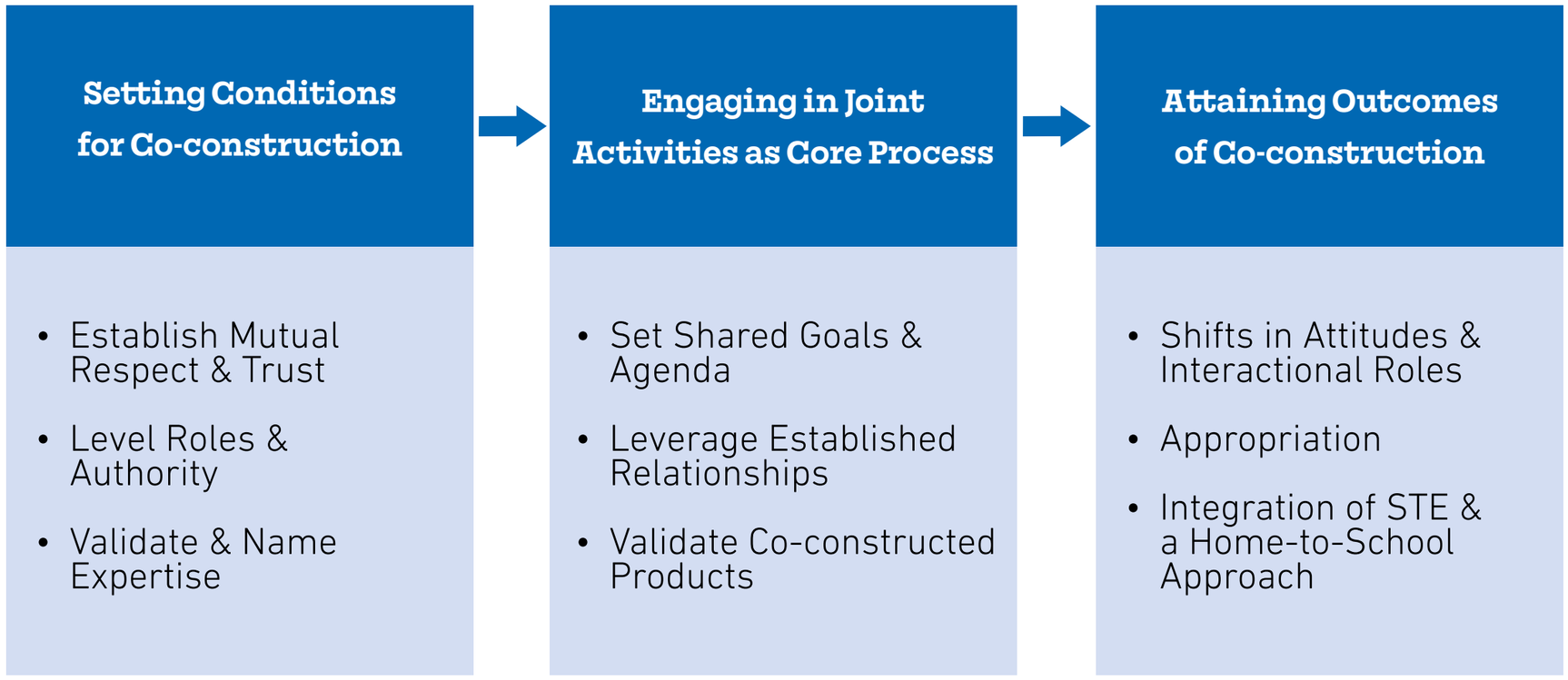
In RISE, this type of collaboration is fostered through joint activities. Sociocultural theorists assert that involving diverse individuals on an equal footing in activities that have shared goals leads to the development of new shared understandings (Cole, 1996; Rogoff, 2003; Werstch, 1985). Joint activities are useful as a PD tool because they have the potential to level the playing field between "experts" and "learners." Specifically, in the RISE approach, joint activities become a tool to engage participants in shared efforts towards shared goals (e.g., STE curriculum development that is culturally-relevant), and to provide a setting where experts and learners contribute their respective knowledge and experience to design joint projects. Recognizing and building on participants' strengths generates communication and leads to "transformations" in their understandings. These transformations lead to the gradual appropriation of various tenets of the RISE approach, and also to shaping it.

Teachers and a RISE researcher discuss options for a neighborhood walk that could be used to teach a science unit.

Throughout the RISE program of PD, researchers documented the process of co-construction as it unfolded with teachers and families (see McWayne, Mistry, Brenneman, Zan, & Greenfield, 2020). Figure 2 depicts this process, and the following section describes each of the three steps in more detail, providing illustrations.

FIGURE 2

The RISE Model of Co-construction



Steps of the
Co-construction Process

STEP 1:

"Setting the Stage" for Co-construction

"I like the coaching part. It's not a shake your finger at you. And that is what I thought it was going to be. And at first it wasn't and I was waiting for it to become a shake your finger, and it never became a shake your finger. So, hope you understand shake your finger. We've all had that experience. Yeah, I like the fact they meet me where I am."

RISE teacher

RISE professional development is intentionally designed to establish a process of co-construction between teachers, support staff (e.g., coaches, education supervisors), and families where the teacher becomes an agent of change who can take responsibility for designing equitable, culturally-sustaining curriculum in their classrooms.

In order to accomplish this, the initial stage of the program is crucial for establishing non-hierarchical, collaborative relationships (see Figure 2):

- Mutual Respect and Trust among Partners
- Leveled Roles and Authority
- Validation/Naming of Expertise

Teachers may be skeptical at first, as they often hear the term "partnership" used in the context of relationships where power is skewed towards experts. However, they soon understand that the success of the RISE approach involves: 1) the theoretical and content expertise of the PD team, 2) the applied expertise of teachers who know best what is possible in the classroom and what can be sustained over time, and 3) the expertise of families who know their children and communities best and have much to offer in building an equitable curriculum. Importantly, these forms of expertise are considered equally valuable.

Furthermore, these relational priorities are not only expressed in RISE discourse, but in practice. From the start, RISE coaches treat the teacher-coach dyad as a "we" designed to build upon teachers' existing curriculum and instructional practices. Coaches set the stage by taking time in the beginning of the coaching relationship to not only get to know the teacher and children in the classroom but to allow the teacher to become familiar with the coach and their own teaching style/pedagogy. By spending time informally in the classrooms and engaging in more casual conversations at the beginning of the coaching experience, trust is established and a transition away from a hierarchical relationship to a leveling of roles is created. This time spent in the beginning sets the stage for all work engaging teachers and coaches thereafter.

"Setting the stage" does not only involve nurturing trusting relationships. In every aspect of professional development, the RISE team is intentional in designing opportunities that build on teachers' strengths and meet them where they are. Coaches highlight teachers' current STE practice, treat them as agents of change, and help them brainstorm strategies for teaching STE that incorporate information from children's lives outside of school. Sometimes this involves scaffolding and guided participation that slows down the learning process, providing time for teachers to develop a clear understanding of the STE content and the process of co-construction.

Although coaches may keep the role of asking questions and suggesting new teaching strategies, teachers are responsible for finding their own answers and making their own decisions about how to deepen a curriculum unit, or how to connect it to what children already know. There are no set prescriptions, and teachers are encouraged to use their own experience and resources creatively to incorporate new STE concepts, materials, and strategies into their teaching. In turn, teachers are expected to use these same strategies in their work with families, as will be seen in later sections of this Guide.

STEP 2:

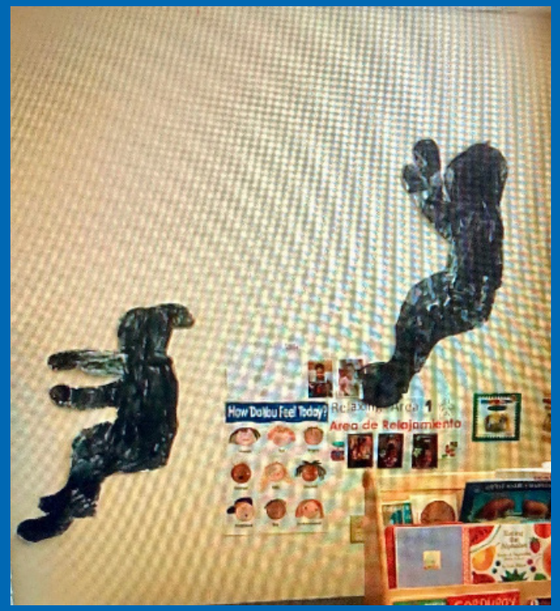
Engaging in Joint Activities and a Shared Learning Process

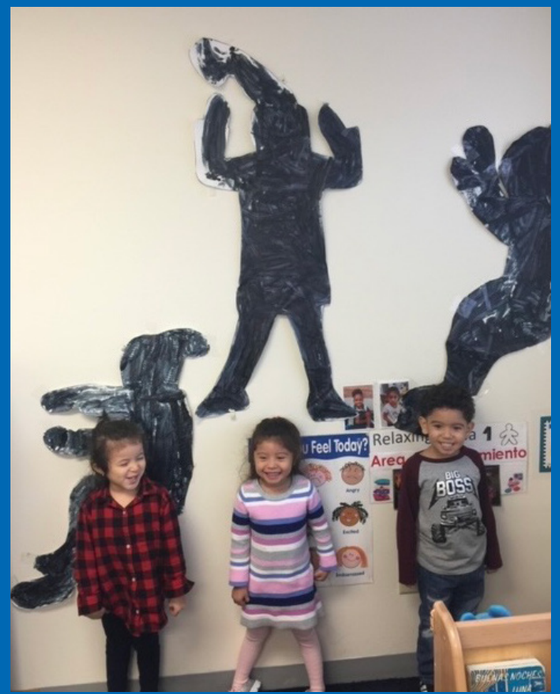
Joint activities and shared learning processes are an integral part of the RISE PD approach as they bring people of different backgrounds together in meaningful ways. The RISE approach relies on joint activities to establish three important processes of co-construction:

- Setting shared goals and agenda
- Leveraging relationships
- Validating co-constructed products

Not all teachers "appropriate" this kind of co-constructive activity immediately. Some teachers may be reluctant about their ability to deepen their teaching in a particular content area. Others may be reluctant to approach families. Since co-construction does not come naturally to everyone, time is dedicated in large group workshops for scaffolded practice. For example, at first, teachers might stay with their respective coaches in small group activities to build relationships with each other and with their coach. Over time, teachers are thoughtfully assigned to integrated groups that allow for some risk-taking and extended collaboration opportunities to gain insight from other teachers outside their immediate coaching group. The example to the right shows how co-construction occurred in such a way in a PD workshop.

One experienced teacher, originally from Guatemala, mentioned having some hesitation to talk with monolingual English-speaking parents as they might not understand the Guatemalan accent. During RISE training, however, with the help of peers, this teacher designed an activity for the light and shadows unit that drew parents into the classroom in a fun way that did not involve much language use. Children were asked to lie on the floor in unusual positions and trace their bodies on large white paper sheets. Children then cut and painted each sheet, and the teacher hung them on the wall around the classroom. When adults came to pick up their children, the teacher challenged them to recognize their child's shape on the wall. Parents had fun with this activity as it was not easy to recognize who was who, and the teacher reported feeling more comfortable about interacting with parents after its completion.





Joint activities also can be designed for teachers and families. An initial joint activity between teachers and parents might involve the thoughtful design of a neighborhood walk, where families share their knowledge of the community, and identify stops along the way—e.g., grocery store, community garden —as in the example below. Parents, who may be reluctant to see themselves as equal partners with teachers, soon understand that they do have knowledge about their children's lives that teachers do not, and that sharing it can improve the quality of their child's educational experience. Teachers reinforce this idea by explicitly labeling and validating parents' expertise and by asking parents to correct any inaccuracies in the mapping, just as coaches do with teachers early in the relationship-building process.

For an example of a discussion where RISE team members and teachers are co-constructing a neighborhood walk, click here.

In other RISE joint activities, teachers and parents worked together to create products that were a source of pride, such as a scrapbook with a collection of pages on "Our Children's Worlds." Alternatively, click here for examples of parents and teachers using recyclable materials to build structures reminiscent of their childhoods and communities (e.g., a model of the Great Wall of China, an apartment in Chinatown, an airport

and recreational field), or something as simple as flyers for coffee hours to invite other parents to a joint activity.

Importantly, in these joint activities, coaches, teachers, and parents do not just work side-by-side. The activity must be set up to involve collaboration and for a leveling of roles to occur. It may take a couple of instances for this dynamic to be established. This effort reinforces the evolution of mutual trust and respect so that eventually partners are more open to discussing sensitive topics. For example, in the activities highlighted here, parents discuss difficulties for family engagement, as well as cultural norms and preferences with teachers.

STEP 3:

Attaining Outcomes of Co-construction

Teachers and coaches generating ideas for classroom experiences based on information gathered from Home-to-School Information Sheets.

Over time, RISE PD develops co-construction as the modus operandi of normal interactions between coaches and teachers, among teachers, between teachers and families, and even between teachers and children. In a truly co-constructive process, the whole is greater than the sum of its parts, and it is hard to pinpoint where ideas come from because they are generated by a group of people thinking together, where the ideas lead to something new. Primary outcomes of co-construction in RISE include:

- Shifts in attitudes and interactional roles
- Appropriation of RISE concepts and tools
- Integration of the STE and Home-School Connection (HSC) components

In the first year, teachers take time to become familiar with STE terminology and the home-to-school approach to engaging families (described in detail in Sections 2 and 3 of this Guide). As time passes, they begin to appropriate RISE concepts such as **home-to-school** and **crosscutting concepts.** They also begin to use tools such as **Home-to-School Information Sheets** and **Questions of the Day (QOTD)**.

Eventually, teachers reach the phase of integrating STE and HSC. This ability to integrate children's daily lives within the STE curriculum is the **final goal of co-construction**.

In the various PD contexts, teachers develop a growing awareness of their own agency as creators of STE curriculum and engagers of families as equal partners.

> **"Being in RISE woke me up, because before I was sleeping in science. It's like science was there but I didn't see it. Now I see science everywhere I go."**
>
> RISE teacher

Over time teachers grow from an initial expectation that coaches will "give" them curriculum to use in their classrooms, to co-constructing it. One teacher powerfully describes this shift: Early in the PD process, coaches can be expected to serve as the main facilitators of small groups, but over time, teachers become comfortable enough with each other to freely share their RISE activities and practices without prompting from their coaches. In fact, by the end of the second year of PD, coaches may find that they do not need to facilitate discussions any more as teachers take over that leadership role. See for example, a **meeting** where teachers are sharing ideas they can use in an STE unit on "moving water" based on their own life experiences in different cultural communities. Whereas at first, teachers were more reliant on examples provided by RISE, they were beginning to share their own stories and expertise, exemplifying the appropriation of the RISE co-construction approach.

After viewing the video clips about "Moving Water," feel free to click on other examples of co-construction by teachers who have appropriated this RISE approach. The series of videos showcase practices that teachers build as part of the three steps of co-construction highlighted in Figure 2.

Also impressive can be the transformation of teachers' attitudes towards families. In the course of two years, teachers can go from a patronizing discourse with regard to parents and a sense that parents do not have enough time, support, and resources to be engaged in meaningful activities, to thinking of them as "friends" and equal partners, showing appreciation for their contributions to curriculum.

Click here, scroll to the bottom half of the page and listen to the audio of a Head Start educational supervisor sharing the value and impact that RISE has had on her program.

Experiential learning to stimulate HSC+STE integration

Throughout PD Workshops, teachers experience thoughts and emotions similar to those they are encouraged to elicit in their students—e.g., the joy associated with recounting stories from home. For instance, when the STE workshop is on "Light and Shadow," teachers can be encouraged to create puppets of a popular character or for telling a favorite story from their childhood. Alternatively, they might bring photos of window treatments and materials from their homes to show the potential diversity that could be obtained from asking families to do the same.

Once teachers bring information from their own homes or from their classroom families to PD Workshops, they can be given the task of integrating it into a STE unit they are preparing to teach. When teachers become familiar with this format, it can become a part of "intentional planning" to develop ways for gaining access to information from families in order to integrate the information into a unit (See Professional Materials p.93). Modeling the order of events as they might occur in the classroom and documenting them in planning sheets is an important strategy reinforced throughout professional development to give teachers a vision for integrating HSC and STE in their own classrooms.

Experiential learning can also happen in games or structured activities such as the HSC Sorting Task as will be discussed in Section 2 of this Guide.

Two teachers from Arabic countries created shadow puppets of wedding participants just like they did as children.

Structure and Organization of PD

As mentioned earlier, the RISE approach to teacher PD is comprehensive and views the teacher as a whole person. Because RISE PD seeks to attain enduring, transformative outcomes, it is intensive, individualized, and flexible enough to work within the structures of existing curricula and program routines. This approach to PD requires intentional and targeted planning aimed at teaching specific STE concepts, while providing teachers with classroom materials, tools, and templates that enhance their content knowledge, pedagogy, and family engagement. Importantly, coaches provide differentiated support to motivate teachers to take action and greater control over their instructional practices. Furthermore, the number of possible STE areas the RISE approach might cover is unlimited, as is the possibility of expanding it to other areas of curriculum.

Members of the RISE Professional Development Team

Team Leaders

Professionals with expertise in science education, curriculum development, preschool teacher preparation and support, early childhood programs and family engagement in diverse sociocultural communities.

Coaches

Graduate-level early childhood specialists specifically hired for their experience in the early childhood classroom and as leaders in the field. They have strengths in classroom management and in curriculum development, particularly in relation to STEM. The Lead Coach supports the coordination of the coaching team through individual check ins and group reflection and development, as well as provides direct coaching to their own set of assigned teachers.

Community Connectors (CCs)

Knowledgeable members of the communities where the programs are located, hired as a resource to use their knowledge to help teachers connect STE curriculum to salient aspects of children's cultural communities and home lives. Though they are not responsible for outreach or for bringing parents to the school, they support teachers and administrators as key informants and **thought partners**. The Lead Community Connector works in conjunction with the STE Lead Coach to provide more personalized support to coaches and teachers upon their request.

Teachers, coach and a researcher co-construct potential experiences around absorbing and repelling water during a PD workshop.

PD Structural Components

An important outcome that the RISE Project seeks to attain with teachers is increasing their sense of agency over curriculum and instruction. To this effect, the entire RISE team provides day-long workshops, while coaches work closely with teachers in individual coaching sessions and Professional Learning Communities (PLC's). All PD is planned ahead to include robust coaching practices such as engaging, interactive content, experiential learning, and appropriate scaffolding that meets teachers where they are in their curriculum and their own practice, building on their own strengths and knowledge.

It is important to note that, in order to infuse co-construction as a modus operandi between teachers and coaches, and eventually between teachers and families, the RISE team itself models collaborative partnerships and joint activities in its internal workings. For example, planning for PD workshops is structured to last two full days. On the first day, the team splits by area of specialty. Home-School Connection (HSC) researchers and community connectors discuss potential ways of bringing information from children's homes into a specific science unit (e.g. Light and Shadow, Sound and Music, etc.). The Science Technology and Engineering (STE) researchers and coaches gather to hash out ways to introduce elements of the science frameworks. On the second day, both sub-teams gather together as partners to collaborate in a joint activity—the development of the PD workshop agenda and specific activities. As this process is repeated in preparation for several workshops, all participants become aware of their unique roles in the team and actively contribute to planning, delivery, and feedback. The expectation is that coaches will replicate the internal dynamics of the RISE team in their relationships with teachers and, in turn, that teachers will use these same dynamics to engage with families.

Whole Group Workshops

In the RISE program, full-day workshops are spaced across each of two school years (for a total of 10-12 full-day workshops), during which teachers are introduced to STE content consistent with state learning standards for preschool and the **Early Science Framework** (Greenfield et al., 2017). Workshops begin with brainstorming and co-constructing ways to access children's familiar knowledge. PD leaders also demonstrate ways that teachers can address the STE concepts through engaging, hands-on classroom experiences. Teachers leave the workshop with easy-to-use, inexpensive classroom materials for upcoming units, as well as visual prompts (e.g., posters or placards) that they can place strategically around their classrooms at adult eye level reminding them of aspects of the RISE approach (**Click here for a printable poster**). Importantly, teachers and project personnel work together as colleagues during the workshops to expand understanding and build towards an integrative STE curriculum that honors home and community information (as will be seen in more detail in Section 2).

During a PD Workshop on blocks and ramps, teachers were invited to explore ramps. This open-ended experience allowed teachers to explore various aspects of the Early Science Framework that will be presented in Section 3.

Generally, the morning portion of workshops is the most "didactic", and the whole group is kept together for the presentation of new information. Rather than a lecture format, presentations tend to be multimedia and involve interactive exercises with teachers. In the afternoon, participants break into small groups which rotate among various Activity Centers staffed by coaches. This kind of session will be discussed below as a joint activity.

For now, it may be useful to consider a Whole Group Workshop focusing on sound and music. In preparation for this Workshop, teachers may be asked to find instruments or pictures of instruments from their childhood as well as recall familiar children's songs from their upbringing. This is a way for teachers to become familiar with the kinds of home information they could ask for from parents, and to share in the excitement of bringing their own life experiences into their teaching.

When the whole group convenes, the morning may begin with the introduction of key aspects of sound such as volume, rhythm, pitch and duration as in the chart below.

Volume	Pitch	Duration
• Using one tool, which item is the loudest? • Using different tools but one bowl, which tool makes the loudest sound? Softest? • Using one tool and one item, can you make a loud sound? Soft sound?	• Using one tool, which of the items makes a high sound? Which makes a low sound? • How can you sort these instruments as high or low sounds? • How can you use your voice to make a high/low sound?	• Using one tool, which item makes a long sound? Which item makes a short sound? • Using one tool and one bowl, how can you create a long sound? Short sound? • Can you follow these musical patterns?

Teachers were presented with a variety of tools at their tables and asked to explore the materials using these guiding prompts.

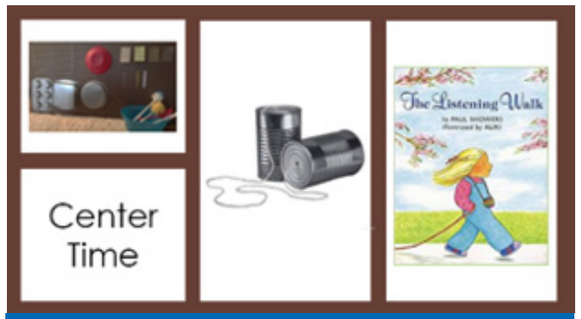
Subsequently, these key aspects can be connected to the STE crosscutting concept of "patterns." As a group, teachers may tap out sound patterns visually displayed, as in the following picture.

A visual representation of a pattern teachers clapped to during a PD workshop about sound and music.

Teachers practice reading these patterns without having to know musical notation and can bring this experience back to their classroom to do with the children to teach them the concept of rhythm. Teachers can make HSC connections by sharing the information about instruments from their childhood as well as familiar children's songs, tapping the patterns in these songs and exposing children to the sounds familiar instruments make. This type of sharing validates teachers' own childhood experiences, allowing them to see and personally feel the HSC and STE integration through the eyes of a child.

Images brought by teachers to a PD Workshop depicting instruments they heard in their childhoods.

After a morning of accessing new information, sharing and brief exploration, the afternoon can be designed with three very different experiences for teachers to further investigate and understand the STE focal concept of the PD: Sound. Teachers are assigned to teams that rotate through three small group experiences: a kitchen band, visual vibrations, and a Listening Walk.



Visual representations of experiences teachers engaged in during a PD Workshop.

Click here for examples and materials pertaining to teaching about Sound and Music.

These experiences all can be brought back to the classroom and replicated with the children. By inviting teachers to "play" with new materials and engage in new activities during PD, they have the opportunity to discover the STE concepts on their own first, experience the joy of these discoveries and reflect on how the children in their classroom might experience this for themselves. This opportunity to play is essential in having teachers connect with the PD content and build excitement for bringing the content back to their own classrooms. By the end of the day, teachers will have engaged in rich learning around sound and music as well as given some thought to how to deepen, connect and extend this content into their own classrooms.

Teachers co-construct an experiment for moving water through pipes. Roles have been leveled. The coach (with her back to the picture) is one more member of the team.

Professional Learning Communities (PLCs)

Teachers across program sites meet approximately monthly in small groups of 7-10 people, for between 60 and 90 minutes each time. Early in the process, each coach facilitates these small group meetings, with teachers taking a greater leadership role in later meetings. In PLCs, teachers can showcase successful classroom practices, share challenges, and take time to examine and reflect upon their own and their peers' work. They may also brainstorm science vocabulary, practice formulating **meaningful questions** (e.g. attention focusing, problem posing, action), and engage in different kinds of inquiry (e.g. **guided, structured, open**). They may intentionally plan lesson content and rollout, predict and plan how to address common misconceptions while keeping topics "alive" in the classroom, and support each other as issues emerge. PLCs also aid in the creation of strong peer networks that teachers use to support one another, both inside and outside formal RISE gatherings and across programs.

PLCs are also an opportunity to discuss RISE's innovative approach to seeking home-to-school information. In fact, teachers who are immigrants or members of racial/ethnic minoritized groups may enjoy talking about life experiences that are not usually represented in curricula. For example, in planning to teach weight and scales, teachers may ask parents which measuring system (metric vs. avoirdupois) they learned, or the kinds of scales they were familiar with as children (mechanical vs. digital). Similarly, in preparing a lesson to "Look inside Fruits," teachers may begin by sharing the names of fruits in their countries of origin, sometimes in other languages, and personal memories involving fruits. (In one RISE session, a teacher mentioned growing up in a community where pineapples were so plentiful that individuals would pick them as needed!). By making personal connections with a STE topic, teachers can then think of questions to ask parents and ways to collect home information to teach a unit. PLCs can thus serve as a time to think about diversifying the curriculum and making it culturally relevant to the children teachers have in their classrooms at any given time.

Individualized Coaching Support

Coaches visit classrooms bi-weekly and provide individualized support to a group of 5 to 7 teachers. During classroom visits (lasting one to two hours each), coaches model STE practices, observe instruction and children's responses, and support teachers in connecting home and community information into their STE curriculum. Ideally, the same day, the **teacher and coach meet one-on-one** to reflect on that day's experience and plan for upcoming HSC and STE experiences. For the first few months, the focus is primarily on establishing relationships where the teacher and the coach work as equal partners, creating the conditions for co-construction of curriculum. In subsequent meetings, the coach and teacher engage in self-reflection (sometimes, video-based) and goal setting (Skiffington et al., 2011). All the while, coaches model and scaffold HSC and STE integrative activities. By the end of the project, depending on the duration and intensity of training, teachers can be expected to design and teach several HSC and STE integrated units, at first with coaching support, and eventually independently. To monitor teacher progress over time, they can use the **Intentional Planning Sheet**, and may also create a tracking sheet.

Highlighting Home-School Connections (HSC) in PD

One of the challenges of the RISE approach is for teachers to wrap their minds around moving from a school-to-home to a home-to-school modality for engaging families. In this modality, the work children do in the classroom is seen as an extension of what happens everyday at home. This simple reversal of direction requires changes in classroom practice and in how teachers understand the value of family engagement (See Section 2 for a more in-depth description and specific illustrations). The quote from a RISE teacher below exemplifies the effort and support required to make this shift:

> **Between PDs, coaching and mentoring, I was able to work with my coach to find different ways to actually make it start working!**
>
> RISE teacher (in reference to engaging families in home-to-school experiences)

Planning the HSC component of professional development involves thinking about community practices, childhood experiences, and everyday objects that connect with STE concepts before each PD experience. Team members and community connectors think about their own experiences growing up and the kinds of questions to ask to elicit similar stories from teachers in small group activities. They can do this as reflective listeners and by labeling teachers' behaviors and knowledge as it is shared. In turn, teachers are encouraged to use these strategies with their classroom families. For example, as mentioned earlier, when a workshop covers an STE concept such as "light and shadow," teachers can be encouraged to bring textiles from their homes to represent concepts such as "opacity," "translucence," and "transparency." When teaching the science concept "Sound and Music," teachers can encourage parents and children to reminisce on rhythms, rhymes and instruments from their childhoods. Notably, no one's familiar knowledge is taken for granted or assumed. In RISE PD, researchers, coaches, community connectors, and (eventually) teachers take a stance of humility and curiosity to learn about what each member of the team and classroom brings to each STE learning experience.

Just as validation of teachers' existing practices is an important component of the initial relationship-building process, coaches continue to validate products that are co-constructed in the context of the coaching relationship. One way to do so is by having coaches display their teachers' emerging HSC work in a Gallery Walk during Whole Group Workshops.

In a review of effective preschool PD, Hamre, Partee, and Mulcahy (2017) noted that in most states, teachers are required simply to complete a certain number of PD clock hours. In the yearly report released by the National Institute for Early Education Research (NIEER) on the state of publicly-funded preschool programs in the US, to meet the quality benchmark for staff professional development, teachers and assistant teachers must participate in at least 15 hours of PD. This PD must involve coaching as well as having individualized PD plans. In the 2019 yearbook (Friedman-Kraus et al., 2020), of the 62 state-funded preschool initiatives, only 13 met this benchmark.

The RISE PD approach far exceeds the requirements for meeting this benchmark. Furthermore, our comprehensive PD approach is consistent with calls for practice-based, individualized, and ongoing supports (Klein & Gomby, 2008; Zaslow et al., 2010). Spacing workshops across the school year allows teachers and support staff to put inquiry-based lessons into practice and work as a community of learners. This differs greatly from the way much PD is implemented—in one-shot workshops that are disconnected from one another and follow a "one size fits all" approach.

CONCLUSION

We have seen so far the "how" of the RISE approach to professional development: co-construction among individuals who are involved as equals in joint activities, where everyone's ideas serve as building blocks for establishing new ways of teaching children and engaging families.

In the next two sections, we will see the "what" of the RISE approach. We will first see the primacy of engaging information from children's homes in the development of culturally-relevant curriculum. Whereas, typically, family engagement is seen as a way of extending what happens in school, in the RISE approach, families and the information they provide about children's lives outside of school become sources of curriculum. For that reason, we talk about the Home-to-School approach next and argue that this approach to family engagement can be used for teaching any content area. Once teachers adopt a co-constructive approach to working with each other and extend this modality to working with families, they develop a stronger sense of agency about teaching and learning in their own classrooms.

In the final section of the Guide, we will discuss the "what" of STE teaching and learning (the specific content focus of RISE) while providing specific illustrations of teachers' integration of HSC+STE across several early childhood classrooms.

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The RISE Home-to-School Approach to Family Engagement

The purpose of this section is to provide ideas and strategies for family engagement that promote equitable, culturally-inclusive curriculum. The section has been especially designed to work with students and families whose lived experiences are not typically represented in school curricula.

Diversity is a source of strength in home-school partnerships and curriculum development efforts.

The HSC approach to family engagement highlights the importance of:

- a school curriculum that intentionally elicits and reflects *all* children's familiar knowledge and prior experience;
- respectful, trusting, and non-hierarchical dialogue between parents and teachers;
- the contributions that all families can and do make to preschool children's knowledge and learning.

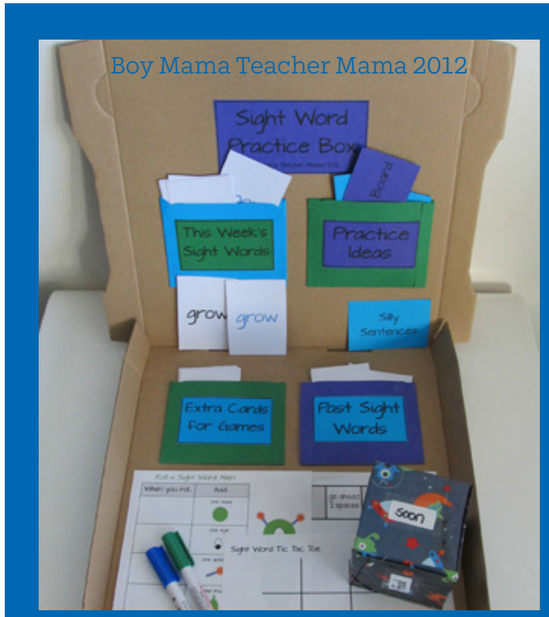
We propose that by placing value on the knowledge and experiences students have from their homes and communities, and by making connections between these experiences and curriculum, teachers can create classroom experiences that are truly powerful for students. We also believe that diversifying the curriculum in this way is enriching for all students. Thus, in the RISE approach, diversity is a source of strength in home-school partnerships and curriculum development efforts, "not a complication to be overcome" (Pope Edwards & Kutaka, 2015, p. 35). Therefore, **the approach rejects a deficit perspective of low-income, ethnoculturally-diverse, and other marginalized families, instead focusing on the resources families bring to their child's education that often remain unacknowledged in classrooms.**

Section 2 begins by situating the Home-School Collaboration component in the field of family engagement, and presenting its broader theoretical and conceptual grounding. We then provide a step-by-step approach for moving from theory to practice and bringing children's everyday lives into the classroom. We include concrete tools and strategies for engaging staff and families in patterns of collaboration that we call ***home-to-school***, as information from home is viewed as providing curriculum-relevant ideas and content to be used in the classroom. In the RISE Project, we use science, technology, and engineering as the areas of curriculum through which to build the home-to-school bridge.

Why do we need yet another family engagement model?

Although research has acknowledged that family engagement in children's schooling occurs in many forms, most practice focuses primarily on school-based participation, or what we call the school-to-home link. One explanation for this idea of "getting parents to the school" is the belief that parents need to be in contact with educators to be instructed on how the school teaches children as well as how to engage their own children's learning at home (Doucet, 2008).

This school-to-home perspective can be a double-edged sword—very valuable at times, but also a tool for perpetuating power differentials that exist in society at large through parent-teacher interactions. Indeed, research has shown that when faced with parents who are marginalized, teachers may "harbor beliefs, attitudes, and fears about families that hinder their ability to cultivate partnerships" (Mapp and Hong, 2010, p. 346). For example, teachers sometimes label families as "hard-to-reach" and do not take responsibility for engaging them; or they think of parents who do not appear to do the typical activities (e.g., read) with their children at home as risk factors. These attitudes can blind educators to family strengths and limit their attempts to access the potentially powerful home-based educational engagement that does occur. As a result, cultural-specific forms of family involvement can remain largely invisible to educators (Doucet, 2011a; McWayne, Melzi, Limlingan & Schick, 2016). In order to address this shortcoming, we need to adopt new points of view.



SIGHT WORD PRACTICE BOX

This activity kit is an example of a School-to-Home interaction.

Among those who call for new points of view, Kim and Sheridan (2015) recommend emphasizing the relational aspects of engagement and thinking of the parent-teacher relationship as an "end in itself". Reaching such a new point means we need to better understand what fosters or prevents successful family-teachers relationships. In fact, "some partnership practices may be experienced as foreign or uncomfortable to family members" (Kim and Sheridan, 2015, p. 7). The question then becomes, what do we do about it? One thought is to develop more "co-determined" activities and "joint engagement" between teachers and parents (Kim and Sheridan, 2015). The terms "co-determined" and "joint" refer to activities where parents and teachers develop relationships as equals working together. The fundamental shift to a "relational approach" suggests the need for a different perspective toward family-school connections that rethinks current family-engagement models. Doing so will lead to new types and sources of knowledge that will make current curriculum models richer and more relevant for all students (McWayne, 2015; McWayne, Doucet, & Mistry, 2019).

Parents working together sharing their lived experiences with teachers as equal partners is an example of a Home-to-School interaction.

“Building a new imagination for family engagement is not coming up with new and creative solutions to increasing family presence at school, per se, but is about forging a community of respect around parents and families, and about recognizing the deeper ways in which parents and families are and can be ‘present’ in their children’s education and in relationship with their children’s schools.”

McWayne, Doucet, & Mistry, 2019, p. 2

Parents and teachers work together creating a familiar structure that has meaning to all using recyclables. In this instance, a replica of the Great Wall of China was co-constructed.

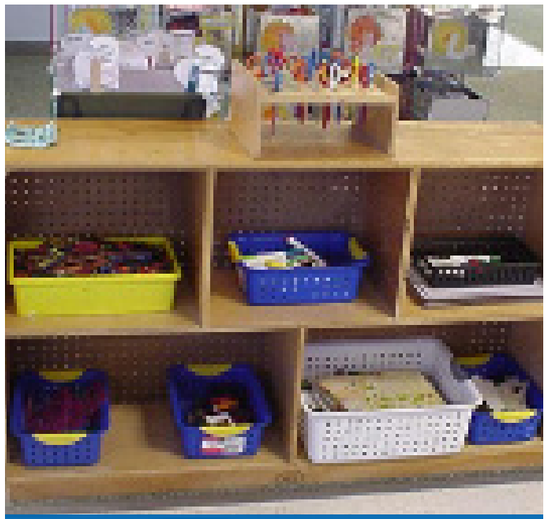
The “community of respect” we refer to is one in which parents are not only welcomed and treated kindly in interactions with teachers. Rather, we envision a school community in which teachers understand at a deep level the ways in which egalitarian partnerships with parents can make them better teachers. The new forms of family-school partnerships that are possible when we shift our thinking in this way are what we hope to illustrate throughout this section of the professional development guide. These new forms of home-to-school partnerships may be particularly effective for: (a) developing family-school relationships built on trust and mutual respect, (b) supporting family engagement that is culturally responsive and meaningful for families and teachers, and (c) addressing typical barriers to family engagement.

The next sections provide the theoretical and conceptual foundations for our proposed shift in focus from school-to-home to home-to-school, followed by a step-by-step process to guide teachers in “rotating their lens” to begin focusing on family life, as told by families and children, as a source of immensely rich, but mostly untapped information they can use in their classrooms.

Theoretical Frameworks

1. Sociocultural Theory

To facilitate all children's transition to school, in addition to being sensitive to the perspectives of families, it is essential to recognize that individuals as well as programs enter into relationships with parents with knowledge and (often) biases that are taken for granted. Sociocultural theory is a useful framework for identifying the 'hidden' assumptions that are embedded in what is seen as 'normal or 'typical' in classrooms and schools. The sociocultural lens can serve to raise educators' awareness about classroom practices and training that may be typical for the dominant group but not for others.



The literacy center is a place where students find writing, cutting, and other tools they use every day in class.

Lev Vygotsky (1978), the founder of sociocultural theory, proposed that:

* **culture is integral in how we think and navigate our surroundings because it is represented in the tools and signs (see Table 1) by which we organize, understand, and communicate our thoughts about our physical and social world.**

* **the tools and signs we use in our everyday lives have developed over generations and are used in a community's customs, practices, and activities. For example, knowledge or facts represented in books or the written word are considered the core component of the formal curriculum in schools because written literacy is a foundational tool in educational settings in the U.S.**

* **learning and development within classrooms happens as we adopt these tools and make them a part of our lives, which in turn enables us to participate as full members of our communities.**

In the Vygotskyan perspective, as children learn to use the tools (e.g., books) and symbols (e.g., written language, numbers) favored in their communities, in activities prepared and guided by adults (e.g., story time, circle time), their thinking is transformed (they acquire literacy, numeracy) in ways that are valued in their communities. For example, "circle time" is an activity where the world is presented through physical and symbolic tools—e.g. weather charts, daily schedules, books. In these activities, adults guide children to learn to display and talk about weather patterns, to interpret schedules, to read and use numbers to represent quantities, and so forth. Children also learn that life is structured around school, and the school's way of "doing" is valued by adults in their community. Thus, children strive to master the use of these tools, and in so doing learn to organize their thinking in culturally-preferred ways. These ways may seem the "best" or the "only" ones until they are exposed to other ways, favored in other cultural communities. Classrooms with ethnocultural diversity provide a unique opportunity for children to interact with peers who, themselves, may come from communities that speak a different language, or dress differently. These children have the unique opportunity, at a very early age, to learn and accept variability in human practices without devaluing what is different. This is why diverse classroom settings provide a unique opportunity to guide young children into developing flexible minds early in their lives.

Vygotsky spoke of physical and symbolic tools favored in cultural communities as "mediational means" because they help us think about and interact with the world around us – they mediate our understanding of our world. For example, if we did not have language, we could not name the things we see everyday. Speaking different languages, however, may change how we perceive the world around us. In the U.S., literacy is an essential tool for adult functioning. Consider, however, a geographic setting that may make the use of machetes an essential skill for survival and adult functioning. The focus on learning to use a machete and learning to read transform children's thinking in ways that are different, yet adaptive in their community contexts (Rogoff, 2003).

During circle time a teacher and students discuss a story.

There are many different ways to tell stories, especially across written and oral traditions.

In U.S. preschools, "circle time" often includes reading stories that follow a linear, chronological structure around a central topic (or a story plot). This particular definition of "story" is often favored during story time, and eventually becomes the expected format for most stories told in classrooms. Stories do not have a universal format, however. Some children may come from homes where adults have always used this linear structure when telling or reading stories to them. Other children, however, may be used to freeform styles of story-telling that are not clearly linear because they are interjected by jokes, or interrupted by side stories—such as might be told by a grandparent during a shared family activity of shelling peas. When these children try to engage in this kind of storytelling in the classroom, they may be corrected by teachers in an effort to "help" them tell stories the "right" (linear, sequenced) way. These children are likely to learn that the stories they hear at home are not valued in school. More important still, their peers in school miss an opportunity to learn about an alternative form of storytelling that actually may be better suited to their learning styles.

Learning centers are another example of a "tool" used in classrooms to engage children in activities that are developmentally appropriate such as: sensory stimulation (water and sand tables), independent reading (book center), dramatic play (tools and costumes), self-expression (art center), and so forth. Table 1 in the next page illustrates some expected transformations in preschool children's thinking and how they are accomplished in a preschool setting. It should be noted that the meaning of these mediational tools may not always be apparent to families who have not been educated in mainstream U.S. settings.

TABLE 1

Common Mediational Tools
in Preschool Classrooms

Mediational Tools		Expected transformations in children's thinking
Physical	**Symbolic**	
Books	Language, Story	Children learn to read, which provides self-reliance in learning. Books on any topic are readily available in libraries in the U.S. Children also learn to use language in culturally-sanctioned ways, as in linear storytelling structures centered on a plot.
Posted Daily Schedule	Numbers and language represent time and activities	Children learn that days have a consistent structure - that there is a time to eat, a time to play outside, a time to read, and so forth, and that those times are set on a schedule. They learn to wait for their favorite activity and to focus on the activity marked on the schedule.
Name Tags	Letters represent a person's identity	Children learn to use an object (tag) with abstract signs (name) to represent "me" and/or "my space". A name on a cubby identifies a child's property, while names on the hooks in a learning center help children determine whether they can enter the center at a given time.
Water Table	Play	Children engage in free play, creativity, improvisation, collaboration, while having sensorial experiences that enhance thinking.

2. Ecocultural Theory

There is considerable overlap between sociocultural and ecocultural theories. In fact, cultural psychologists (Rogoff, 2003; Mistry et al., 2016) draw from and integrate both. One difference worthy of discussion is how activities are viewed. While sociocultural theory emphasizes the role of tools, symbols, and activities in how we learn to think, ecocultural theory views them as representations of the values and norms that are favored in a community. The ecocultural framework is commonly adopted by anthropologists (Heath, 1983; Weisner, 2005) and views the day-to-day activities, tools, symbols and shared practices of both children and schools as rituals (Doucet, 2011b) or routines (Weisner, 2005). Rituals play an important role in normalizing engagement for group inclusion while also setting the boundaries for group exclusion (Doucet, 2011b). Yet, because the cultural codes embedded in rituals remain unwritten (Turner, 1979), those who know these codes become part of an "ingroup" that excludes those who may not quite see the meaning of daily rituals, or the "outgroup".

Focus on daily "rituals" or "routines" that transmit cultural values/norms to children

In schools, routines help to order the day, to create structure and predictability, to teach students behavioral expectations, community values, and their roles vis-à-vis teachers and other school personnel (Kapferer, 1981). For example, just like sociocultural theorists understand "circle time" as an activity organized with tools that help us learn how to think, ecocultural theorists see it as a daily routine that helps children learn culturally-valued behaviors such as: sitting quietly, listening respectfully, raising hands, and taking turns. Similarly, school-based family engagement involves a system of interconnected rituals—parent-teacher conferences, orientation and curriculum nights, potlucks and coffee hours—which are means through which schools communicate to parents what is important in their children's education. "Insider" parents know that their attendance at these meetings is noted and valued by school personnel. "Outsider" parents may think that, since attendance is optional, it does not quite matter whether they go or not, and do not realize that teachers and other personnel do notice who is there and might confer advantages (perhaps implicitly) to the children of families who attend.

Circle Time is a typical daily routine where the teacher and children come together to read stories, review the daily schedule, and sing songs, while practicing accepted group behavior such as raising hands, waiting for one's turn, and listening to other children.

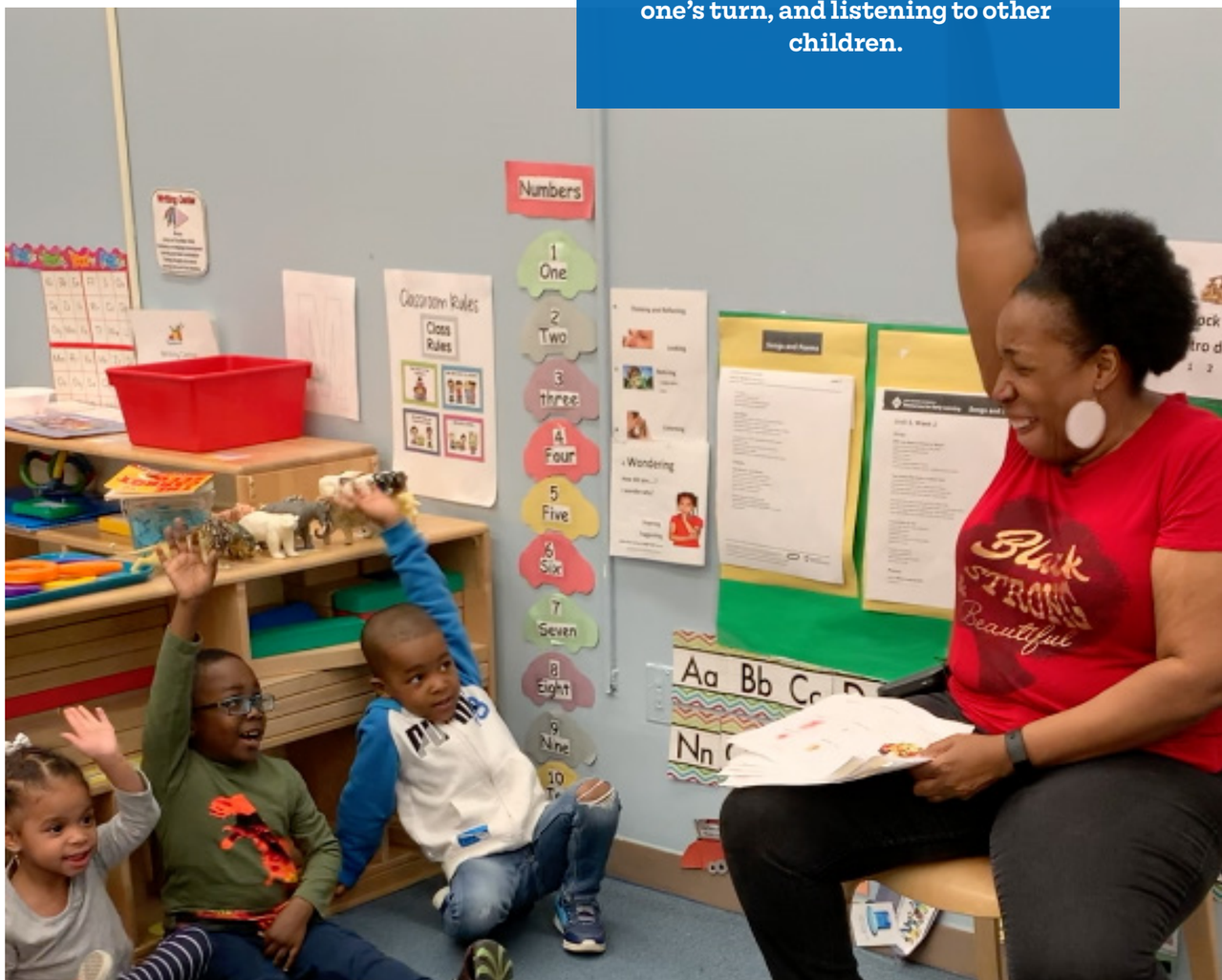
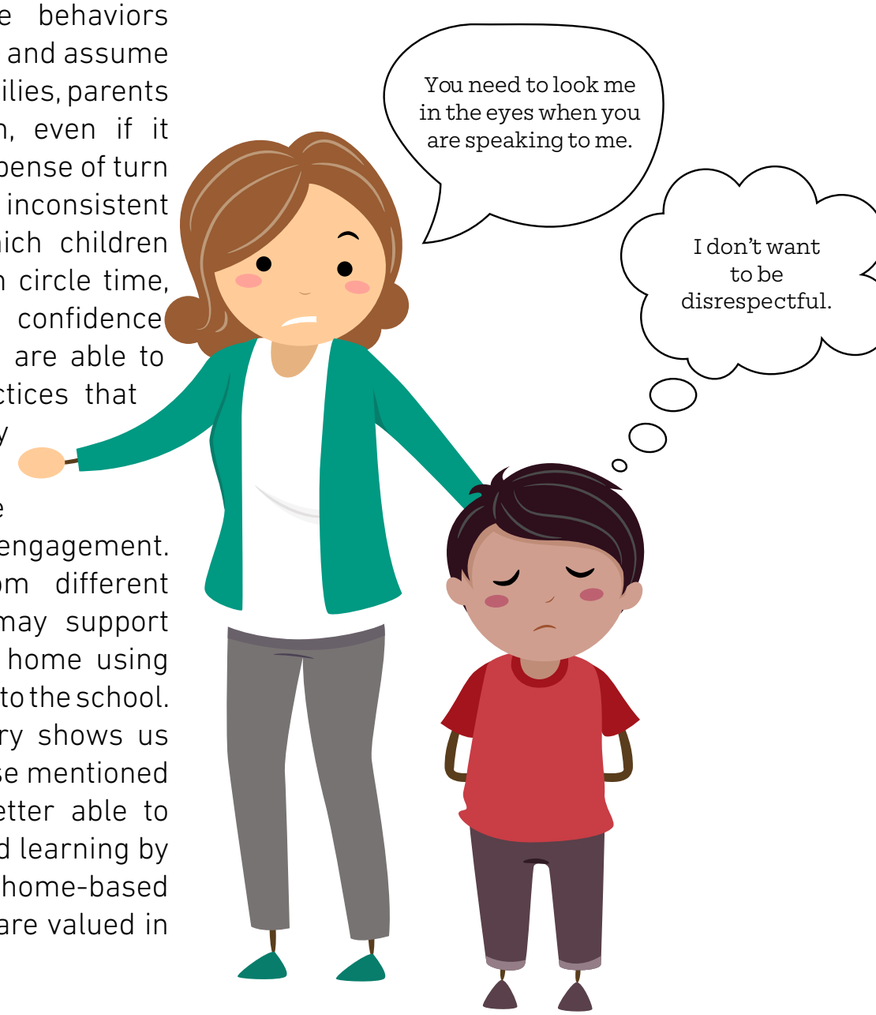


TABLE 2

Desired behaviors implicit in preschool routines

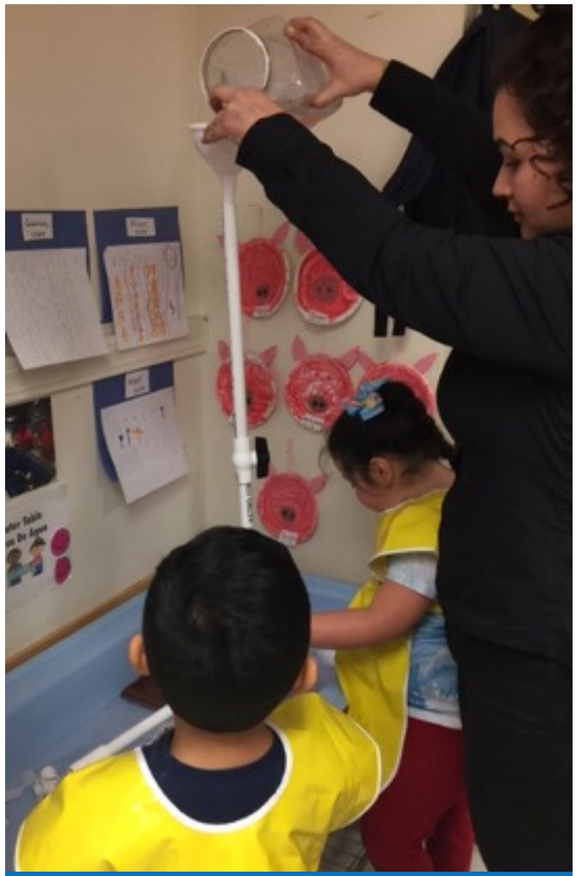
School Routine	What Children Learn About Desired Behaviors
Circle Time	Circle time is a typical preschool routine where children sit in a circle as a whole group, led by a teacher, with a focus on storytelling, sharing experiences, didactic lessons. Children are learning desired behaviors such as hand-raising, turn-taking, using an "indoor" voice, listening to others, etc. Children who are not familiar with these ways of interacting may be regarded by teachers as being less "ready for school".
Learning Center	Preschool classrooms typically have Learning/Activity Centers that are not directed by teachers. Children are expected to engage in "free play" with age-appropriate activities and toys. Children learn to select options from a limited range, as well as how to negotiate with their peers, and play cooperatively.
Parent-Teacher Conference	A highly scripted, rather brief interaction where parents are summoned to the school to listen to teachers' reports about their child's school performance. Parents express comments, questions, concerns, and can request a separate time to hold a more lengthy conversation. Many parents see this as an opportunity to check whether their child is "behaving well", and defer to the teacher's judgment about their child's performance, rather than bringing up learning issues or dissatisfactions expressed by the child.
Parent Coffee Hour	A time when parents interact with each other without a script, and often without school personnel in the room. Assumes that a cup of coffee is attractive to parents. Requires knowing how to approach strangers (who sometimes do not speak the same language), acceptable conversation topics, length of exchanges, and how to connect all of this to a child's learning.

Similarly, many parents schooled and raised in the U.S. practice behaviors encouraged during circle time and assume they are "normal". In other families, parents may support self-expression, even if it sometimes happens at the expense of turn taking. This practice, although inconsistent with the orderly way in which children are expected to participate in circle time, can enhance creativity and confidence in social settings. If teachers are able to appreciate the value of practices that diverge from their everyday expectations, all students can benefit. The same rationale can be applied to family engagement. Parents and guardians from different ethnocultural backgrounds may support their children's education at home using practices that remain invisible to the school. The lens of ecocultural theory shows us why, in examples such as those mentioned above, educators may be better able to elicit children's motivation and learning by bringing into the classroom home-based knowledge and "rituals" that are valued in their students' communities.



Behaviors can have different meanings across families and communities. What may be deemed disrespectful in one setting, may be expected as a behavior of respect in another.

3. Funds of Knowledge: Engagement of Families' Experiential Knowledge in Curriculum



A child shared their understanding of pipes and water movement based on what they had learned from their father who is a plumber.

The term 'funds of knowledge' is defined as immigrant parents' knowledge of the local environment and community, and the expertise they have developed to function within their various contexts (work, neighborhood, social networks, political activities, etc.) (Moll, et al.,1992). The RISE project takes the term one step further to include any family—e.g. homeless, U.S.-born members of minority groups—whose experiential knowledge is invisible in school curricula and family engagement practices. When teachers spend more time learning about families' experiences, what children see and do every day, what family routines are important, it is possible to envision alternative forms of family engagement.

"...by drawing on household knowledge, student experience is legitimated as valid, and classroom practice can build on the familiar knowledge bases that students can manipulate to enhance learning in mathematics, social studies, language arts, and other content areas"

Gonzalez, 2004, p. 43

The labor histories of parents working in trades such as carpentry, tailoring, selling food, cosmetics, or engaged in household chores such as cooking, cleaning, and caring for young children can be rich sources of knowledge and skills that teachers can infuse into the school curriculum. Carpenters and tailors use mathematics; food, cosmetics, cleaning are connected to science concepts; and often parents in various trades develop a number of skills to adjust to an unstable job market. This teaches flexibility and problem solving that children will need when they enter the labor force, regardless of their occupation (Gonzalez, Moll, & Amanti, 2005).

In RISE, children's homes and neighborhoods become rich resources for STE curriculum. For example, teachers use **home visits** at the beginning of the school year to look for important "tools" in the home that can be brought into the classroom related to a particular STE concept (e.g., special spoons for noodle soups or chopsticks provide examples of the relationship between structure and function). One mother volunteered to cook a soup from El Salvador in connection with a unit on plants, vegetables, and states of matter. The teacher used the opportunity to highlight science concepts such as "stability and change" as well as "structure and function" with familiar tools and foods from students' homes.

In RISE, children's homes and neighborhoods become rich resources for STE curriculum

The Science Behind Cooking Soup

A mother cooks soup. In preparation, children chop the vegetables with plastic knives and explore technology as a core idea, as well as the crosscutting concept of structure and function. Once the vegetables begin to cook and their texture changes from hard to soft, children learn new science concepts such as stability and change.

Teacher leading a unit on life science using a fish she bought at the local market.

One teacher who used PVC pipes in their classroom to explore how water moves inside a house reported that one of their students told a story about funds of knowledge in their home. They said that a pipe broke under their kitchen sink and recalled their father using a thicker pipe to fix it. In a later activity at the water table, that same child thought creatively about using a container to stop water from leaking out of a pipe, while recalling how their father had done that at home to stop the leak under the kitchen sink.

Another common routine among early childhood classrooms is taking neighborhood walks; teachers can readily identify relevant STE concepts in children's communities (e.g., the ramps in the block center relate to ramps coming off service trucks, at curb cutouts, and going into the local grocery store; patterns on a leaf can be used to teach about mathematical patterns children encounter every day at home or in nature).

A father who cares for live fish in a grocery store in Chinatown, demonstrates how a fish tank is maintained.

In a walk in Chinatown, a mother pointed out a grocery store where her husband worked managing the fish tank where fish are kept alive before they are sold to customers for consumption. Teachers used this story to invite the father to demonstrate how a fish tank is maintained, and also used a toy fish and sheet with the different parts of fish in a biology unit.

These are just a few examples of the rich teaching and learning opportunities that teachers can introduce in their classrooms by knowing parents' strengths and multiple experiences. In fact, we believe that, because teachers have the opportunity to interact with parents regularly, they can become "agents of change" who are in an ideal position to increase equitable practices and culturally-relevant curriculum in their classrooms and their schools. Yet, in order for teachers to imagine and forge new ways of partnering up with parents, they must first become aware of their assumptions about what children know and learn at home. It is only when teachers understand the wealth of knowledge they do not know and that can be tapped from talking to families that they will see the value of learning about children's experiential knowledge.

TABLE 3

Integrating Funds of Knowledge into STE Curriculum

Funds of knowledge	Curriculum relevance
Plumbing Construction	Investigating structure and function of how the pipes and interconnected parts move water in and out the house.
Soup making; Cooking	Exploring the states of matter such as that cooking vegetables in boiling water changes them from hard to soft and water to steam.
Fishing; Feeding fish	Gaining understanding about the needs of living things along with the systems in which they live.
Grocery business Buying and selling	Experiencing scale, proportion and quantity; navigating amounts of food, pricing and packaging.
Driving motor vehicles How engines work Transportation systems	Investigating the structure and function of different modes of transportation as well as the system of parts that work together to make the machine and systems work.
International travel Countries, continents, Different climates	Opportunities to obtain information related to differences in climates around the world, tools we use every day, different ways in which we protect ourselves from the weather.

Two kinds of events for promoting egalitarian parent-teacher partnerships:

* **<u>Joint Activities:</u> Designed by practitioners in the sociocultural perspectives to engage diverse groups of participants to work together with shared goals. The premise is that having a common goal helps participants understand each other as equal partners, and to communicate more fluidly. For example, a teacher organized an activity where parents were asked to work as a team on the task of using recycled materials to build familiar structures from their neighborhood. The teacher participated as one team member among many. They later reported that parents negotiated what structures to build, and worked together re-creating them, even when they did not speak the same language!**

* **<u>Parent-Teacher Discussions</u> (PTDs): This conception of parent-teacher meetings originates in the work of Adair & Tobin (2008), who proposed that parent-teacher dialogues that build understanding across cultural differences help create non-hierarchical relationships. With support, groups of teachers and parents can come to question their assumptions about one another, even disagree, while building toward understanding (Adair & Tobin, 2008). For example, a teacher invited families from East Asia to talk about the expression of affection between parents and their children, and elicited a rich discussion about cultural differences in this area.**

By supporting teacher-parent communication and relationship-building in these ways, teachers can engage parents in reciprocal exchanges that lead to the co-construction of more inclusive early childhood curriculum. In addition, this kind of equal partnership where parents' expertise and funds of knowledge are valued and brought into the classroom is empowering for parents, students, and teachers (see McWayne, Mistry et al., 2018).

Joint activities where teachers and family members use recyclable materials to create a representation of their community. Pictures above represent the local airport, a soccer field and an iconic bridge.

Three Mantras of the RISE Home-to-School Approach

The theories covered in the previous section point to the home-to-school approach as a way to build equitable and inclusive curriculum based on the wide range of life experiences children bring to the classroom. This approach requires planning and intentional efforts to partner with parents, something all teachers can do. To help teachers conceptualize the home-to-school approach, we propose three principles which we repeat to ourselves as "mantras".

FIGURE 3

Three Mantras of the RISE ***Home-to-School*** Approach

Learning Builds On Familiar Knowledge

This principle is often repeated in early childhood settings. Teachers know that children connect new learning to existing knowledge. In fact, we all do. Young children are likely to express excitement and a sense of belonging when they connect with what they see in the classroom. When children come from diverse ethnocultural backgrounds, however, what is familiar to them may not be familiar to teachers.

Culture Is What We Do Everyday

This definition of culture addresses the challenge of learning about the ethnocultural backgrounds of our students when we do not speak their languages, or know much about their histories. By seeing culture embedded in all that we do in the course of our daily lives, it becomes possible to learn about each other's cultures by asking about daily routines, and practices.

Parents Are Equal Partners

To learn about children's lives without speaking their home languages (an unrealistic expectation in the growing number of multilingual classrooms across our nation) requires a shift that we call the home-to-school mindset. It requires that we treat parental expertise as valuable as our own expertise as teachers. It is only in the context of partnerships among equals that the home-to-school approach can be implemented.

From Theory to Practice: Professional Development Step-by-Step

STEP 1:

Unpacking Implicit Assumptions Behind Observable Behavior

When we become aware of some of our own implicit assumptions for interpreting other people's behavior, we begin to wonder what other interpretations might be possible for the same behavior.

As a first step in our professional development, we facilitate a look at some of the implicit assumptions (ideas, values, beliefs) underlying observable behavior (what we do everyday). We believe that enhancing teachers' existing awareness of the culturally-grounded beliefs, values, tools, and symbols that guide their own lives and the practice of preschool education (as discussed in Tables 1 and 2) is beneficial in two ways: first, it enables teachers to begin to explain and make their own practices more transparent to parents (Delgado-Gaitán, 1991); second, when we become aware of some of our own implicit assumptions for interpreting other people's behavior, we begin to wonder what other interpretations might be possible for the same behavior.

For example, earlier in the document we introduced the image of a teacher who is not aware of the assumptions behind a child's behavior that seems disrespectful to them. In the first frame, the teacher is telling the child how to change their behavior. In the sequence we introduce below, there is a second frame where the teacher realizes that they may not know the implicit assumptions behind the child's behavior. The teacher's realization is followed by an action that falls under what we call our home-to-school approach, and is represented in an information sheet they design to enhance their understanding. In that sheet, the teacher might ask the question: "Who should I look in the eye?" with prompts for: parents, grandparents, teacher, policeman, peers, siblings. In subsequent sections, we will see how this information can be used in the classroom.

Reacting to unexpected behaviors

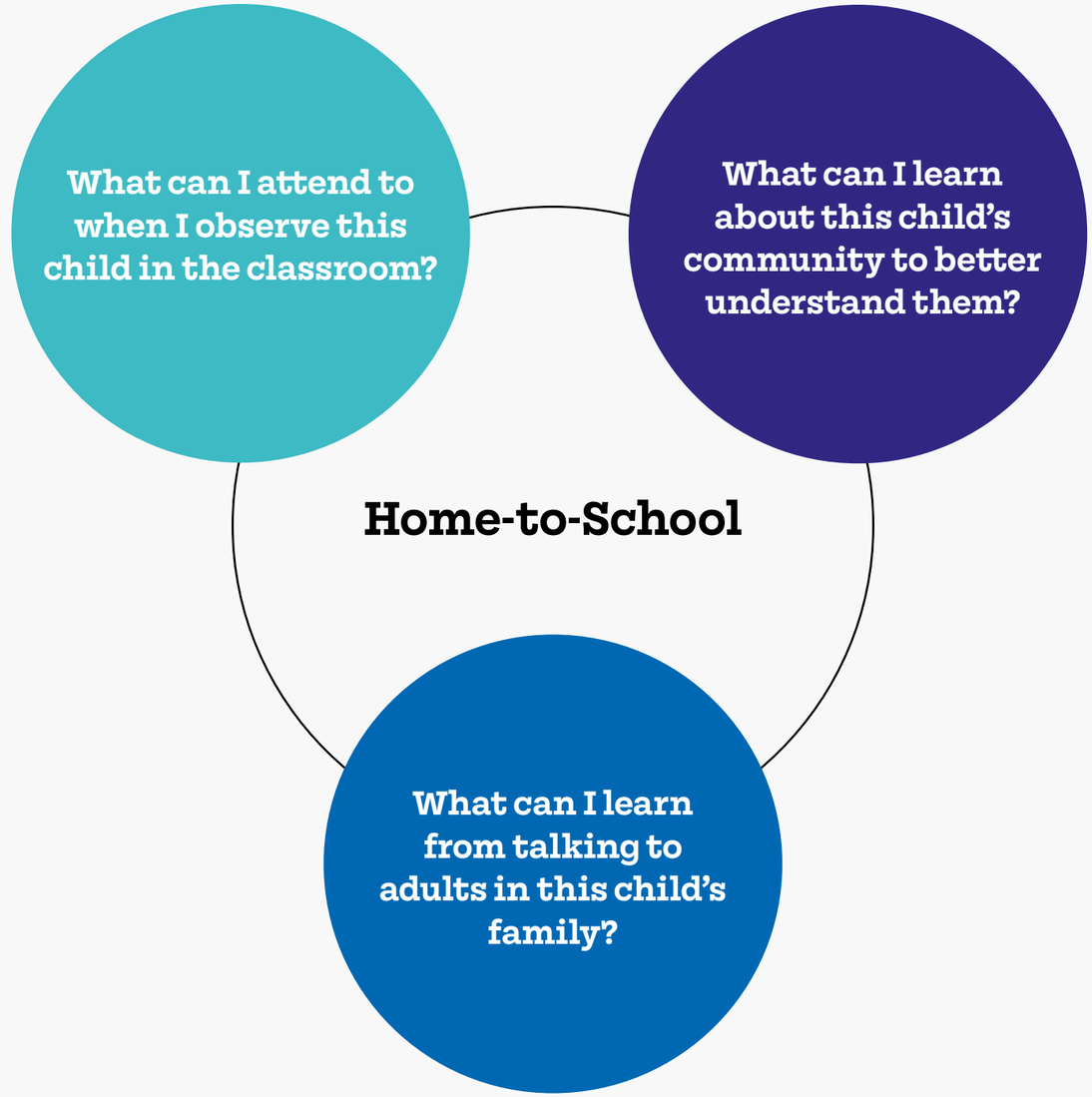
Assuming Vs. Wondering

Behaviors can have different meanings across families and communities. Mismatch of assumptions leads to misinterpretations of observable behavior, such as the child avoiding teacher's direct gaze in this picture.

Wondering about behaviors that seem out of place is a first step towards understanding. Next, this teacher can talk to the child's parents or other culturally knowledgeable colleagues.

FIGURE 4

Three Ways I Can Learn
What Families Know and Do



Reacting to unexpected behaviors

Assuming Vs. Wondering

As an outsider to the child's cultural world, the teacher may not know about rich oral traditions and how they may promote outstanding public speaking outcomes in children.

This teacher has now identified a resource in the child's home that they can bring into the classroom for the benefit of all children.

What can I attend to when I observe this child in the classroom?

What can I <u>learn</u> about this child's community to better understand them?

Home-to-School

What can I learn from talking to adults in this child's family?

Communities are groups of people with shared experiences.

When teachers adopt all three mantras of the home-to-school approach and develop trusting partnerships with parents as experts, it is easier to ask about children's behavior and/or to invite family members to showcase their talents in the classroom. It is important to notice that not only does the individual child benefit from each of the incidents depicted in the cartoons above, but the entire classroom does, as the teachers then design exercises that use the strengths in the child's approach to teach new knowledge.

Our shoes are a form of technology. The same type of shoe can have different meanings in different communities.

STE CONNECTION: Technology as tools
PROMPT: Please bring a tool that means something special to you

In an early professional development activity, we asked participants to bring a tool from home that had a special meaning for them with the expectation that meaningful tools say something about a person's values, beliefs, and may have different meanings to different people. Indeed, the exercise helped us see subtle and significant ways in which our lives differed. One RISE member brought a pair of hiking boots as family hiking trips are a valued tradition. In conversation, another person pointed out that their husband wears similar boots to work in the construction industry. We discussed how the same tool may be used for relaxation and time together in one family, while in another family it might represent work that is stressful and would probably not be a choice for a relaxing day together.

We then talked about potentially shared world views among people who choose hiking as a recreational activity, and spoke about a "cultural community of hikers" where some behaviors, objects, and language are shared. Participants then thought about construction workers and wondered what is shared in this "cultural community." The exercise was revealing to participants who could begin to examine themselves as cultural beings, along with the implicit knowledge and assumptions they shared with members of their own communities. Participants also looked at prejudices and stereotypes they held towards outsiders. In this process, we modeled at all times respectful curiosity and an eagerness to learn about the different cultural communities represented in our midst.

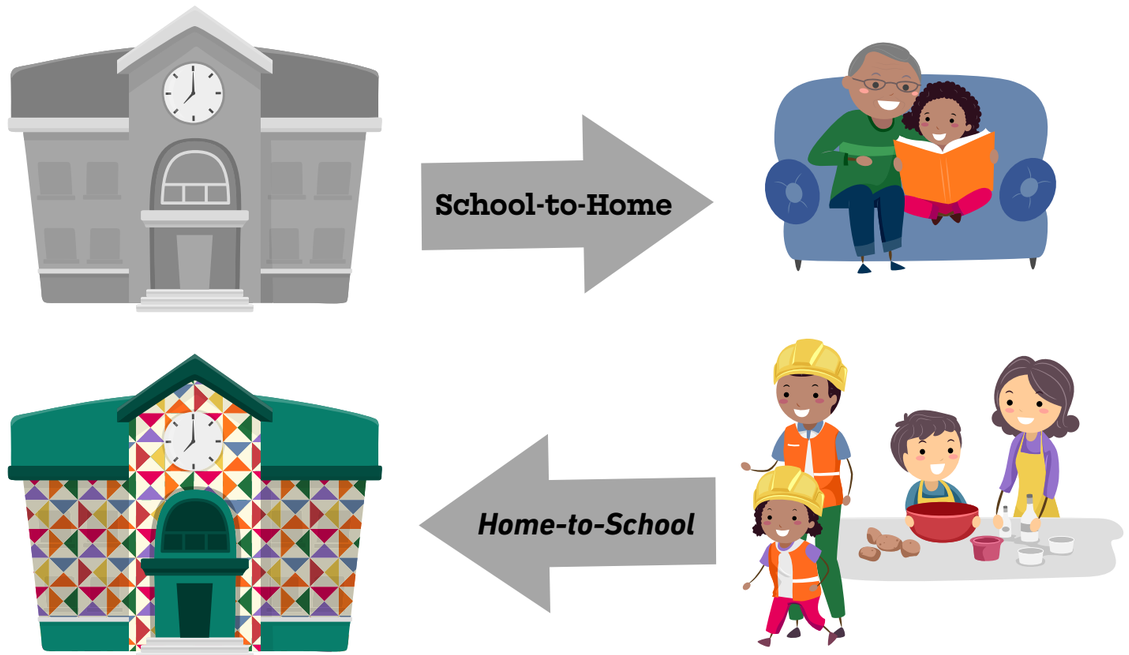
STEP 2:

Flipping the Script on Family Engagement

In line with the learnings of Step 1, we now address more specifically what we mean by home-to-school and why we believe this attitudinal shift towards family engagement, although subtle, can make profound changes in our teaching practice, and potentially in our students' academic and socioemotional outcomes. Because we propose an attitudinal shift, the "flipping of the script" does not require that we change everything we do with families. Rather, the change is the assumptions underlying our family engagement, and what the outcome of that engagement should be. Specifically, an important change we propose is that we move beyond typical home extension activities where the home reinforces learning that happened in the classroom. In addition, we think of incorporating into the classroom some aspects of home life, so that the classroom affirms and validates the knowledge children gain at home. This way of "welcoming" children into the school is deep, powerful, and immediately increases the readiness for school of children who might, otherwise, find the school environment foreign to any life experience they have had prior to arriving there.

FIGURE 5

School-to-Home vs. Home-to-School



The School-to-Home approach tends to default into standardized strategies for engaging families, such as reading at home. In our Home-to-School approach, engagement builds on family strengths, and helps diversify the curriculum.

We have found that some home-to-school practices are already instituted in many early childhood programs, when teachers ask children to bring a favorite book from home, or a favorite song, or a musical instrument. The idea is to expand the home-to-school flow as much as possible so it includes realms of children's everyday lives that go beyond the traditional material aspects of culture typically celebrated in schools such as holiday festivities, food and music.

Both school-to-home and home-to-school approaches to family engagement have value. The School-to-Home approach provides valuable information to families about what children are learning in the classroom, while the home-to-school approach gives teachers an opportunity to learn from families about children's everyday experiences. Each experience below is identified as a home-to-school, School-to-Home or both along with an explanation.

Table 4: Home-to-School or School-to-Home Sorting Resource Page

Experience	H to S	Both	S to H	Explanation
Send home weekly newsletter			X	Parents are given information about school
Send worksheet to practice at home what is done in the classroom			X	Parents reinforce school curriculum at home
Send worksheet to ask information from parents about plants they grow at home and bring it back to school	X			School learns about children's everyday experiences at home
Children talk at home about school			X	Parents learn about what children learned at school
During circle time, children share what they did at home	X			School learns about children's home activities
Attend coffee hour where teachers and administrators provide information			X	School gives information to parents
Attend coffee hour where teachers and administrators seek information from parents	X			School obtains information about each family
Ask parents where/when counting happens naturally at home	X			School learns about math practices at home
Teachers encourage parents to take children to the library and bring back their favorite stories		X		School asks parents to engage in a specific learning experience at home - But child brings back a book of personal interest
Practice counting at home as children learned at school			X	School encourages repetition of school-based activity at home
Teacher asks parents what stories children like	X			School gathers information about children's personal interests
Teacher requests parents read to their children daily			X	School asks parents to engage in a specific learning experience at home
Parents share favorite recipes with teachers	X			School learns specific information about families
Parents volunteer in the classroom		X		Volunteer learns/supports school practices - Volunteer shares stories, information about the family with teacher and students.
Parents attend early education workshops			X	School provides advice for parents to apply at home
Parents bring photos from home	X			School learns about family life (i.e. family members, physical environment)
Parents complete question of the day (QOTD) in the classroom		X		Only home-to-school if the teacher asks question to learn specific information about each child/family
Find out where children spend their time while parents are working	X			School learns about children's routines outside of school
Parents attend Parent-Teacher Conference		X		Teachers receive information about a child from parents – Parents learn about their child's progress at school. Teachers must take the lead in eliciting this bi-directional dialogue to be both
Grandparent comes to classroom to share folk tales with children	X			Teacher and students learn about a child's culture
Teacher makes home visits		X		Teacher learns about child's family, home life, history – Parents learn about the school
Parent sends homemade artifacts to classroom	X			Teachers and students learn about family's practices

Find an unmarked version of this page in the Professional Materials section of this Guide

STEP 3:

Accessing home information about children's day-to-day activities, routines, and their families' funds of knowledge

In Step 3, we continue moving from theory to practice by funneling the three mantras into concrete interactions with families (Figure 6) in order to learn what families know and do, teachers can:

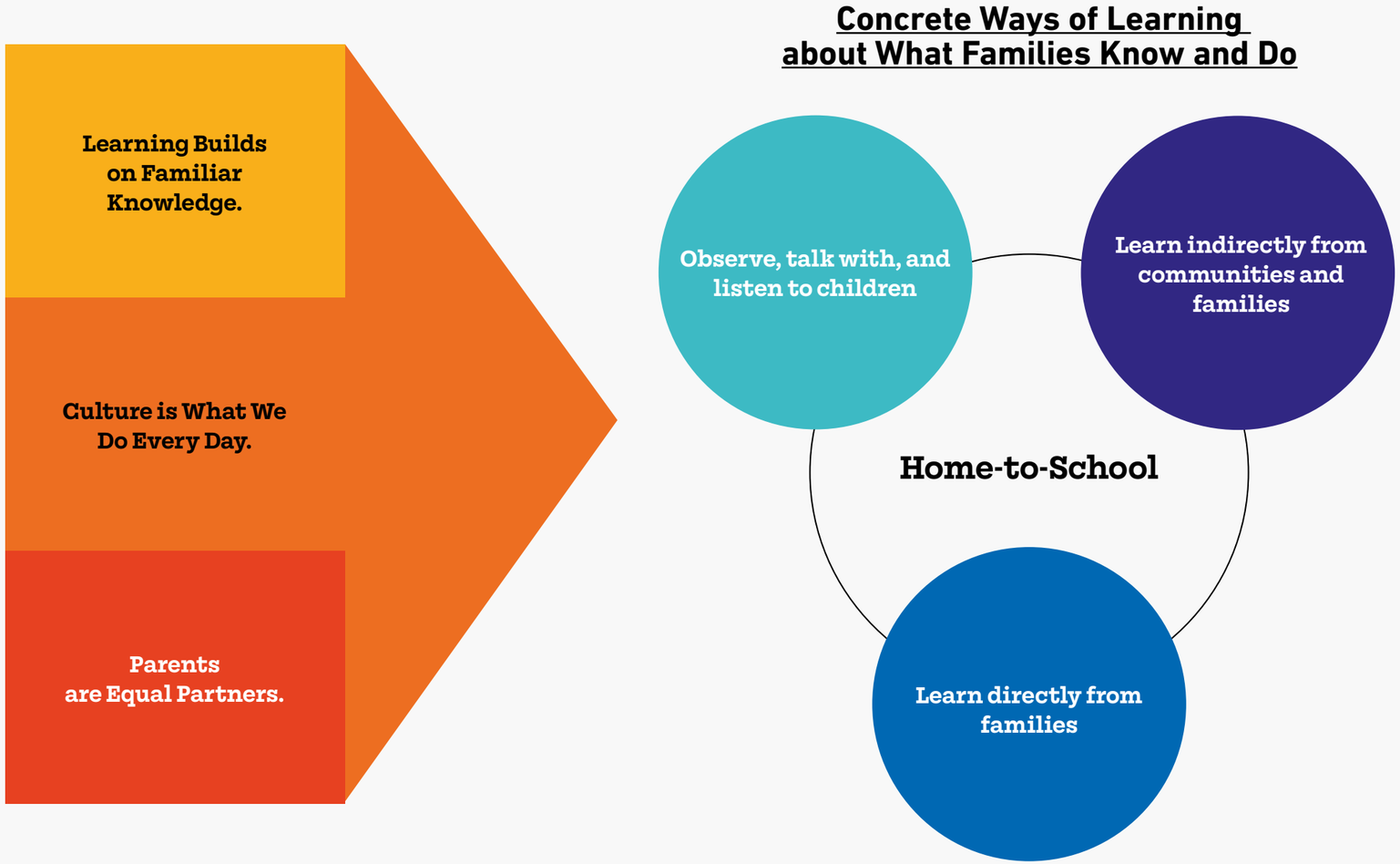
a. observe, talk with, and listen to children;
b. learn indirectly from communities and families; and
c. learn directly from families.

The rest of this section provides some examples of concrete tools and ways to access this knowledge, as well as many links to the **RISE website** for further information and ideas.

See also a list of possible HSC activities and how to plan them in the Professional Materials section.

FIGURE 6

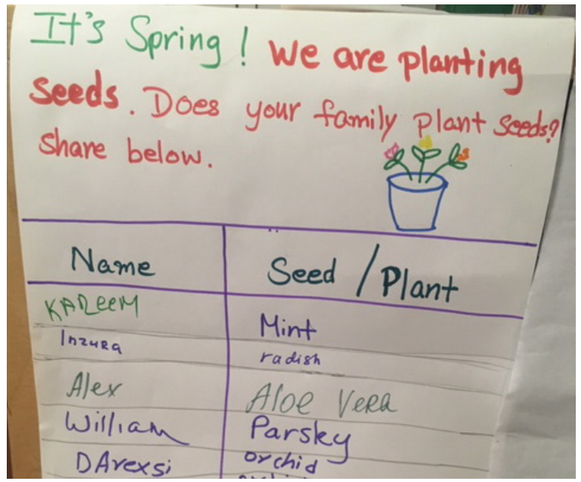
Theory To Practice: From Mantras to Working with Families



I Can Observe, Talk with, and Listen to Children

During Children's Play

During play, children naturally share what they already know and do at home and in their communities. Teachers can listen intentionally and learn rich information about children's homes, communities, and their daily activities/routines. RISE teachers use this information to inform/ enhance STE curriculum units.



Question Of The Day (QOTD)

Question of The Day (QOTD) is an easy and fun activity parents and children can do together during drop-off to the classroom. A good QOTD gives teachers information that can be used to connect home-to-school within the curriculum.

Click here for QOTD templates.

STE CONNECTION: Sound and Music
PROMPT: Name a sound that melts your heart

In preparation for a professional development workshop on an STE unit on sound and music, teachers were asked to think about a special sound. The purpose of the activity was to sensitize teachers to sounds in their daily environment beyond traditional children's songs that they could elicit in conversation or while observing their students. We wanted teachers to walk into their classrooms armed with questions and examples from their everyday lives that they could share with children. Teachers were excited to tap into their childhood memories for sounds ranging from rain on a tin roof, wind in the pines, "coquis" (Puerto Rican frog) at night, waves breaking on a beach, barking dogs announcing someone's arrival.

When teachers asked their children to listen to sounds in their lives, one teacher asked their class to listen to sounds in the night. A child reported hearing their uncle snore in an adjacent bedroom, and a door creak. The teacher used these and other examples to introduce science concepts such as volume, pitch, duration, and rhythm.

I Can Learn Directly from Parents

A Parent-Teacher Discussion (PTD) group.

Home Observations

Teachers use home visits at the beginning of the school year to observe children at home and learn about the natural STE opportunities and resources that are part of children's daily lives (e.g., special spoons for noodle soups or chopsticks provide examples of the relationship between structure and function). They also take the opportunity to introduce the curriculum and begin collecting some initial information about children's everyday lives.

POSSIBLE HOME VISIT INTRODUCTION

My classroom is part of an exciting project this year called RISE. An important goal of our project is to learn what children already know and about their everyday lives. To do this, I need to learn from you, as you are the expert on your child. If you agree, we could start today with some questions. I would like to ask you about your child's favorite places, people, daily routines and objects.

What are some favorite places you go to regularly with your child in your neighborhood, or community?
- **Prompts: religious, parks, markets, relatives', restaurants, centers?**

What are some favorite activities you do regularly with your child at home or outside the home?
- **Prompts: cooking, bedtime, sports, family routines?**
- **Prompts: who does your child spend time with doing these activities?**

What are some favorite objects your child likes to use around the house?
- **Prompts: toys, eating utensils, cooking utensils, plant watering**

Different uses of aluminum foil as a shelf cover and as a splash protector were observed during a home visit, showing how families use this as a tool.

Joint Activities

Joint Activities are a key strategy used to facilitate non-hierarchical and reciprocal exchanges between teachers and parents. Joint Activities were employed at various points throughout the RISE project to create common ground, facilitate a sense of shared responsibility and inspire STE integration and co-construction of curriculum that built on knowledge of children's cultures and communities. A good topic can be developing a scrapbook on "Our Children's Worlds?", which could then be shared not only with the teacher and students in the classroom, but with other classrooms and parents as well.

Models created by parents living in a community close to an airport, which has many soccer fields. These models are ripe with natural opportunities to discuss STE concepts.

Parent-Teacher Discussion Groups

In Parent-Teacher Discussion groups, the teachers invite parents for a conversation on a previously agreed upon topic of interest—e.g. child's readiness for school. However, rather than taking the role of "experts", teachers "give over the floor" to parents. At first, this requires intentional facilitation to focus attention on what parents have to say, as there is a natural tendency for parents to defer to teachers, or for teachers to "take over". However, once parents understand that they and their knowledge and ideas are the focus of the meeting, it is possible to establish non-hierarchical, reciprocal discussions about children's home culture and contexts. Parent-Teacher discussion groups are a great opportunity to raise questions about differences in behavior and understandings.

I Can Learn Indirectly from Communities and Families

Neighborhood walk in Chinatown where families and children told teachers about places that they visit regularly.

Neighborhood Walks

There are many ways in which neighborhood walks can be used to tap information that is familiar to children. Parents can share their knowledge of the local neighborhood by mapping routes for teachers to follow. On these neighborhood walks, teachers can take photographs of the buildings, physical environments, and natural landscapes that are familiar to children. Connections can then be made to a variety of STE concepts including stability and change, patterns, and systems and system models. In the block center, children can make connections between the ramps they use to build structures in the classroom and the ramps they see coming off service trucks, at curb cutouts, or going into the local grocery stores. In some cases, teachers and children can write books together, such as "**Patterns All Around Us**".

Culturally-Rooted Stories

A compelling resource that is very popular with parents, culturally-rooted stories solicit stories about parents' everyday lives, now or when they were children. This can be done in different ways. Parents can be invited to participate in an activity where they write and illustrate a story, which then is turned into a book as **My Colorful Day** below (**click here for more examples**) The activity can involve teachers or it can be facilitated and led by parents.

To give teachers a taste of how engaging this kind of activity can be, we asked them to brainstorm ideas about "ramps and blocks in my childhood" in small groups. Teachers acknowledged their own excitement recalling childhood experiences and were eager to try it in their classrooms. Furthermore, the conversation yielded a number of ideas that were valuable for planning the unit. Teachers remembered a range of experiences from walking on logs to cross creeks, using cardboard mats to slide down dunes, food on ramps at supermarkets, or ramps for delivering bags of rice in a grocery store. All of these ideas can be used to teach various aspects of ramps and building blocks. For examples of how teachers integrated home information into units on ramps and blocks, **click here.**

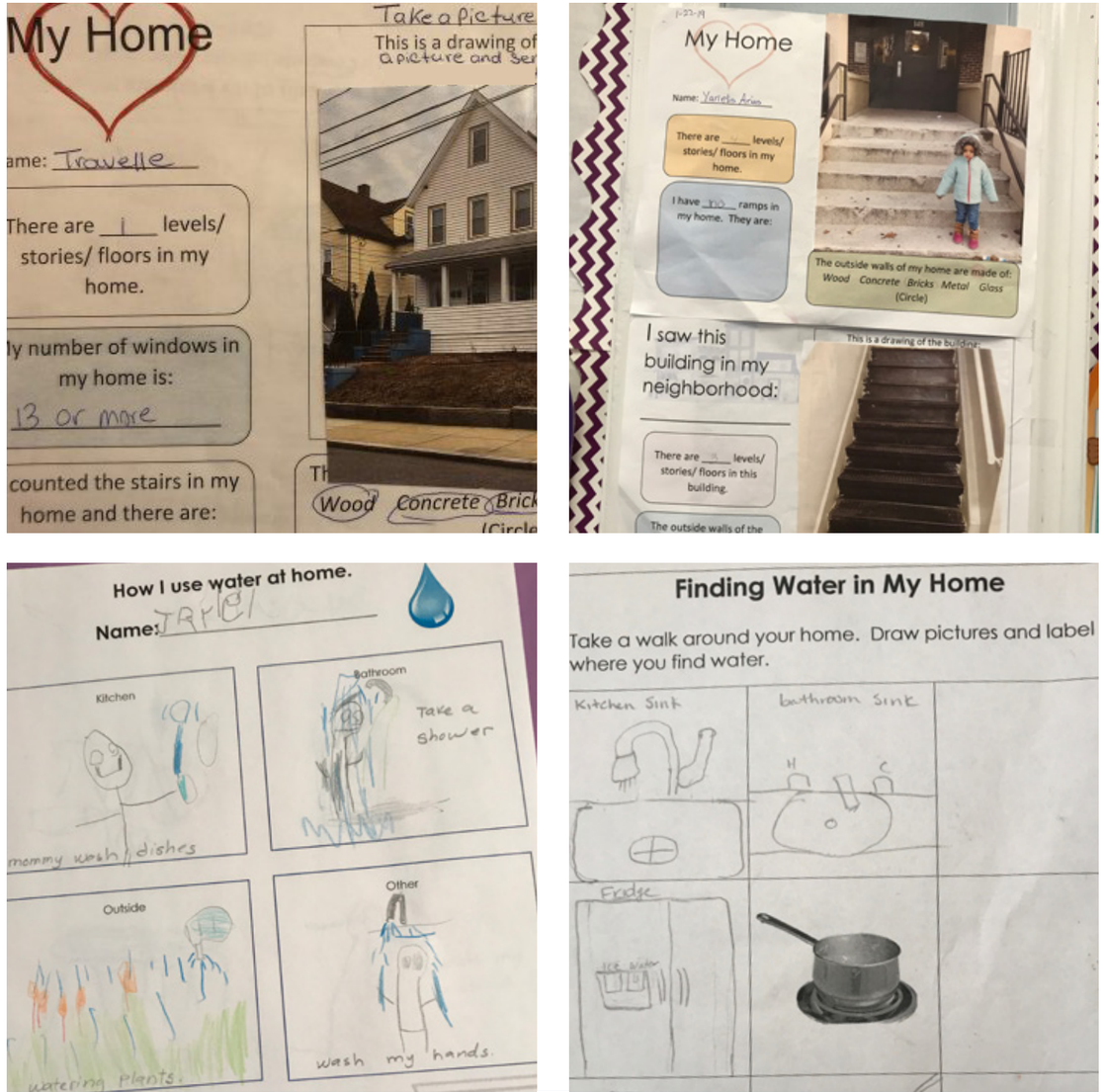
Books also have the advantage of staying in the classroom and serving as "good start" activities — activities that initiate a discussion about a new curriculum unit, or an important STE theme. In fact, many teachers assembled binders with photos taken on neighborhood walks with children, or sent in by parents, and these binders stayed in the classroom to serve as good start activities the following year **(click here for examples)**.

Children review a binder with images provided by families in response to Home-to-School Information Sheets. The binder stays in the classroom and becomes a reference source for children throughout the year.

Home-to-School Information Sheets

In addition to sending worksheets or activities home for parents to reinforce learning in the classroom (a school-to-home approach), teachers can send sheets home to learn more about children's daily lives and routines. To give teachers a sense of the kind of information they could seek from parents, we asked them to think about experiences or objects from their own lives related to a specific topic. For example, when teachers were preparing a unit on plants that involved planting seeds, we asked them to consider what plants in the squash family had special meaning to them. We were surprised to find teachers who were immigrants from different backgrounds and U.S.-born teachers mention pumpkins as a seed that they associated with a range of meals, from "soup de jumon" cooked in Haiti on January 1st to welcome the new year, to other forms of pumpkin soup, to pumpkin pie eaten during Thanksgiving in the U.S. Teachers enjoyed exchanging information about how they prepared different pumpkin meals.

Teachers found ***Home-to-School Information Sheets*** relatively easy to use as they resembled sheets sent home with extension ideas for parents to do with their children after a classroom unit. The difference here was that the ***Home-to-School Information Sheets*** were sent *before* the beginning of a unit, rather than upon its completion. In other words, the home information preceded the introduction of the unit, and was incorporated into the topic being taught (see pp. 119-122). **Find templates of Home-to-School Information Sheets here.**



Home-to-School Information Sheets in preparation for units on Building and Ramps (top) and Water and Air (bottom).

Inflection Point

INFLECTION POINTS are moments where noticeable attitudinal or cognitive shifts in understanding of an idea occur. The new understanding may seem simple on hindsight, but at the moment it resolves a question or problem.

INCREASING PARENT PARTICIPATION IN AN ACTIVITY: Two teachers requested information about children's home and family lives for an annual "All About Me" activity. They specifically asked for a current and a baby picture for each child and planned to use them to illustrate the science concept of "stability and change."

One of the teachers received only two parent responses and was quite disappointed. In conversation with the coach, however, the teacher decided to proceed with the STE unit, and integrate the information from the two families who had replied. The teacher then posted the work on the walls. Unexpectedly, upon seeing the photos on display, other parents became interested and offered their children's pictures.

Eventually, the teacher moved from only two responses to creating a book entitled "All About Me" with responses from most of the students.

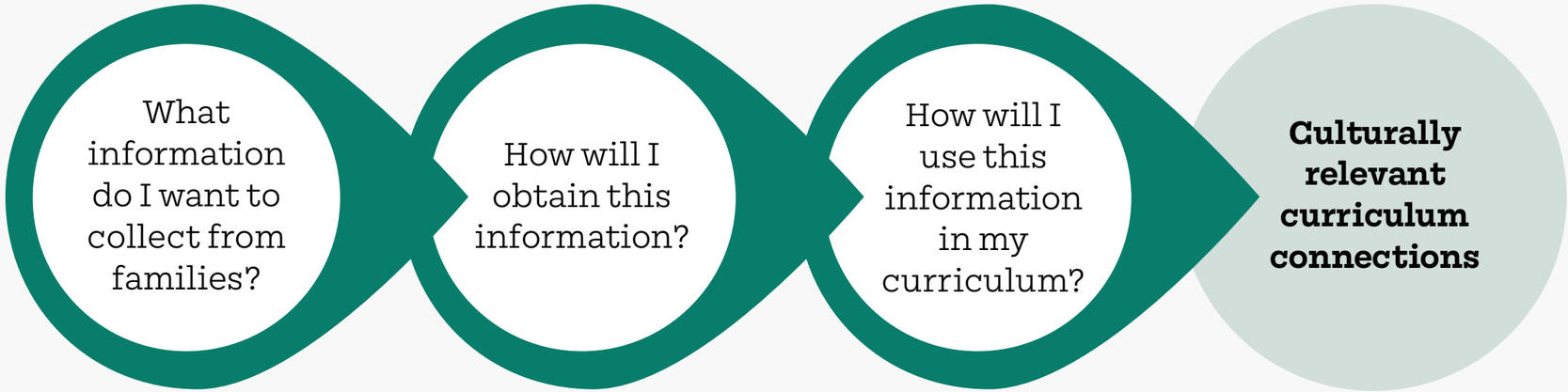
When other teachers saw that it was possible to teach an STE unit with information from just one or two homes, the burden of waiting and "nagging" parents for their responses was lifted, and they saw that the process could be much more flexible and dynamic than they had envisioned originally.

STEP 4:

Integrating Home and Community Information into Curriculum

FIGURE 7

Process for Integrating Home Information into Curriculum



In steps 1, 2 and 3 we have shown how the home-to-school approach is not really a strategy for bringing parents to the school, but rather a framework for integrating children's everyday life experiences outside the classroom into STE curriculum. Achieving this kind of partnership requires intentional planning on the part of the teacher. As seen in Figure 7 above, teachers begin by asking themselves three questions (See **page 94** of the Professional Guide Materials section for a printable worksheet).

- What do I need to know about my students' everyday lives to teach this unit?
- How am I going to access this information?
- How will I use it in the classroom?

In this section, we provide some ideas about how teachers may answer these questions, and how they move towards co-constructing a culturally-relevant curriculum, as indicated in the last circle of Figure 7. The RISE website offers several examples for teaching units on "**Blocks and Ramps**," "**Plants**," "**Color, Light and Shadows**," and "**Sound and Music**." As you read and view these examples, you will notice the iterative nature of accessing and using home information. The videos do not show the intentional planning phase of teaching science concepts, but you will see how, once teachers begin the unit, they remain attentive and open to incorporating information from children's homes as it emerges in the course of teaching the unit. Teachers are also alert to new opportunities to **connect, deepen and extend STE concepts** (see Section 3 of this Guide) and practices by initiating more classroom activities that reflect children's everyday lives. In many cases, information that comes into the classroom in connection with one unit can then be re-purposed when working on a different topic.

Reaching STEP 4 requires planning, practice, and some initial guidance. Following are concrete examples of the process required to integrate home information into curriculum, and thus honor the home-to-school approach.

Integrating Home Information* in an STE Curriculum Unit on Seasons and Change

I want to learn about my families' experiences with seasons growing up. Did they live in geographic areas that had four seasons? What was their favorite season/part of year? What activities do they remember most?

I will invite families to come to a "tea and coffee hour" for a **Joint Activity** where I will invite parents to share stories and create images of "A seasonal activity I enjoyed doing as a child." I will show parents the **culturally-rooted stories** we created with other parents, and explain how the information they give me will help me teach STE concepts, and will give their children a sense of pride."

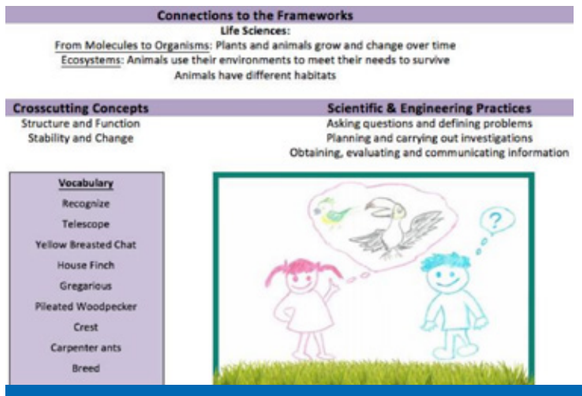
For those families who cannot attend, I will send ***Home-to-School* Information Sheets** asking a slightly different question: "Describe seasonal activities you enjoy together as a family."

I will use the information I gather from the families to talk about Earth Science. For example, if I learned that families have lived in a climate with different seasonal variation than ours, I can compare and contrast weather patterns during the same time of year. I can also compare and contrast different types of homes and foods in tropical and colder climates; how plants need different amounts of light and water, and so forth. I will also encourage children to observe and collect data on weather (sun/clouds/wind/snow/rain/temperature).

*Text in light blue font exemplifies home-to-school information

Culturally relevant curriculum connections

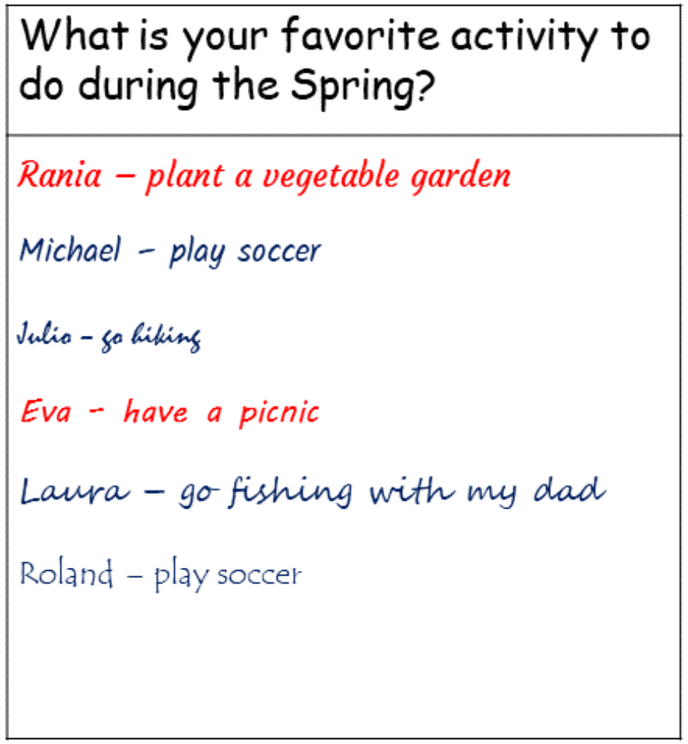
Day 1: In April, while I wait for the information from home, we will start by reading **"Spring"**, a book written by a parent last year about their family's favorite season and activities. Then we will use the information from the book to discuss Earth, Space, and Life Sciences (See Box).



A resource page from one of the culturally-rooted stories with science ideas for teaching about the Spring.

Day 2: We will look at responses on ***Home-to-School Information Sheets*** to begin classifying and tallying data into charts and reaching conclusions about frequencies. For example, first we will create a chart and count what seasons were selected by most children. We might also create a chart with children's favorite activites and count which one has more points.

Children will then be asked to enact a favorite seasonal activity in the dramatic play area. As they play, we will place items that represent some of the scenarios in the information collected from home. In this new context, we will continue our discussion of seasonal change.



My Family's Favorite Seasonal Activities

Teachers use a Question of the Day (see image to the left) as a tool to get some quick information about children. In this case, the question is connected with a unit on Earth Sciences, seasonal stability and change. Adults fill this information up during drop-off and pick-up times, and the teacher then uses to show children how to document data, tally frequencies, and so forth.

Day 3: It's early May and I want to take children on a neighborhood walk to look at seasonal change. We will do this today, and once again towards the end of the school year, so we can talk about changes in vegetation between Spring and Summer.

We will document each walk with pictures, and then we will create books about seasonal change. Children will then be able to observe, document, and reflect on the changes they will see during that month.

Day 4: Parents will come in for "tea and coffee hour" discussion about seasons. They will speak about the difference between the seasons in their home countries growing up and seasons in the U.S., and of different activities they did as children and do with their children now. We will take note of everything they will say to examine its potential use in curriculum.

For example, if planting flowers was a favorite experience, we could explore more about life sciences by creating our own garden. This will provide us opportunities to investigate stability and change, scale, proportion and quantity, and cause and effect.

Day 5: We will use information from the discussion with parents to invite a parent to the classroom and engage the children in a game, or tell them a **story** of an activity they enjoyed in their childhood.

For example, if a family member shares their passion for soccer, we may invite that parent in to teach children some basic soccer skills while simultaneously providing us the opportunity to investigate the crosscutting concept of energy and matter.

*Text in light blue font exemplifies home-to-school information

Integrating Home Information* in an STE Curriculum Unit on Sound and Music

What information do I want to collect from families?

I want to find music and sounds from children's everyday lives: music families hear together, instruments at home, favorite songs and musicians, sounds children notice at different times of day, in different places (home, neighborhood), while engaged in different activities (bathing, eating, walking, sleeping), with different people (siblings, parents, grandparents), and so forth.

How will I obtain this information?

Over the course of the unit, I may choose or combine several ways to seek information from home: I will listen to and talk to children at circle time, I will use a **Home-to-School Information Sheet** and a **Question of the Day** to elicit information from parents, I will take children on a neighborhood walk, and I will invite a grandmother to read a book about music they created together with the grand-daughter.

How will I use this information in my curriculum?

I will use information gathered from families as the examples to build children's understanding of volume, pitch, and rhythm. I will bring in instruments familiar to children to explore hands-on, create loud/soft sounds, and observe high/low sounds. I will also use samples of songs shared to have children clap along with the rhythm and identify fast and slow within the music.

Culturally relevant curriculum connections

Click here to view a book created by a grandmother and granddaughter about music related to their Ghanaian and Puerto Rican heritage. The book was inspired by an African instrument the RISE teacher shared in class.

*Text in light blue font exemplifies home-to-school information

Integrating Home Information* in an STE Curriculum Unit on Blocks and Ramps

What information do I want to collect from families?

I want children and their families to find examples of blocks, ramps, stairs, number of floors in their homes, what materials their homes are built from, ramps and bridges in their neighborhoods.
I will use an **Intentional Planning Sheet** to plan this unit.

How will I obtain this information?

I will send home two items: one is a **Home-to-School Information Sheet** asking children and parents for concrete information involving all of the above. The other item is an invitation for parents to come to the school for a **joint activity** to build structures like the ones in their neighborhoods.

How will I use this information in my curriculum?

I will use information from the ***Home-to-School Information Sheets*** to count frequencies and present data scientifically. **(click here for an example).** Children will build with blocks and ramps and explore the stability of different materials. I will take them on a neighborhood walk so they can identify blocks and ramps in their neighborhood.

Culturally relevant curriculum connections

For more examples:
See Rania's Story on Blocks and Ramps
See Amira's Story on Building

*Text in light blue font exemplifies home-to-school information

CONCLUSION

The RISE approach to developing culturally-inclusive curriculum assumes that teachers want all their students to learn and be engaged in the classroom and have the agency to achieve this goal, in spite of the increasing demands of their job. Yet, in many urban schools, as student bodies become increasingly diverse, teachers need new tools to address the cultural relevance of their teaching practice. The RISE approach provides guidance for re-thinking both teaching and family engagement strategies to be more responsive to the children teachers have in front of them each year. Many manuals and guides for family engagement are designed with specific ethnic groups in mind. This poses problems, because there is great diversity within groups, and because it is often hard to apply recommendations across different contexts. Thus, many family engagement guidelines appear to be too general to be useful or an irrelevant exercise designed for different populations and different settings.

RISE regards children's families as crucial contributors to improving the quality and relevance of curriculum and instruction. According to the RISE perspective, therefore, engaging family members is crucial to teachers' ability to reach and engage each student in their classroom. Furthermore, the RISE approach concretizes mandates for cultural inclusivity by seeking discrepancies between curriculum and children's home environments as opportunities for connecting, extending and deepening curriculum. RISE teachers learn to identify strengths in differences and use them to illustrate STE themes and concepts in ways that are familiar to children. In the RISE approach to engaging families, parents' physical presence in the classroom is not necessary in order for them to participate in meaningful ways in their children's educational experiences or to demonstrate their commitment to their children's school success.

"As immigrant parents, sometimes we feel a bit shy to interact with teachers, other parents or staff as we are sometimes afraid to speak English. However, sharing the activity sheets does not require to speak too much English and we could still share our stories. The meetings also gave us a chance to improve our English skills by motivating us to practice English with other parents outside our own language groups."

RISE parent

In the next section, just as we have demonstrated ways and strategies to create egalitarian partnerships for home-school connection, we discuss ways and strategies for making STE curriculum relevant to the youngest children. Teachers who participate in RISE professional development report a new awareness of the number and range of opportunities for teaching STE within the regular preschool day, within the strictures of a standard curriculum, and by incorporating a range of familiar experiences from children's homes and communities. As will be seen in the next section, RISE teachers learn that science, technology and engineering are everywhere, just like culture is everywhere, and that connecting STE learning standards to children's out-of-school experiences can help them discover, at an early age, all the ways in which science, technology, and engineering is a natural part of their daily lives.

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The RISE Approach to Teaching Science, Technology, and Engineering

Science

Systematic knowledge of the physical or material world that is obtained through observation and experimentation.

Technology

Any modification of the natural word done to fulfil human needs or desires.

Engineering

An approach to designing objects, processes, and systems to meet human needs.

Before addressing how to support teachers in providing high quality STE experiences for children, we define what we mean by STE. Science can be thought of as *systematic knowledge of the physical or material world that is obtained through observation and experimentation*. A careful reading of this definition reveals that science consists of two parts: knowledge (systematic knowledge of the world) and practice (observation and experimentation). For many years, K-12 science education tended to focus more on the knowledge part and much less on the practice part, but that has been changing over the last few decades, especially since the National Research Council's publication of *Taking Science to School* in 2007. The emphasis on science as practice can be seen in the Framework for K-12 Science Education, described in Figure 8, p.77.

Technology and engineering are very closely related. Technology can be thought of as *any modification of the natural word done to fulfil human needs or desires*. A very simple definition is that technology is the human-made world. This means that our world is filled with technology. When humans figured out that they could fashion vessels for holding water rather than using their hands (thus limiting how much water could be carried at once), that was breakthrough technology. Technology can be as simple as a shoelace or as complex as a jet airplane. Our everyday lives are so completely surrounded by technology—the beds we sleep on, the clothes we wear, the appliances we use to store and prepare our food—that although we rarely reflect on how dependent we are on it, few of us would survive without it. Given this definition of technology as the human-made world, then engineering is how that human-made world comes into being. Engineering can be thought of as *an approach to designing objects, processes, and systems to meet human needs*. Engineering gives us the substances and processes used to manufacture our beds, our clothes, our appliances, our vehicles—in short, everything that we depend on to carry out our everyday lives. In order to design those objects, processes, and systems, engineers draw on science and mathematics.

STE represent particularly ripe areas of learning for children, because strong STE pedagogy involves engaging children

immediately with interesting materials, and with each other, in ways that invite exploration, inspire ideas, and provide ample opportunities to build skills across all domains of learning and development. STE learning can activate interest and promote learning across multiple domains, including bolstering children's executive functioning skills, their approaches to learning, collaboration with peers, mathematics understanding, and language development (Bustamante, White, & Greenfield, 2016; Gelman & Brenneman, 2011; Nayfeld, Fuccillo, & Greenfield, 2013).

Recognizing that young children are highly motivated to find out how the world works (Duschl, Schweingruber, & Shouse, 2007), we embraced the notion that STE is everywhere and can be approached in a variety of ways. At the same time, however, we also recognize that many early childhood educators lack both the knowledge and the confidence to teach STE (Brenneman, Stevenson-Boyd, & Frede 2009; Greenfield et al., 2009).

In accordance with the strength-based approach to family engagement discussed in the previous section, we were inspired by the premise that individuals are more likely to act their way into a new way of thinking than to think their way into a new way of acting (Pascale, Milleman, & Gioia, 2001). Therefore, we focused on teachers' current STE practices. We started by identifying and building on what the teachers already knew and were doing around science education. Through an intensive, two-year program of professional development consisting of full-day workshops, in-person coaching, and professional learning community meetings (described in detail in McWayne, Greenfield, Zan, Mistry, & Ochoa, in press), we helped teachers learn how to recognize and strengthen the STE content in what they were already doing with children. We worked with them to identify and use children's familiar knowledge to design meaningful STE experiences.

Recognizing that young children are highly motivated to find out how the world works, we embraced the notion that STE is everywhere and can be approached in a variety of ways.

Theoretical Framework

Theory:
The making of a scientist or engineer

Children explore their own shadows outdoors during a neighborhood walk.

Constructivist theory serves as the broad conceptual framework that guides our approach to STE. Constructivist theory argues that humans generate knowledge and meaning from their experiences (Piaget, 1963). From birth, children explore their environment in order to make sense of it and adapt to it. They do this through a cognitive process that Piaget terms *equilibration*. That is, when children (or adults, for that matter) encounter something new to them, this puts them in a state of disequilibrium that can range from mild to severe. They first try to fit the new information into what they already know about the world. For example, imagine a newborn who is given a bottle for the first time after having been breastfed exclusively. The infant first tries to *assimilate* the new object to their existing sucking reflex by sucking on it in exactly the same way. If the bottle reacts in the same way as the breast, there is no problem, and the child remains in a state of equilibrium. However, if the bottle doesn't react the same way as the breast, they experience disequilibrium. They adjust their sucking reflex until they are able to *accommodate* the bottle, at which point they return to a state of equilibrium. The infant will continue to adapt as they are presented with other objects to suck (pacifiers, thumbs, etc.).

Moving from reflexes in infancy to science learning in preschool, consider a situation in which a group of preschool children notice their shadows on the sidewalk during a neighborhood walk. The teacher decides to create a learning center in the classroom where children can have more direct experiences exploring and investigating shadows. During shadow play, a child notices that when they wave their hand in front of a blank wall illuminated by a strong light, they see their shadow hand move. The child constructs the idea that a lighted surface (such as the sidewalk or the wall) is needed to make a shadow. After some time exploring shadows, the child notices

Children explore shadows in a home-made lightbox.

that their shadow gets bigger when they move away from the wall. Fascinated, the child moves back, farther and farther, explaining "I'm getting bigger!" until the child moves out of the path of the light and the shadow disappears. Confused (in a state of *disequilibrium*), the child first tries to fit the new information into what they already know—their familiar knowledge—in this case, that when they wave their hand in front of the lighted wall, they will see their hand shadow move. The child moves back to where they first saw their hand shadow move: directly in front of the wall. The shadow hand reappears, and the child is satisfied (in a state of *equilibrium* again). This occurs several times, and each time, the child simply walks back to the wall. The child has *assimilated* the new information about how shadows behave without changing appreciably their ideas about shadows (that what is needed is a lighted surface such as the wall).

After observing the child closely, the teacher steps into the shadow center one day and begins to imitate what the child has done in the past. Inviting the child to think more deeply about the shadows, the teacher states "My shadow keeps disappearing. I wonder what is happening." Together, they explore the problem until the child notices that when they can see the teacher's hand shadow, the light can also be seen on the teacher's hand, but when they can't see the teachers' hand shadow, the light is not on the teacher's hand. With this new information (more *disequilibrium*), the child concentrates on exploring how the light appears on their hand when the hand's shadow can be seen and not when the shadow cannot be seen. With further exploration and investigation, the child comes to realize that it's not enough to have a lighted surface; to make a shadow, their hand must be between the light and the wall. The child has *accommodated* the new information about how shadows behave by changing their understanding, and returns to a place of *equilibrium*. This continual process—disequilibrium, assimilation, accommodation, equilibrium—repeats over and over, with every new experience and every new piece of information.

Children explore color mixing.

Jean Piaget's extensive research (1932, 1963, 1974a, 1974b) explaining how children come to know what they know has several implications for teaching early childhood science, technology, and engineering:

* Young children construct knowledge of the physical world through direct experiences in which they explore, experiment, and form hypotheses about how the world works. Sometimes their hypotheses are correct and sometimes they are incorrect, but regardless, their hypotheses are the result of children's hard work and intellectual effort to make sense of their world.

* Young children are dependent on what is directly observable. Phenomena that children can explore and investigate for themselves provide children with opportunities to make close observations (independently or with the aid of tools, such as hand lenses, balance scales, cameras, etc.), describe what they observe, report changes that they observe when they act on objects, make predictions about what might occur if they change their actions in some way, and suggest possible explanations.

* Young children create connections between causes and effects more readily when they can observe results immediately. Preschoolers' developing long-term memory is such that if they must wait some time for an effect, they are much less likely to attribute the effect to something that occurred previously and thus construct causal relationships. However, photographs can be a powerful tool to make change over time visible to children.

* Young children like to make interesting things happen, whether that be swinging on a swing at a playground, building a tower with blocks and knocking it down, or pouring water into tubes and watching the water travel. They have a strong need and desire to be active. A great deal of their learning occurs through play, whether that be independent free play, guided play, or structured play.

* Young children are social creatures (although how social they are varies along a continuum). When they play, it is often with other children. This is good, because the pursuit of scientific understanding is a social activity. Scientific inquiry occurs best in a social atmosphere of cooperation, collaboration, and communication. Investigating, experimenting, and making errors—vital to the process of scientific inquiry—require an environment in which children are free to interact with their peers around scientific and engineering content, sharing ideas and trying out new ideas without fear of correction or reprisal.

Science Framework

Science:
More than a mile wide and an inch deep

For more than a decade, the quality and approach to K-12 science education has been a topic of concern. In 2007 the National Research Council of the National Academies published a comprehensive volume on how children in grades K through 8 learn the ideas and practices of science. Subsequently, the principles outlined in the 2007 volume led to a fundamentally different approach to K-12 science learning with the publication of a new conceptual framework for K-12 science education (NRS, 2012). This new approach restructured the prior focus on rote learning of a multitude of science facts across a wide range of topics, referred to as being a "mile wide and an inch deep," into an active-oriented, in-depth study of a smaller set of "big ideas" in four disciplinary core areas integrated around a core set of broad concepts. These three components, "learning by doing," of "core ideas," with a focus on "crosscutting concepts" were to occur together, analogous to the strand of a rope, woven together to produce a strong knowledge base acquired by active, "hands-on learning" and deep, "minds on" thinking.

This K-12 restructuring of science education has also begun to more broadly impact science education in early childhood. Despite the focus on K through 8th grade, the 2007 NRS volume included a chapter (Chapter 3) on the foundations for science learning prior to K, noting that science learning does not just begin at the onset of formal education when children enter kindergarten. Given the importance of early childhood for developing these foundations for science learning, in 2009 Greenfield and colleagues began adapting the K-12 science framework for preschool (birth to age 5; See Greenfield, Alexander, Frechette, 2017).

Learning should be much deeper than the surface level introduction provided to children around content.

The National Framework: A 3D approach to learning

The K-12 framework is a three dimensional approach (3D) for students to learn key disciplinary content through active engagement in science and engineering practices and attending to crosscutting concepts. Specifically, the three dimensions, woven together like the strands of a rope include:

1. eight science and engineering practices that are designed to engage students in active learning;
2. seven crosscutting concepts that are applicable across all science disciplines; and
3. four disciplinary areas that include the three traditional science areas (i.e., life science, physical science, earth and space science) and the addition of engineering, technology and the application of science as the 4th disciplinary area.

Within these disciplinary areas are two to four core ideas (e.g., ecosystems for life science, force and motion for physical science, earth systems, and engineering design). See Figure 8 to the right.

FIGURE 8

K-12 Science Framework

Disciplinary Core Ideas **Science content: life science, physical science, earth science, engineering and technology.** ***What children are interested in.***	1. Life sciences 2. Physical sciences 3. Earth and space sciences 4. Engineering, Technology, and the Applications of Science
Crosscutting Concepts **The big ideas that emerge and generalize across content, creating a coherent world view.** ***What children are trying to understand.***	1. Patterns 2. Cause and effect 3. Scale, proportion, and quantity 4. Systems and system models 5. Structure and function 6. Stability and change 7. Energy and Matter
	Early Science Framework
Scientific & Engineering Practices **Behaviors that children engage in to explore and develop knowledge.** ***What children do to answer their questions.***	• Observing and describing • Asking questions and defining problems • Making predictions • Developing and using models • Planning and carrying out investigations • Using math and computational skills • Documenting, analyzing and interpreting data • Constructing explanations and designing solutions based on evidence • Obtaining, evaluating, and communicating information

Adjusting the Framework: Building STE Understanding in Preschool

The Early Science Framework (Greenfield, Alexander & Frechette, 2017) models the K-12 Framework's three dimensional integrative approach (i.e., disciplinary core knowledge is acquired through active engagement in science and engineering practices while attending to crosscutting concepts, see Figure 8) , but adapts it to make it developmentally appropriate for three- to-five year olds. Specifically, the 8 scientific and engineering practices were modified as follows:

- "Observing and describing" was included as a free-standing practice due to its high salience for preschool and the need to alert early childhood teachers to begin with the foundational skills of observation and description.

- "Documenting" was added to practice #4 (Documenting, analyzing and interpreting data). Analyzing and interpreting data is illustrated with documentation activities that are familiar and common place in early childhood classrooms (e.g., charting children's favorite ice cream flavors and then using the chart to determine which flavor is most popular).

- "Making predictions" was added as a free standing practice. This was done to create a more developmentally appropriate context for encouraging the use of evidence by preschoolers. In the context of "making predictions," preschoolers are asked to provide evidence to justify their predictions.

- Practices #6 and #7 (see Figure 8) were combined into a single practice, "constructing explanations (science) and designing solutions (for engineering) based on evidence." This was done to create an additional context for encouraging the use of evidence by preschoolers.

As noted, Engineering and Technology is now the 4th Disciplinary content area in the new K-12 framework. During the preschool years children learn about engineering design process and the links between engineering, technology, science and society. The active engagement component includes both science and engineering practices.

In RISE, we begin with the practice of observing and describing. As active participants in learning about science content, children must be able to freely explore using all of their senses. This open exploration allows teachers to slow down the experience, allowing children to truly build a foundation of understanding. With the RISE teachers we engage them in the simple observation of an apple. Consider what responses teachers might receive when asking children what they know about an apple. They may receive responses such as it is red, it is round, it is yummy, we can use it in a pie. These are all valid responses. However, when this experience is slowed down and children are invited to use all 5 senses to observe and describe, what they realize is that there is much more to an apple. Now children may offer more detailed comments such as it has brown dots, it is white inside, there is a stem at the top, it tastes sweet, it smells fresh. Even deeper observations may include it feels smooth on the outside and wet on the inside or that it is starting to change and turn brown. This exploration is not limited to an "apple" and can be used with any fruit as illustrated in the following Box.

Observing and Describing a Piece of Fruit

This experience supports building the understanding of the importance of slowing down experiences and the value of using all five senses when learning.

Provide each teacher a piece of fruit. Ask them to:

1. **Observe the fruit only with their eyes.**
2. **Observe the fruit only with their sense of touch.**
3. **Observe the fruit using all 5 senses. At this time, provide teachers with a plastic knife to support their exploration.**

Engage teachers in conversation around:

- **The level of detail they were able to observe and describe by slowing down the experience and inviting them to use all five senses.**
- **Ways in which a child would freely explore the fruit.**
- **Potential extensions that could stem from this experience.**

As we continue to build on teachers' understanding and application of the science framework, we offer teachers experiences that invite them to engage in hands-on opportunities they could then bring directly back to their classrooms. These experiences allow the teachers to see the framework in action, consider adaptations to meet the individual needs of children, reflect children's everyday lives, and extend learning beyond this one experience. With each experience, the core idea, crosscutting concept(s) and practice(s) are identified, highlighting the integration of this 3D model.

The RISE approach is a flexible approach that can work within many different schools and program types. The examples provided represent some of the experiences we provided to teachers, all of which coincided with the theme-based curriculum program that was being used by teachers. The following examples reflect the units on sound and plants (prescribed by the curriculum in use in their programs) and were chosen to help teachers prepare for that unit. The first example focused on making a percussion instrument. An initial discussion to build on existing knowledge and home-to-school connections centered on percussion instruments that the children knew/had at home and heard most often. This led to the choice of "making maracas." A similar discussion with a different group might lead to the choice of a different percussion instrument (e.g., drums that might also vary across different cultures in their structure and sound).

Making Maracas

Disciplinary Core Idea: Physical Science
Crosscutting Concept: Cause and Effect
Practice: Investigation

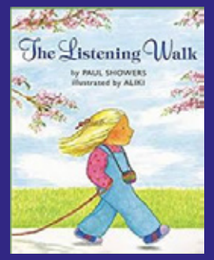
Provide teachers with plastic cups, tape and a variety of materials such as sand, cotton balls, beads, bells. Invite teachers to make maracas.

Invite conversation by asking:
How does adding _____ affect the sound?
How does increasing/decreasing the amount of ___ affect the sound?
Which items make the loudest sound?
Which items make the softest sound?

Click here for Yani's Story on Sound and Music. It's the first video, in a row of three.

The Listening Walk

Disciplinary Core Idea: Physical Science
Crosscutting Concept: Structure and Function
Practice: Observation



Read *The Listening Walk* by Paul Showers. Next take the teachers on a listening walk within the school and outside. Encourage everyone to focus on just their sense of sound which will require them to remain as quiet as possible.

Document the sounds in some fashion (written notes, audio recordings, etc.)

Upon return, share a set of "sound cards." Discuss how teachers could use these visuals as a means to adjust the experience for children of various ages as well as to focus the children's attention on particular sounds during the experience.

Consider the following:
Give each child a card to hold on the walk and focus on trying to hear the related sound.
Provide children laminated copies, clipboards and dry erase markers. The images can then become part of a scavenger hunt.
Use the images before the walk to discuss what sounds the objects make.
Use the images after a walk to sort out what sounds were heard and which were not.

STE are Everywhere

With so many teachers feeling uneasy about implementing STE in their curriculum, we wanted to offer experiences that highlight that **STE are everywhere** -in our everyday environment and embeded in our daily routines. In fact, without even realizing it, many teachers were already providing STE opportunities to their children. We spent time on typical school experiences that teachers reported doing in their classrooms and re-experienced them with an STE lens. We spent time reflecting on these experiences and identifying connections to the framework and language that teachers could use to highlight the crosscutting concepts.

Science During Mealtime: Preparing and Enjoying a Salad

Making connections to the Framework

Provide a variety of familiar salad ingredients (already washed) to teachers along with gloves, paper plates, plastic knives and access to a larger bowl. Invite teachers to prepare a salad together. Encourage them to use all 5 senses as they prepare the salad.
Have teachers consider the types of conversations that could occur during this experience with children. Together have them fill in the corresponding sheet noting:

What specific crosscutting concepts might be explored?

What scientific practices may be incorporated?

What rich vocabulary words may be used?

Summary of STE connection that RISE teachers identified during the salad experience can be found **here**.

Moving from Standard to Culturally-Inclusive STE Curriculum

Connect, Deepen, and Extend

Great STE curriculum goes beyond the idea of a "one and done" experience. For children to truly understand the concepts of science, engineering, and technology, teachers must create learning experiences that **connect, deepen** and **extend** initial understandings.

Connect
refers to our approach that asks teachers to investigate and uncover what children already know and can do in order to connect experiences and instruction to children's familiar knowledge. Children's everyday lives at home, with their families, and in their communities provide a wealth of opportunities for STE curriculum. Recognizing that learning builds on familiar knowledge, RISE emphasizes how learning occurs when classroom activities are connected to children's experiences in their homes and communities. **Connect** also refers to our emphasis on the importance of connecting what is learned to other learning that occurs in the classroom. The framework, and particularly, the crosscutting concepts offer rich opportunities to connect knowledge. For example, children grapple with cause and effect when they build unstable and stable block structures, when they create a sound by striking a metal pot with a wooden spoon, and when they roll marbles down ramps of varying heights. These concepts occur throughout STE, but teachers must support children in recognizing these concepts and making the connections to other places where they also appear.

Children can learn about the crosscutting concept of **stability and change** as they plant seeds and watch them grow and as they observe the construction of a home in their neighborhood. Both are very different experiences but connected through the crosscutting concept of **stability and change**.

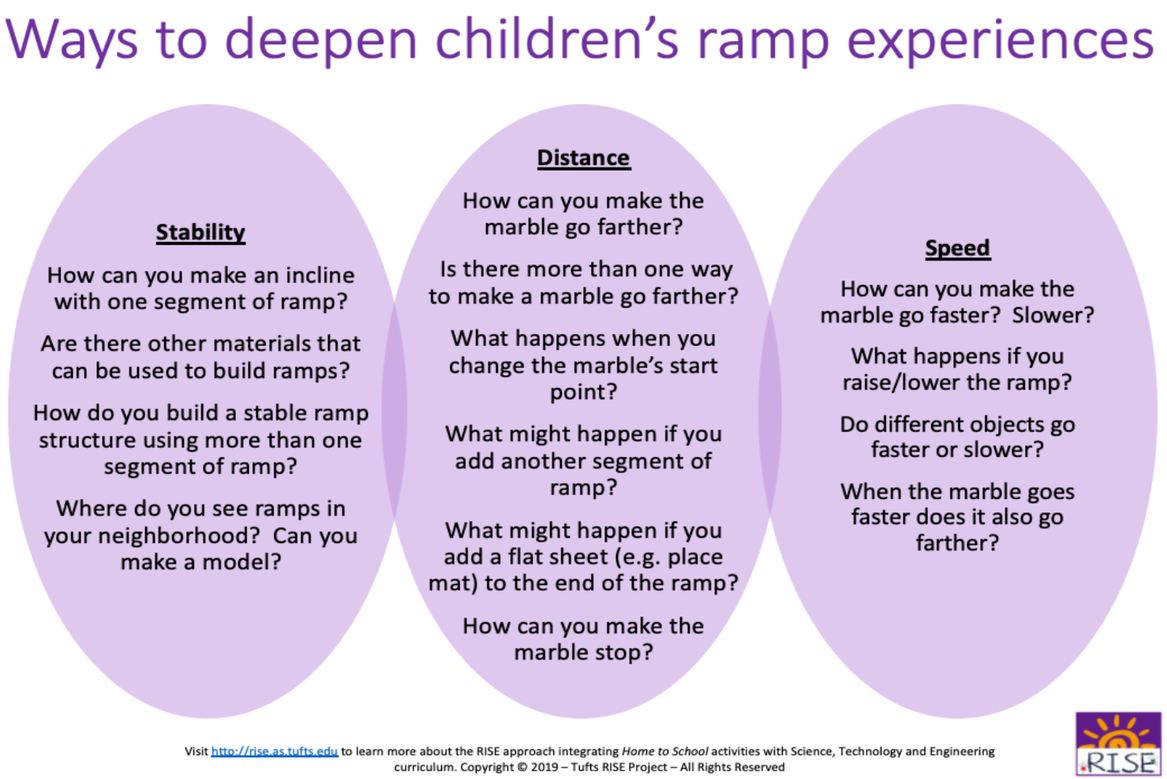
Click here for more information on this topic

Deepen

refers to our approach that asks teachers to slow their curriculum down and engage children in focused, in-depth investigations of STE topics and phenomena. When investigations occur over days, weeks, and even months, this allows children sufficient time to investigate and think about focal science and engineering ideas and makes it possible for their learning to deepen. For example, when children take several neighborhoods walks during a spring unit on plants, the teacher can take photos of the same plants over time. In this way, the children not only notice plants in their environments, but they also notice and document the changes taking place in those plants (the crosscutting concept of *stability and change*).

FIGURE 9

Ways to Deepen Children's Ramp Experiences



Extend

refers to our approach that asks teachers to focus on STE throughout all times of the day and areas of the classroom. When investigations occur at circle time, in the block area, at the science center, on the playground, on walks in the neighborhood, and anywhere else the class explores together, children's learning extends outward across multiple contexts. Similarly, gathering information from families brings children's explorations at home and in the community back into the classroom, creating the bi-directional home to school connections that are critical for learning.

The K-12 Framework and Early Science Framework include crosscutting concepts as a key component of science learning. We engaged teachers in **guided explorations of blocks and ramps** to highlight two of the crosscutting concepts, "structure and function," and "cause and effect."

Guided Exploration of Blocks

Crosscutting Concepts:
Structure and Function
Cause and Effect

Provide teachers with a variety of unit blocks. Challenge them in teams to:

- **Build tallest structure they can with the blocks in their tallest orientation;**
- **Build tallest structure they can with the blocks in their widest orientation;**
- **Build tallest structure with the fewest blocks.**

Bring measuring tape or use an alternative unit of measure (e.g. 1-unit block)

Challenge - build something familiar in your community
If finish early – use the Stages of Block play handout as discussion tool
Small groups in classrooms:
Break it down

What do you notice about how the shapes and placement of blocks affect the stability of a block structure?

Guided Exploration of Blocks and Ramps

Crosscutting Concepts:
Structure and Function
Cause and Effect

As an introduction to ramps, put teachers in pairs. Provide each pair a 1-foot length ramp (cove molding), a marble, a tray and one standard unit block. Ask teachers:

How can you cause the marble to move without touching it or blowing on it?

As they explore, ask them: What do you notice about the speed of the marble? What caused these differences?

Allow teachers a few minutes to explore various ways to accomplish this task. Invite them to share out how they approached this challenge and highlight the various ways this challenge was solved.

Next, give each pair a bag of items (e.g. pom poms, cotton ball, checkers, wooden screws, prescription bottle tops, candles). Invite them to further explore these materials on their ramp and ask them:
What do you notice about how the different objects move along the ramp?

Extended Guided Experience with Blocks and Ramps

Crosscutting Concepts:
Structure and Function
Cause and Effect

Provide teachers with a variety of different length ramps, marbles and a variety of unit blocks.
Begin with free exploration.

Add guided challenges:

Can you build a ramp structure that can go downhill and uphill?
Can you build a ramp structure where a marble can fly through the air?
Can you build a ramp so that the marble goes faster / farther?
Can you make the marble stop? (use consistent language for all 4?)
Can you build a ramp structure that can turn a corner?

Share out the various ways people solved the challenges. What occurred that surprised them? What problems did they have to solve to be successful?

Finding the STE in Back-to-School Routines
Connect, Deepen, Extend
Making Connections to the Framework

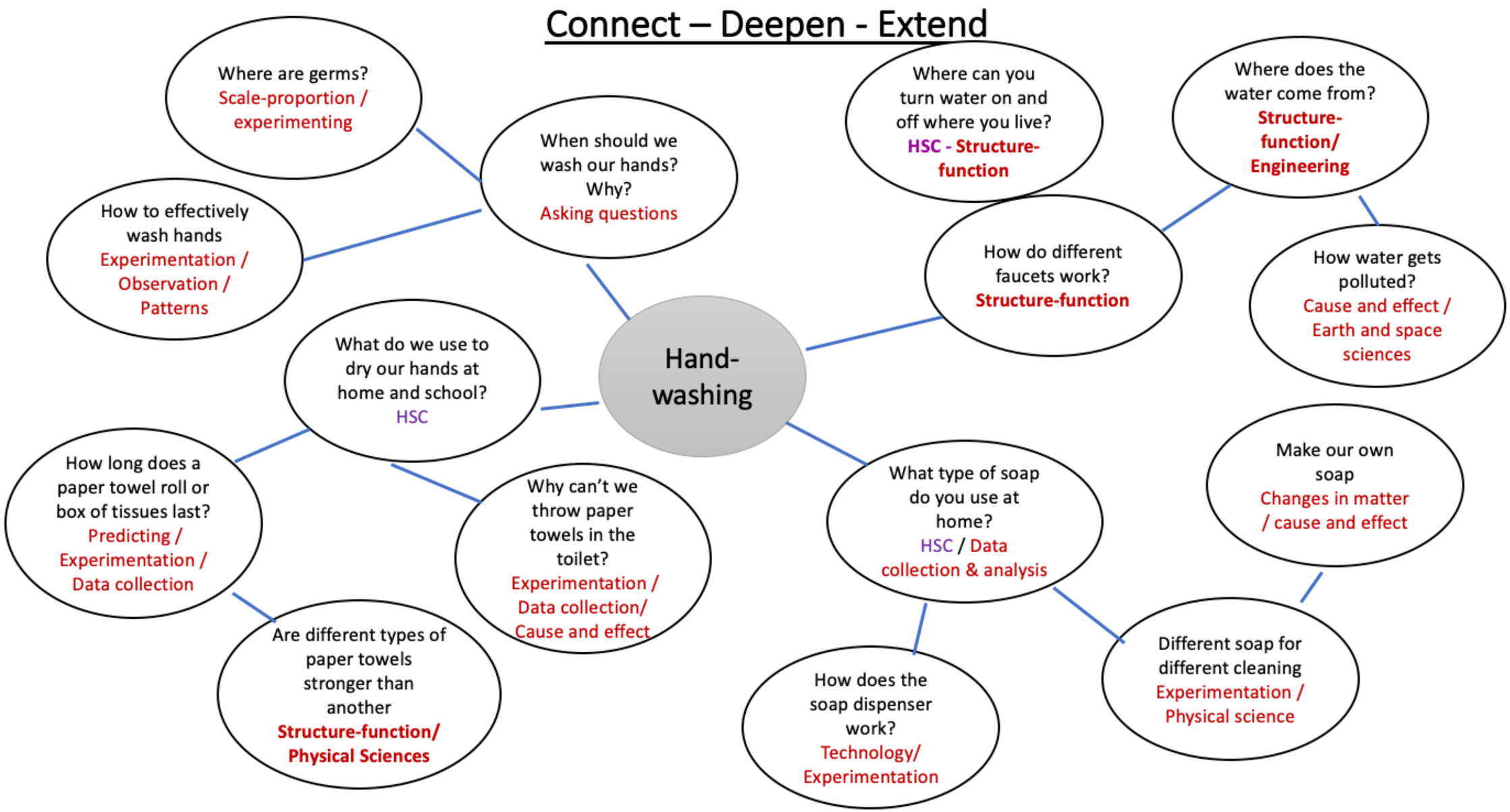
As a group, identify the various health and safety routines you work to instill in the children at the beginning of the school year. Note on poster paper.

Break teachers into small groups. Assign each group one of the health and safety topics listed on the poster paper. Ask them to web out the various ways in which they will engage children to learn about the importance of this routine and why. Then have teachers reflect on these experiences and identify the crosscutting concepts that can be incorporated into the experience.

Have small groups share their work with whole group.

FIGURE 10

Connect - Deepen - Extend

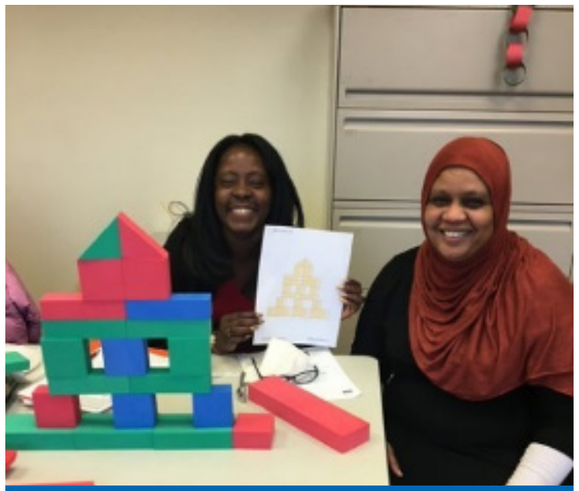


Note: Many of these activities might incorporate more of the framework – noted here are the most prominent ones.

Types of Inquiry: Each with Value

There are three types of inquiry, each of which offers a different level of teacher support: open, guided and structured.

Opportunities to experience activities based on different types of inquiry provide teachers time to reflect on their own curriculum practices as well as compare when and how to use these different styles with children. As teachers planned for an upcoming unit on blocks and building, we suggested that they offer the experiences below, each based on a different type of inquiry. Each experience will support the learning of different crosscutting concepts and reinforce different science practices.



Teachers engaging in experiences that focus on types of inquiry during a PLC.

Open Ended:

During free exploration, children build whatever they want. During their building, they can come across their own questions and then plan and implement an investigation to answer their question. The crosscutting concepts will vary based on their individual questions.

Guided:

During the guided experience of challenging children to make an enclosure with a roof for the different sized dinosaurs, teachers provide the question. The end goal is the same for all children but the way in which they accomplish this task will vary. Within this experience, children can explore scale, proportion and quantity as well as structure and function.

Structured:

In this experience, children are provided with a blueprint, or model, to replicate using blocks. Children use their math skills as they explore patterns and scale, proportion and quantity.

There is no "right or wrong" when choosing between the three inquiry types. However, offering a combination of each of them within the curriculum allows more diverse opportunities and challenge levels for children.

What is Inquiry-Based Science?

Inquiry-based science allows children to become an active participant in their own learning. By building off of children's knowledge and interests, educators can guide learning opportunities that will lead to deeper learning and understanding, greater problem-solving skills, better critical thinking skills and more excitement about learning. Inquiry-based learning supports the development of science process skills as well as language, math and social emotional skills.

Three Kinds of Inquiry

Structured Inquiry:
Students follow precise teacher instructions to complete a hands-on activity.

Guided Inquiry
Students develop the procedure to investigate a teacher-selected question.

Open Inquiry
Students generate questions about a teacher-selected or student-generated topic. Students design their own investigations.

Consider the three types of block experiences noted within the chart below. Each one offers a rich experience with blocks. While the open inquiry allows for complete choice by the child, the guided and the structured inquiries pose problems for children to solve, scaffolding their learning. Each type of inquiry can engage young children in an appropriate way provided it was planed with the child in mind.

Open	Guided	Structured
Students design their own investigations.	Student and teachers design and carry out collaborative investigations.	Students follow precise teacher instructions to complete a hands-on activity.
Explore the blocks. 	Make an enclosure for each dinosaur with a roof. 	Build this. 

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Light and Shadows

Crosscutting Concepts: Cause and Effect
Scale, Proportion and Quantity

Using a bright light source, set up the following experiences:

Free Exploration (open ended)

- **Project the light onto a blank wall. Provide ample space between the light and the wall for teachers to move about. Invite teachers to use their bodies or various materials around the room to explore shadows. Ask some questions to provoke teachers' thinking about examples from their childhood around cause and effect as well as scale, proportion and quantity.**

What happens when you do _____ (action)?
What do you think caused that to happen to the shadow?
How can you make the shadow bigger?
How can you make the shadow smaller?

Puppet Show (Guided Inquiry)

- **Provide teachers with props for a puppet show. Encourage the teachers to use the props to represent a specific story or be a variety of characters for creating a new story. Also provide materials so that teachers can make their own props.**

Opaque, Translucent and Transparent (Guided Inquiry)

- **Provide teachers with a variety of types of materials such as lace, sheer fabrics, see through colored plastics, paper. Have them investigate the properties of these materials to better understand how shadows behave.**

Fit the Bird in the Window (Structured Inquiry)

- **Determine how to make the bird's shadow fit within the various sized windows.**

Click here for more information on this subject

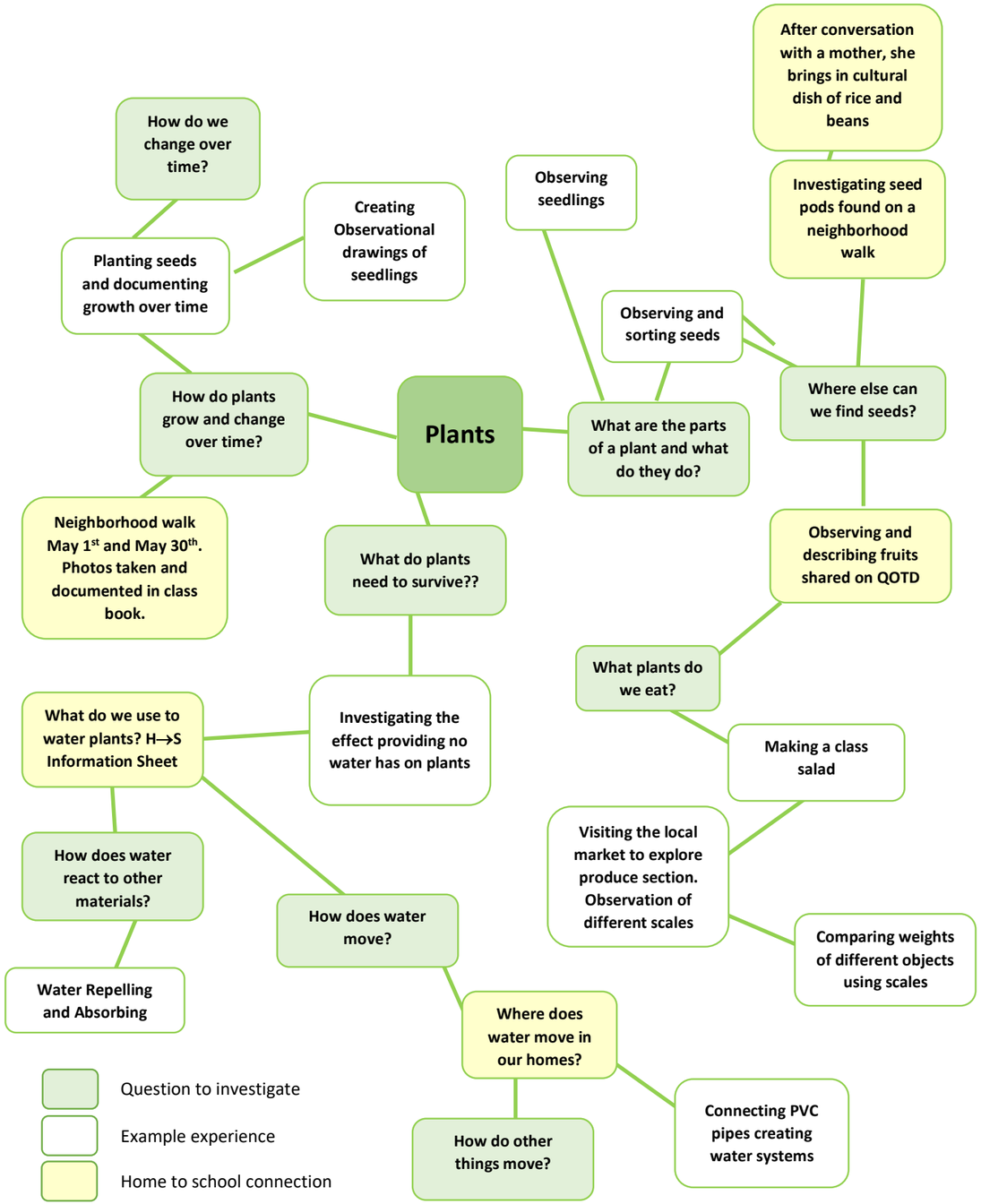
TABLE 5

Curriculum Unit	RISE Related PD Experiences (Across Two Years)	Framework Focus		
		DCI	CC	SEP
Colors	**Color, Light, Shadows** • Free exploration with light and various materials • Explore opaque, translucent and transparent • Shadow puppet show • Get shadow of puppet to fit within windows	Physical Science	Cause and Effect Scale, Proportion and Quantity	Observing and Describing Investigation
Sound and Music	**Sound and Music** • Making maracas • Kitchen Band • Following music sequence • Listening Walk • Sound vibrations	Physical Science / matter and interaction Engineering	Cause and Effect Scale, Proportion and Quantity Patterns Structure and Function	Observing and Describing Analyzing & Interpreting Data Investigation
Building and Ramps	**Blocks and Ramps** • Can you build the tallest tower with the fewest blocks? • Can you get the marble to move without touching it? • Can you get the marble to roll up / knock down object at end of ramp? • Can you build a bridge?	Engineering Physical Science / force	Structure and Function	Asking Questions Investigation
Watch it Grow **Plants We Eat**	**Plants, Living, Non-Living Things and Water** • Making our own salad • Exploring Seeds • **How to plant a seed** • How water moves • Properties of Water • Absorption • Taking apart wind-up toys	Physical Science living things / molecules to organisms	System and System Models Stability and Change Cause and Effect Structure and Function	Asking Questions and Defining Problems Documentation
Health and Safety	**Health and Safety Routines** • Neighborhood Walks • Classroom Routines	Engineering, Technology, and the Application of Science.	Patterns Cause and Effect	Observing and Describing Investigations

The chart above reflects the focuses that RISE used during professional development to align with the curriculum used by the classrooms, highlighting the flexibility of RISE to work within any school context.

FIGURE 11

Connect, Deepen, Extend: Plants



As mentioned earlier, RISE is a flexible approach that can be used with a wide variety of curricula. Within any unit, topic, or lesson, teachers can connect, deepen and extend children's learning. In one program that had adopted a prescribed curriculum, teachers were able to use RISE to enrich the scheduled units. For example, in the plant unit, teachers connected the learning to what children knew and experienced in their homes, neighborhoods, and communities, deepened their learning about plants beyond what was prescribed in the curriculum, and extended their learning into other topics (see Figure 11 to the left).

At the beginning of the unit on plants, teachers took time with children to observe and describe seedlings. Using magnifiers, children observed the various parts of the plants, including the leaves, stem and roots. This initiated conversation on the structure and function of the parts of the plant. Children also had the opportunity to observe various seeds, comparing a variety of attributes including their size, shape and color.

Investigating the various parts of a seedling

Connect

For one classroom, this provided the opportunity to connect where seeds come from while on a community walk. The teachers found seed pods along the walk that the children brought back to the classroom to further explore, learning about the structure and function of the pod itself.

Seedpod collected from neighborhood walk

Deepen

As a way to deepen children's understanding of plants and their growth, one teacher took her children on a neighborhood walk to a nearby community garden. Children first went on the walk during the first week of May and then again during the last week of May. Along the way and at the community garden, children made observations of various living and non-living things. The teacher took photos and created classroom books. The first book documented the first walk and the observations that children made. The second book used photos of the same objects from both walks so that children could compare the changes in the plants over time, but not in the non-living objects (stability and change). To deepen children's understanding of seeds further, experiences segued from flowers to plants that grow foods that we eat. Through information obtained through QOTD and Home-to-School information sheets, teachers were able to bring in fruits and vegetables that were familiar to children so that they could dissect and investigate them. This allowed children to continue to explore structure and function, not only of the seeds, but of the fruit and vegetables themselves. For example, the children were able to see how the rind of an orange protects the fruit inside and the stem is how the fruit and vegetable connect to the plant.

Extend

When one teacher took her children for a walk through the produce section of a local market to see a variety of fruits and vegetables, the children were introduced to the various types of scales used to weigh food. This provided a wonderful opportunity to extend children's learning and return to the classroom to investigate weight of objects (scale, proportion and quantity).

Scale constructed from a coat - hanger to explore weight

Other opportunities for connecting, deepening and extending surfaced during this unit on plants. During discussions on what plants need to survive, children and teachers became interested in the properties of water. Using a Home-to-School Information sheet, families were asked what they used to water plants at home, providing rich opportunities to begin exploring how water moves. Several additional Home-to-School Information sheets and QOTD were designed to obtain additional information from children's homes.

Home to School sheets sharing information on how water is used at home, how it moves / Watering can used to investigate moving water

Connect

Conversations around water movement brought on opportunities for classrooms to make connections to water at their homes. Children were encouraged to look for where water is used in their homes and share back with the classroom using Home to School Information Sheet. Children became more aware of the many ways we depend on water to live.

Deepen

Throughout these discussions, one child shared a story about his father fixing the pipes under the sink at home because there was a water leak. This became a wonderful way to deepen children's learning about water movement and its use at home. PVC piping and valves were added to the water tables. Children now had a hands-on experience to better understand the systems used to move water in their homes.

Extend

With the variety of experiences related to water and how it moves, a new extension surfaced to build upon the properties of water; specifically, they investigated absorbing and repelling. Children noticed that some materials absorbed water, such as a paper towel to clean up a spill, while others repelled water. This extension led teachers and children in the direction of investigating the structure and function of various materials, specifically as it related to staying dry in the rain. A **QOTD** was used to ask what types of clothing they use to stay dry in the rain.

Using PVC piping in sensory table to better understand the structure and function of plumbing.

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Professional Materials

Professional Materials

Throughout this guide, we have made reference to the professional materials that were developed by the RISE project as resources for teachers. This section is packed with many of these resources (some mentioned in the Guide). Please keep in mind that the RISE approach is a flexible way of enriching your curriculum so strict use of these materials in any prescribed order is not necessary. Rather, use them in ways and at times you feel will best support your work in the classroom and with families.

Resources are organized by the three sections of the Guide:

The Co-construction section includes:
- One-page summary of the RISE Project (**download poster**).
- Other materials are useful to plan co-constructive activities with parents, or in coaching relationships.

The Home-School Connections section includes:
- Home-to-School Sorting Game: This activity tends to elicit misunderstandings and shed clarity on what are home-to-school vs. school-to-home activities.
- HSC Activities Planning Sheet: Summary of different ways of learning what families know and do every day.
- Home-to-School Information Sheets and Questions of the Day: Templates for asking families who cannot or do not normally come to the school building to provide information about their children's daily lives. This information is then used to inform curricular units.

The Science, Technology, and Engineering section includes:
- Two templates for asking science questions and thinking about science inquiry
- Materials pertaining to five areas of the preschool science curriculum:
  - » Blocks and Ramps;
  - » Color, Light and Shadow;
  - » Health and Safety;
  - » Plants; and
  - » Sound and Music.

Click here for access to more RISE resources.

Co-Construction Materials

- RISE Poster
- Co-Construction Activity Sheet
- Intentional Planning Sheet
- Teacher/Coach Meeting

The RISE Project

Readiness through Integrative Science and Engineering

Project Mantras

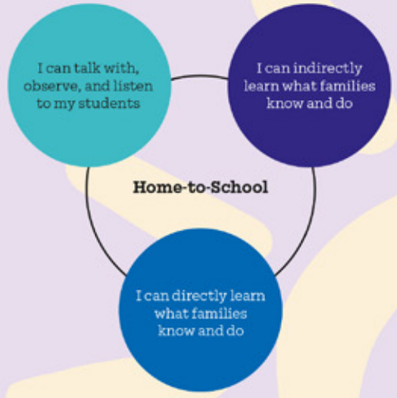
Science, Technology, and Engineering are Everywhere

1. Parents are Equal Partners
2. Learning Builds on Familiar Knowledge
3. Culture is What We Do Everyday

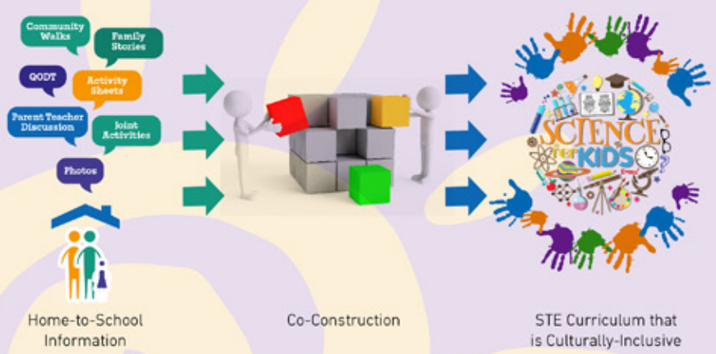
RISE focuses on preschool teachers and children pursuing explanations for how the world works (science – S) and solutions to problems (technology & engineering – T & E). By creating learning experiences that build from STE that is part of children's lives, teachers connect new learning experiences to what children already know and extend children's understandings.

Scientific & Engineering Practices	Crosscutting Concepts	Disciplinary Core Ideas
1. Asking questions & defining problems 2. Developing & using models 3. Planning & carrying out investigations (Observe, Describe, Document) 4. Analyzing & interpreting data 5. Using mathematics 6. Constructing explanations (science) and designing solutions (engineering) 7. Engaging in argument from evidence 8. Obtaining, evaluating & communicating information	1. Patterns 2. Cause and Effect 3. Scale, Proportion, and Quantity 4. Systems and System Models 5. Energy and Matter 6. Structure and Function 7. Stability and Change	1. Physical Sciences 2. Life Sciences 3. Earth and Space Sciences 4. Engineering, Technology, and the Applications of Science

Three Ways I Can Learn What Families Know and Do



Building Culturally-Inclusive Curriculum



Connecting... Deepening... Extending...

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CO-CONSTRUCTING ACTIVITY SHEET

Use this sheet to collaborate with co-teachers, teaching assistants, and families to complete some preliminary planning for an upcoming curriculum focus. Consider how to integrate Home - School Connection (HSC) and Science, Technology and Engineering (STE) cohesively.

HSC + STE Underlying Goals:

- Start with children's familiar knowledge
- Connect, Deepen, Extend

Co-Constructing
What information do I want to obtain from families?
How will I obtain this information?
How will I use this information in my curriculum?
What Science and Engineering Practices (SEPs) will I be incorporating?

RISE

Intentional Planning Sheet

The Intentional Planning Sheet provides guidance in planning an experience and considers key details to assure the experience is rich in STE and HSC.

What is the problem/challenge? What is the learning goal?	
HSC Information - What do the children know or what relevant experiences have they had? What links can we make from this information to the challenge activity?	
What prior knowledge or skills are needed?	
Variables:	Materials (e.g. visuals, charts, books, songs, manipulatives):
How would you introduce the lesson (whole group)? Be sure not to give away the answer! ☐ open ended ☐ guided ☐ structured	
What type of investigation would you set up in a learning center after the introduction (small group)? ☐ open ended ☐ guided ☐ structured	
What questions would you pose to the children? Attention-focusing, action, problem-posing, comparison, math:	
How would you assess understanding?	
Potential extensions? (**connect – deepen – extend**)	

Circle the frameworks that will be addressed:

Scientific & Engineering Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

1. Physical sciences
2. Life sciences
3. Earth and space sciences
4. Engineering, technology, and the applications of science

Teacher / Coach Meeting

Coach		Date		Meeting Length	
Teacher		School			

Copy provided to teacher upon completion

Follow up from previous meetings:

Highlights (what and why):

Connections to the Frameworks

Disciplinary Core Ideas	Crosscutting Concepts	Science & Engineering Practices

How might you connect-deepen-extend your curriculum between today and our next visit together?

Idea #1

Connection to Frameworks:

HSC ☐ Yes ☐ No
Action Steps (task/person responsible/date)

Idea #2

Connection to Frameworks:

HSC ☐ Yes ☐ No
Action Steps (task/person responsible/date)

Additional Notes

HSC Materials

- Home-to-School Sorting Game (with and without answers)
- HSC Activities Planning Sheet
- Home-to-School Information Sheets
  - » *"My Favorite Fruit"*
  - » *"Fruits and Vegetables in My Home"*
  - » *"My Family's Favorite Food Dish"*
  - » *"How Do You Eat Apples?"*
  - » *"Plants in My Home"*
  - » *"How I Use Water at Home"*
  - » *"Finding Water in My Home"*
  - » *"Pipes in My Home"*
  - » *"Family Music"*
  - » *"We're Learning About Music!"*
- Questions of The Day (QOTD)
  - » "Na*me a fruit that your family enjoys at home"*
  - » *"When it is raining outside, I use this to stay dry:"*
  - » *"What does your family use to clean up spilled water"*

Sorting Activity: Home ➡ to ➡ School OR School ➡ to ➡ Home

Experience	H to S	Both	S to H	Explanation
Send home weekly newsletter				
Send worksheet to practice at home what is done in the classroom				
Children talk at home about school				
Send worksheet to ask information from parents about plants they grow at home with children and bring it back to school				
During circle time, children share what they did at home				
Attend coffee hour where teachers and administrators provide information				
Attend coffee hour where teachers and admin seek information from parents				
Ask parents where/when counting happens naturally at home				
Teachers encourage parents to take children to the library and bring back their favorite stories				
Practice counting at home as children learned at school				
Teacher asks parents what stories children like				
Teacher requests parents read to their children daily				
Parents share favorite recipes w/ teachers				
Parents volunteer in the classroom				
Parents attend Head Start training workshops				
Parents bring photos from home				
Parents complete question of the day (QOTD) in classroom				
Find out where children spend their time while parents are working				
Parents attend parent-teacher conferences				
Grandmother comes to classroom to share folktales with children				
Teacher makes home visits				
Mother sends homemade artifacts to classroom				

Home ➡ to ➡ School OR School ➡ to ➡ Home
Sorting Resource Page

Both *School-to-Home* experiences and *Home-to-School* experiences have value. While *School to Home* experiences support teachers in sharing with families what children are learning in the classroom, *Home to School* experiences capture information from families about a specific learning concept. These familiare home experiences to the child can then be explored in the classroom. Each experience below is identified as a *Home to School*, *School to Home* or both along with an explanation.

Experience	H to S	Both	S to H	Explanation
Send home weekly newsletter			X	Information about school is going home
Send worksheet to practice at home what is done in the classroom			X	School curriculum is being asked to be reinforced at home
Children talk at home about school			X	Children's school experiences are being shared
Send worksheet to ask information from parents about plants they grow at home with children and bring it back to school	X			School is learning about family-specific information about plants; information is flowing primarily from home→ school
During circle time, children share what they did at home	X			School is learning about children's home activities
Attend coffee hour where teachers and administrators provide information			X	School personnel are disseminating information to parents
Attend coffee hour where teachers and admin. seek information from parents	X			School is obtaining information about each family
Ask parents where/when counting happens naturally at home	X			School is learning about how learning occurs at home
Teachers encourage parents to take children to the library and bring back their favorite stories		X		School is encouraging a specific learning experience to take place at home - bringing the story back shares children's personal interests
Practice counting at home as children learned at school			X	School is encouraging a specific learning experience to take place at home
Teacher asks parents what stories children like	X			School is gathering information about children's personal interests
Teacher requests parents read to their children daily			X	School is encouraging a specific learning experience to take place at home
Parents share favorite recipes w/ teachers	X			School learns specific information about each family
Parents volunteer in the classrooms		X		Volunteer learns specific school practices - school learns about parent/family indirectly through interactions
Parents attend Head Start training workshops			X	School is providing specific information that parents can apply at home
Parents bring photos from home	X			School learns about family details (i.e. family members, physical environment)
Parents complete question of the day (QOTD) in classroom		X		Only home-to-school if the teacher asks questions to learn specific information about each child/family
Find out where children spend their time while parents are working	X			School learns about children's routines outside of school
Parents attend parent-teacher conferences		X		Teachers find out information from parents to further understand a child – parents learn how a child is progressing at school; must involve reciprocal dialogue to be both; teachers must take the lead in eliciting this bi-directional dialogue
Grandmother comes to classroom to share about folktales with children	X			School gains information about culturally-specific stories for that family
Teacher makes home visits		X		School learns about child's family, home environment, history – parents learn how school will support the child's growth
Mother sends homemade artifacts to classroom	X			School learns about something culturally relevant about a specific family

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"THOUGHT PARTNERING" WITH TEACHERS
ABOUT WAYS TO ELICIT HOME-TO-SCHOOL INFORMATION

Engage teachers in conversations around ways to elicit information from families by reflecting on various examples of family engagement. Begin by sharing the examples on the RISE website (e.g. Community Book, Neighborhood Walk, Joint Activity, Parent-Teacher discussion group).

Community book
A community book is created collaboratively among parents and teachers. It represents all of the families' culture as it is reflected in the community. The process is driven by parents, allowing them a leadership role and an opportunity to acknowledge the value of their own culture.

Neighborhood Walk
A neighborhood walk may take multiple forms. It may be a walk around the neighborhood with parents taking lead on pointing out specific landmarks, items of interest, or daily routes. It could also be the co-creation of a map of the community with the same goals, if this proves more accessible for parents. (This creation and further discussion could lead to a Parent-Teacher discussion or joint activity).

Joint Activity
A joint activity involves parents and teachers co-creating a product that is connected to the curriculum. For example:

- A teacher may wish to create a garden in their classroom utilizing the herbs that their children eat at home. Parents can bring in herbs that they use and create a garden in that represents the children's cultures.
- A teacher can ask parents to make a traditional family soup to bring to school. Parents can be invited to enjoy at a potluck. They can share various details about their soup such as ingredients, when this is typically made, or other culturally relevant information.

Parent-teacher discussion group
Parent – teacher discussion groups are opportunities for families and teachers to come together to engage in conversations around relevant topics. These conversations allow participants to learn more about one another and engage equally, rather than be "informed" by the school. One example of a discussion topic is "How do you define community?"

Then, invite teachers to:

- Identify the various elements incorporated in the experience that reflect the family's cultures.
- In a similar experience, share one way they might would they envision their own culture to be represented.
- Reflect on how this experience positively impacted parents and teachers.
- Reflect on how children may engage in the curriculum differently.

Have teachers share out responses above.

Next, have teachers identify ways in which they could engage families in a similar project.

- Who will be involved? (e.g. family, teachers, family engagement)
- Where and when could this be hosted? (e.g. coffee hour, before or after school)
- How will you invite families to participate? (e.g. classroom parent leader, flyers)
- Do you have classroom parent leaders to support this project?
- How will you create a collaborative environment among families?

Have teachers share out responses above.

Have teachers share out responses above.

Continually focus the group on how their ideas are reflecting the HSC mantras:

- **Parents as Equal Partners**
- **Culture is what we do every day**
- **Learning builds on familiar knowledge**

Home-to-School Information Sheets

My Home

Name: _____

There are _____ levels/ stories/ floors in my home.

Number of windows in my home is:

_____

I counted the stairs in my home and there are:

_____

This is a drawing of where I live:

The outside walls of my home are made of:

Wood *Concrete* *Bricks* *Metal* *Glass*

(Circle)

Visit http://rise.as.tufts.edu to learn more about the RISE approach integrating *Home to School* activities with Science, Technology and Engineering curriculum.

My Favorite Fruit

Name: _____

Answers written in your home language are welcomed

My favorite fruit is _____ .

The color(s) of this fruit is:

This fruit comes from:

This is what the fruit looks like:

Visit http://rise.as.tufts.edu to learn more about the RISE approach integrating *Home to School* activities with Science, Technology and Engineering curriculum.

Fruits and Vegetables in My Home

Look in your home. What fruits or vegetables do you have? Draw a picture and label these foods in the boxes. Circle whether it is a fruit or a vegetable.

Name: _____

Answers written in your home language are welcomed.

Fruit / Vegetable	**Fruit / Vegetable**
Fruit / Vegetable	**Fruit / Vegetable**
Fruit / Vegetable	**Fruit / Vegetable**

Visit http://rise.as.tufts.edu to learn more about the RISE approach integrating *Home to School* activities with Science, Technology and Engineering curriculum.

My family's favorite food dish.

Name: _____

My family's favorite food dish is

_____.

The ingredients in this dish are:

CHILD'S NAME _____

Do you eat apples at home?

(Circle one)

YES NO

Is there another fruit your family enjoys?

_____

How do you eat apples?

Applesauce

Apple slices

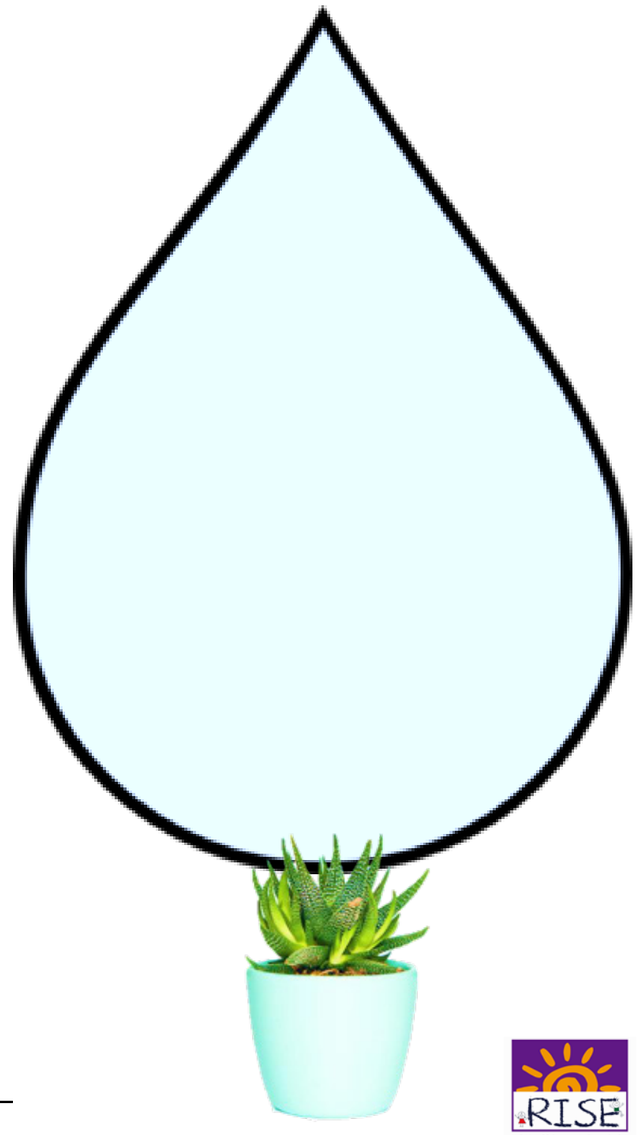
Apple Pie

Other (write or draw answer)

Visit http://rise.as.tufts.edu to learn more about the RISE approach integrating *Home to School* activities with Science, Technology and Engineering curriculum.

Plants in my home

This is a picture of an inside / outside (circle one) plant:



Name:_____

How I use water at home.

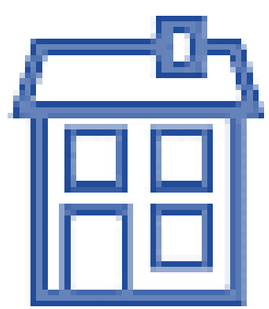
Name: _____

Kitchen

Bathroom

Outside

Other



Finding Water in My Home

Take a walk around your home. Draw pictures and label where you find water.

Name: _____

Pipes in My Home

We are talking a lot about water! This week we're looking at pipes, how they connect and how water moves through them.

Do you have pipes in your home? YES / NO (circle one)

Where are they? What do they do?

Draw or take a picture to share with the class.

Family Music

Name: _____

These are the times my family enjoys music together:

This is a picture of my family enjoying music:

(Attach a photo or draw a picture)

We're learning about music!

There is so much beauty in music!
And there are so many countries and cultures represented in our classroom!

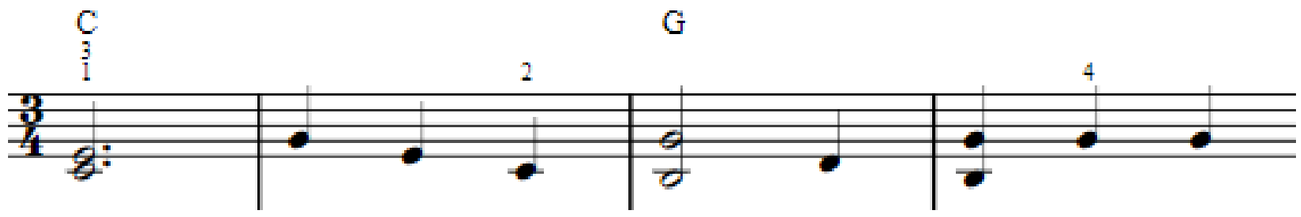
Please share a picture of an instrument, a dance or words to song that is important to your family culture.

Child's name:

Country of origin:

Music/Song/Instrument:

Picture:



Questions of the Day (QOTD)

Question of The Day

Name a fruit that your family enjoys at home.

Answers written in your home language are welcomed.

Name	Fruit

Question of the Day

When it is raining outside, I use this to stay dry:	
	
	
	
	
Other	

Question of the Day

What does your family use to clean up spilled water?

Name	Answer

STE Materials

- STE Questions
- What is Inquiry-Based Science?
- BLOCKS AND RAMPS
  - » Intentional Planning Sheets
    - Building a Bridge Over “Water”
    - Knocking Down Object at End of Ramp
    - Rolling Up
    - Wrecking Ball
  - » Challenge Cards
  - » Ways to Deepen Children’s Ramp Experiences
  - » “My Home” Home-to-School Information Sheet
- •COLOR, LIGHT, AND SHADOW
  - » Shadow and Light Exploration
  - » Rainbow Scavenger Hunt
- •HEALTH AND SAFETY
  - » Connect-Deepen-Extend Health and Safety Webs
  - » Hand-Washing
  - » Crossing the Street
  - » Fire Drills
  - » Mealtime
  - » Using Toys Safely
  - » Safety Signs Scavenger
- •PLANTS
  - » How to Plant a Seed
  - » STE That Can Happen During Meals
- •SOUND AND MUSIC
  - » Volume/Pitch/Duration
  - » *Sound Cards*

STE Questions	
Attention-Focusing Questions	*Have you seen? What do you notice about?*
Measuring and Counting Questions	*How many? How long? How much?*
Comparison Questions	*How are they the same or different?*
Action Questions	*What happens if….?*
Problem-Posing Questions	*Can you figure out how to…?*
Reasoning Questions	*Why do you think…?*

What is Inquiry-Based Science?

Inquiry-based science allows children to become an active participant in their own learning. By building off of children's knowledge and interests, educators can guide learning opportunities that will lead to deeper learning and understanding, greater problem-solving skills, better critical thinking skills and more excitement about learning. Inquiry-based learning supports the development of science process skills as well as language, math and social emotional skills.

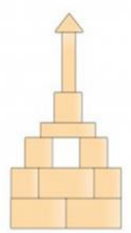
Three Kinds of Inquiry

Structured Inquiry:
Students follow precise teacher instructions to complete a hands-on activity.

Guided Inquiry
Students develop the procedure to investigate a teacher-selected question.

Open Inquiry
Students generate questions about a teacher-selected or student-generated topic. Students design their own investigations.

Consider the three types of block experiences noted within the chart below. Each one offers a rich experience with blocks. While the open inquiry allows for complete choice by the child, the guided and the structured inquiries pose problems for children to solve, scaffolding their learning. Each type of inquiry can engage young children in an appropriate way provided it was planned with the child in mind.

Open	Guided	Structured
Students design their own investigations.	Student and teachers design and carry out collaborative investigations.	Students follow precise teacher instructions to complete a hands-on activity.
Explore the blocks. 	Make an enclosure for each dinosaur with a roof. 	Build this. 

Rise.as.tufts.edu

Intentional Planning Sheets

RISE

Intentional Planning Sheet – Building a Bridge over "Water"

This is a sample of the RISE Intentional Planning Sheet that was co-constructed by RISE teachers with the goal of challenging children to engineer a stable bridge that will span a predetermined "river" (made of blue felt/paper). The Intentional Planning Sheet provides guidance in planning an experience and considers key details to ensure the experience is rich in STE and HSC.

What is the problem/challenge? What is the learning goal?
Can you build a bridge over the "river" that is wider than the longest block in the set?
Children will begin to understand the structure and function of bridges.
Alternative learning goal: motion and stability: can this bridge withstand weight, and if so, how much?

HSC Information - What do the children know or what relevant experiences have they had? What links can we make from this information to the challenge activity?
Using the QOTD, we asked children to think of a bridge they had seen and if it went over water, train tracks, roads or something else. This allowed us to begin a discussion on bridges and for children to share experiences.

What prior knowledge or skills are needed?
- *A bridge connects 2 places*
- *There are different types of bridges*
- *Bridges do not fall down*
- *Children will need to be beyond the "stacking" stage of blocks*

Variables:	Materials: (e.g. visuals, charts, books, songs, manipulatives)
Width of the river, height of the bridge, which sized blocks are being used	*"river" made out of felt, blocks, pictures of various types of blocks, people figures, toy car; bridge photos; neighborhood walk; songs (HS has a "Bridge/Tunnel/Road" song)*

How would you introduce the lesson (whole group)? Be sure not to give away the answer!
☐ open ended *X* guided ☐ structured

1. *Begin with a discussion allowing children to share what they know about bridges and/or the one they noted on the QOTD.*
2. *Given that the bridges over water was checked off the most on the QOTD, focus discussion more about what children know about this type of bridge and their experiences with water.*
3. *Share pictures of various sized bridges.*
4. *Using a narrow "river" (made out of felt or paper), have children determine how to create a bridge over the water (this will simply be a block on each side and one on top). Then provide a wider "river" and repeat activity. (This is a structured mini lesson or guided discovery)*
5. *Using a toy car, test the bridge. The car cannot get on the bridge. Introduce the use of ramps on both sides of the bridge.*

What type of investigation would you set up in a learning center after the introduction (small group)?
☐ open ended *X* guided ☐ structured
Provide children with an even wider "river". Can you build a bridge over this river? Offer only the long size block initially and then offer the shortest blocks only.

What questions would you pose to the children? Attention-focusing, action, problem-posing, comparison, math:
- *How does the length of the block impact our design?*
- *How many blocks do we need to _____?*
- *How can you change your design so that the boat will fit under?*
- *I noticed you made a path around the water. Can you tell me about what you are designing?*

How would you assess understanding?

Potential extensions? (**connect – deepen – extend**)
- *Continue the challenge on other days, continuing to widen the "river"*
- *Provide some materials that will not allow help in making a functional bridge*
- *Provide various size boats. Is the bridge tall enough to allow the boat through?*
- *Provide various sized objects to test the amount of weight the bridge can hold.*
- *Play big by offering children large cardboard pieces/boxes and chairs to design large bridges*
- *Read Three Billy Goats Gruff.*
- *Take a neighborhood walk to notice bridges in our community.*

Circle the frameworks that will be addressed:

Scientific & Engineering Practices	Crosscutting Concepts	Disciplinary Core Ideas
1. Asking questions (science) defining problems (engineering)	1. Patterns	1. Physical sciences
2. Developing and using models	2. Cause and effect: Mechanism and explanation	2. Life sciences
3. Planning and carrying out investigations	3. Scale, proportion, and quantity	3. Earth and space sciences
4. Analyzing & interpreting data	4. Systems and system models	4. Engineering, technology and the applications of science
5. Using mathematics and computational thinking	5. Energy and matter	
6. Constructing explanations and designing solutions	6. Structure and function	
7. Engaging in argument from evidence	7. Stability and change	
8. Obtaining, evaluating and communicating information		

RISE

Intentional Planning Sheet – Knocking Down Object at End of Ramp

This is a sample of the RISE Intentional Planning Sheet that was co-constructed by RISE teachers with the goal of challenging children to design a ramp structure that, when a marble is rolled down, it will knock down an object at the end. The Intentional Planning Sheet provides guidance in planning an experience and considers key details to assure the experience is rich in STE and HSC.

What is the problem/challenge? What is the learning goal?
Can you knock down an object at the bottom of a ramp?
Children will learn about stability of structures while building ramps and the concept of force as an object (specifically a brick here) is or is not knocked down.

HSC Information - What do the children know or what relevant experiences have they had? What links can we make from this information to the challenge activity?
Children had previously completed a Home – School Sheet. From this, we were able to obtain information and extend conversation about materials that homes were made out of, where ramps are around us and how many levels were in our homes.

What prior knowledge or skills are needed?
- *Ability to make comparisons between different materials*
- *Understanding of weight - heavy and light*

Variables:	Materials: (e.g. visuals, charts, books, songs, manipulatives)
Weight of objects, incline/slope of ramp, speed of the marble/ball, the potential energy of the moving object	*Sample bricks/wood/stucco, balancing scale, ramps of various sizes and lengths, various size/weight marbles and balls*

How would you introduce the lesson (whole group)? Be sure not to give away the answer!
☐ open ended ☐ guided *X* structured
1. *Conduct a demonstration for children that includes: introducing materials, incline and weight.*
2. *Allow children the opportunity to feel and explore the different materials.*
3. *Make a connection to The Three Little Pigs story.*

What type of investigation would you set up in a learning center after the introduction (small group)?
☐ open ended *X* guided ☐ structured
- *First, allow children to explore on their own, providing lighter objects to give children "success" and gain knowledge and experience.*
- *Provide children a brick to knock over next. Ask them to make predictions as to how they will get it to knock over.*

What questions would you pose to the children? Attention-focusing, action, problem-posing, comparison, math:
- *Which material is heavier and which is lighter?*
- *How can you get the marble to go faster?*
- *How does the angle of the ramp effect the marble?*
- *How do the materials feel?*
- *Where is the brick less stable?*
- *Which type of block will fall with the least force?*

How would you assess understanding?
- *Listen to the responses children provide to us when asked various questions*
- *Observe children's play and how they adapt what they are doing to accomplish the challenge*

Potential extensions? (**connect – deepen – extend**)
- *Explore ramps with different surfaces and their effect on speed*
- *Continue exploring materials used to build houses*
- *How is a brick made?*
- *Continue to explore blocks and ramps – can you get a marble to roll into a cup?*

Circle the frameworks that will be addressed:

Scientific & Engineering Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating and communicating information

Crosscutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

1. Physical sciences
2. Life sciences
3. Earth and space sciences
4. Engineering, technology, and the applications of science

RISE

Intentional Planning Sheet – Rolling Up

This is a sample of the RISE Intentional Planning Sheet that was co-constructed by RISE teachers with the goal of challenging children to determine a way to make a marble roll up a ramp without pushing it with their hands. The Intentional Planning Sheet provides guidance in planning an experience and considers key details to assure the experience is rich in STE and HSC.

What is the problem/challenge? What is the learning goal?
How can we get a marble to roll up a ramp without pushing it or throwing it?
Children will learn that it takes force to get a marble to go up.

HSC Information - What do the children know or what relevant experiences have they had? What links can we make from this information to the challenge activity?
The QOTD around "Did you go up a ramp today? Yes/No – Did you go up the ramp or down the ramp?" gave us information as to whether children have experience or understanding around ramps.

What prior knowledge or skills are needed?
How do marbles behave on a ramp?
What are the properties of ramps (stability, incline)?

Variables:	Materials: (e.g. visuals, charts, books, songs, manipulatives)
Height of ramp, length of ramp	*Blocks, ramps, marbles*

How would you introduce the lesson (whole group)? Be sure not to give away the answer!
☐ open ended *X* guided ☐ structured
1st – Read the book Rollercoaster
2nd - The information from the QOTD allowed us to have a discussion around ramps in our environments, sharing our experiences (roller coasters, hills, while riding bikes/scooters, slides) and considering how easy it is to go down a ramp versus up.
3rd – Demonstrate for the children marbles going down one of four ramps beginning with a flat ramp and each one increasing in angle. Invite children to make observations of the demonstration.

What type of investigation would you set up in a learning center after the introduction (small group)?
☐ open ended *X* guided ☐ structured
Provide children with ramps, blocks and marbles, with the challenge of designing a ramp system that gets a marble to move up a ramp.

What questions would you pose to the children? Attention-focusing, action, problem-posing, comparison, math:
- *What did you notice about how the marble went down each of the ramps?*
- *Why does the marble roll on its own down a ramp but not up? What does it need to go up?*
- *How many blocks did you use to make that ramp?*
- *Which one is taller?*
- *I noticed the marble keeps falling off of the ramp at the bottom. What can we do to get it to stay on?*
-

How would you assess understanding?
- *Listen to the answers and explanations that children provide during observation and in response to questions.*
- *Observe how children manipulate the materials to succeed with the challenge and in response to designs that did not work before.*

Potential extensions? (**connect – deepen – extend**)
- *The same challenge but this time with different rolling objects (e.g. cotton balls, ping pong balls, different sized marbles)*
- *Revisit the same challenge with the added challenge of getting 2 marbles to roll down and up the ramps together.*
- *How could you get the marble to turn corners?*
- *Make observations within environment of slopes/inclines around them.*

Circle the frameworks that will be addressed:

Scientific & Engineering Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating and communicating information

Crosscutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

1. Physical sciences
2. Life sciences
3. Earth and space sciences
4. Engineering, technology, and the applications of science

RISE

Intentional Planning Sheet – Wrecking Ball

This is a sample of the RISE Intentional Planning Sheet that was co-constructed by RISE teachers with the goal of challenging children to design a wall that can withstand the force of a wrecking ball. The Intentional Planning sheet provides guidance in planning an experience and considers key details to assure the experience is rich in STE and HSC.

What is the problem/challenge? What is the learning goal?
Can you build a wall that is strong enough / stable enough to withstand the wrecking ball?
Children will learn about stability through engaging with force of the wrecking ball and various types of materials

HSC Information - What do the children know or what relevant experiences have they had? What links can we make from this information to the challenge activity?
We obtained information about the homes children live in through an HSC Activity Sheet. From here we were able to engage children in talking about the various types of materials their homes were built out of and offer the opportunity for them to share other observations and experiences of their own (e.g. wood house is green because it was painted, you use a hammer and nails to build with wood, you need cement to build with bricks) .

What prior knowledge or skills are needed?
Children need some awareness of materials and their strength in building. We decided that reading the story The Three Little Pigs would be an important activity to implement before this challenge. This would lay a foundation around this idea and link to cause and effect.
Do children know what a wrecking ball is?

Variables:	Materials: (e.g. visuals, charts, books, songs, manipulatives)
Weight of ball, size of ball, length of string, type of material, how materials are constructed?	*PVC piping to create frame of wrecking ball. Various size & weighted balls, string, tape, various building materials (wooden blocks, foam blocks, ramps, magna-tiles, bricks)*

How would you introduce the lesson (whole group)? Be sure not to give away the answer!
☐ open ended *X* guided ☐ structured

1. *We share the activity sheets and invite them to talk about their homes, materials from which they are made, levels in their homes, and other experience and knowledge.*
2. *Share real pictures of buildings made of the materials noted on the activity sheet (glass, wood, brick, and cement). Ask children what they notice about them. How are they the same; how are they different?*
3. *Pass around samples of the actual building materials (wood, cement, and brick).*
4. *We would revisit The Three Little Pigs story asking children what they remember about the story including the materials homes were built from, which withstood the wolf, what cause and effect connections were made.*

What type of investigation would you set up in a learning center after the introduction (small group)?
☐ open ended *X* guided ☐ structured
The first day, we would offer children the wrecking ball and 2 different materials to build with (wooden blocks and foam blocks). Children will build walls however they want and test it to see if it can withstand the wrecking ball.

What questions would you pose to the children? Attention-focusing, action, problem-posing, comparison, math:
- *Does the height of the structure affect the stability?*
- *How many layers of blocks did you use?*
- *What do you notice about the way your wall is designed compared to this wall?*
- *Notice the way the bricks are laid in this picture. Do you think that affects the wall's stability? Let's explore!*
- *I noticed you let go of the ball up here and before you let go of the ball down here. Does it matter at which point you release the ball?*

How would you assess understanding?
- *We would listen to the children's responses to our questions. Are they able to articulate accurate connections? Are they designing responses to our questions that are successful?*

Potential extensions? (**connect – deepen – extend**)
- *The second day, we would offer the same experience as above but change the materials that children could build a wall with (e.g. magna-tiles and legos).*
- *The third day, we would offer 2 different balls hung from the wrecking ball. The string length would be the same, the size of the ball would be the same, but the weight would be different. Children would only be provided wooden blocks to build a wall with. Why does one wrecking ball work while the other does not?*
- *The fourth day, children would be encouraged to build their home, using their HSC activity sheet as guidance. Could they build it to withstand the wrecking ball? What materials do you need? Do you notice any patterns?Are there parts of the wall that are stronger or weaker?*
- *What can be used to stabilize materials? Playdough, shaving cream, toothpaste?*

Circle the frameworks that will be addressed:

Scientific & Engineering Practices	Crosscutting Concepts	Disciplinary Core Ideas
1. Asking questions (science) and defining problems (engineering)	1. Patterns	1. Physical sciences
2. Developing and using models	2. Cause and effect: Mechanism and explanation	2. Life sciences
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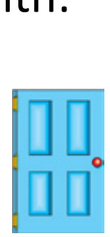
5. Using mathematics and computational thinking	5. Energy and matter	
6. Constructing explanations and designing solutions	6. Structure and function	
7. Engaging in argument from evidence	7. Stability and change	
8. Obtaining, evaluating and communicating information		

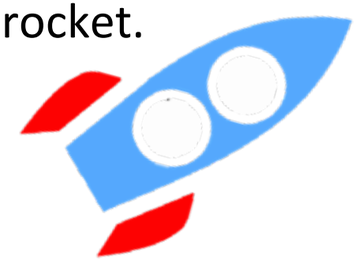
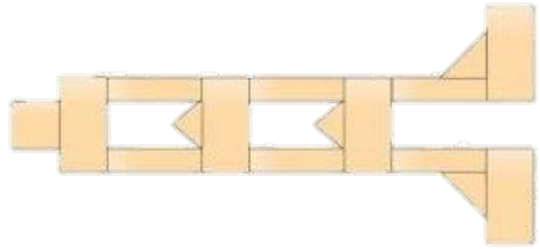
Challenge Cards
Blocks and Ramps

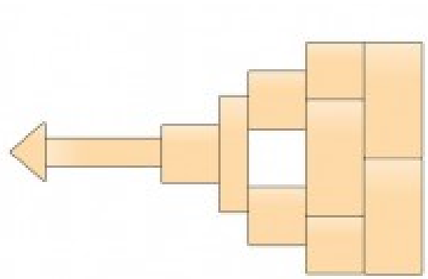
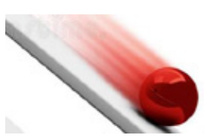
These challenge cards provide additional ideas that will Deepen – Extend – Connect learning while children explore block and ramps. Each card poses a new problem for children to solve at various skill levels.

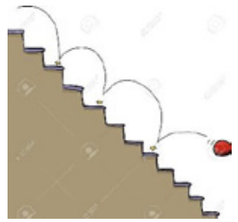
Directions:

- Laminate and cut out each card
- Age variations:
  - For younger children: intentionally choose the card that would provide an appropriate scaffold based on the current play occurring in your classroom.
  - For older children: place the cards in a box (e.g. a square tissue box works great). Invite children to choose one card at a time. Encourage them to solve the challenge prior to choosing another card.

Can you build a structure with: 1 Door 2 Windows  	Can you get the marble to stop at the bottom of the ramp?
Can you make an enclosure for the dinosaur? 	Can you make the marble make a 90 degree turn?
Can you make a structure with a roof?	Build the tallest tower.

Can you build a bridge?	Build a rocket. 
Build something using only 1 hand. 	
Build your house. 	
Can you create a ramp structure with 2 ramps?	Can you get the marble to land in a container?

Can you make the marble go up the ramp?	
Get the ball to go down the ramp and stay inside the enclosure at the bottom	Predict how the ball will behave at the end of a ramp with different surfaces at the end. Test your predictions
Can you make a ramp structure that includes a tunnel?	Make the ball make a turn without falling off the ramp 
Make the marble jump from one ramp to another 	Can you make the ball go faster as it hits the water? Can you make it go slower? 

How many stairs can a ball roll down? Will it go onto every stair? Will it stop at the bottom? 	Get the ball to stop at the end of a ramp without it falling off the end or sides 

Ways to deepen children's ramp experiences

Stability

How can you make an incline with one segment of ramp?

Are there other materials that can be used to build ramps?

How do you build a stable ramp structure using more than one segment of ramp?

Where do you see ramps in your neighborhood? Can you make a model?

Distance

How can you make the marble go farther?

Is there more than one way to make a marble go farther?

What happens when you change the marble's start point?

What might happen if you add another segment of ramp?

What might happen if you add a flat sheet (e.g. place mat) to the end of the ramp?

How can you make the marble stop?

Speed

How can you make the marble go faster? Slower?

What happens if you raise/lower the incline?

Do different objects go faster or slower?

When the marble goes faster does it also go farther?

Shadow and Light Exploration

Young children have a natural curiousity and interest exploring light and shadow. When we, as educators, facilitate these explorations, we provide children with the opportunity to engage in several Scientific and Engineering Practices (SEPs) and Crosscutting Concepts (CCs). Consider the following scenario:

*A teacher places a flashlight and variety of transparent, translucent, and opaque materials on a table next to a large blank wall. Two children enter the science area. They turn on the flashlight and point it at different objects. They notice (*observing*) that when it is pointed at one another, sometimes they see a shadow and sometimes they do not. They wonder why (*Asking questions and defining problems*). They continue to move around and shine the flashlight on one another (*planning and carrying out investigations*) and come to the determination that when they are between the wall and the light, they see a shadow (*analyzing and interpreting data*). They dance around and observe their shadows moving (*cause and effect*). They notice some green in one child's shadow. The teacher states," I notice you are looking at the green in your shadow. How can you find out where the green is coming from?" (*asking questions and defining problems*). They continue to watch the green in the shadow as they move (*planning and carrying out investigations*). Eventually, they make the connection between the green in one child's bracelet and the green in the shadow. They take the flashlight and hold it close to the bracelet and see the green against the wall (*explanations based on evidence*).*

The opportunity to explore over an extended time and engage in multiple SEPs along with facilitation by the educator to support these investigations and make CCs visibile to the children is what deepens their understanding of light and shadow. Supporting educator's role in deepening, connecting and extending this understanding is facilitated by a developmental progress as to how children understand shadow and light (DeVries, R., 1986):

Level 0: Children have little or no awareness of shadows.

Level 1: Children focus on the object and shadow relationship. Children begin to notice that the shadow is the shape of the object. They begin to investigate what happens as they move the object closer or further from the light but do not yet understand the purpose the light plays.

Level 2: Children become aware that light is a needed element in making a shadow. The idea of how light makes something dark is still not understood.

Level 3: Children begin to understand that a shadow (or the darkness) is caused by the object blocking the light. They gain understanding of the spatial relationship between light and the object and how moving the object, or light, changes the shadow. Children still may think that shadows still exist when they do not see them anymore.

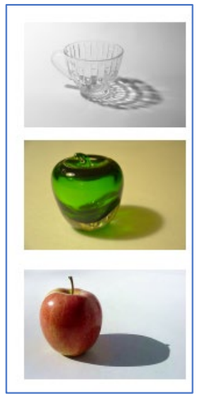
Level 4: Children now understand that shadows are the absence of light. They now know that shadows do not exist when they cannot see them.

Key concepts:

Transparent: an object that allows light to go through fully.

Translucent: an object that lets only some light through.

Opaque: an object that does not allow any light through.



Consider experiences that allow you to connect, deepen and extend children's understanding of shadow and light in your classroom.

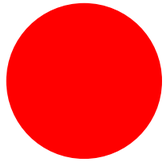
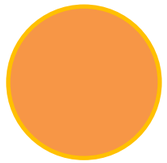
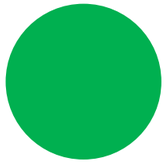
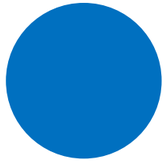
- What materials could you provide?
- What light sources could you use?
- What vocabulary could you introduce?
- How might you ensure children of various ages and abilities can access this experience?

Adapted from the University of Northern Iowa Regents' Center for Early Developmental Education. *Light and Shadow*. Cedar Falls Iowa.

Rise.as.tufts.edu

Rainbow Scavenger Hunt

In a group, encourage children to observe their environment and find colors. The same can be done with older individuals or pairs. Document observations by placing an "X" in the right column. Use indoors or outdoors.

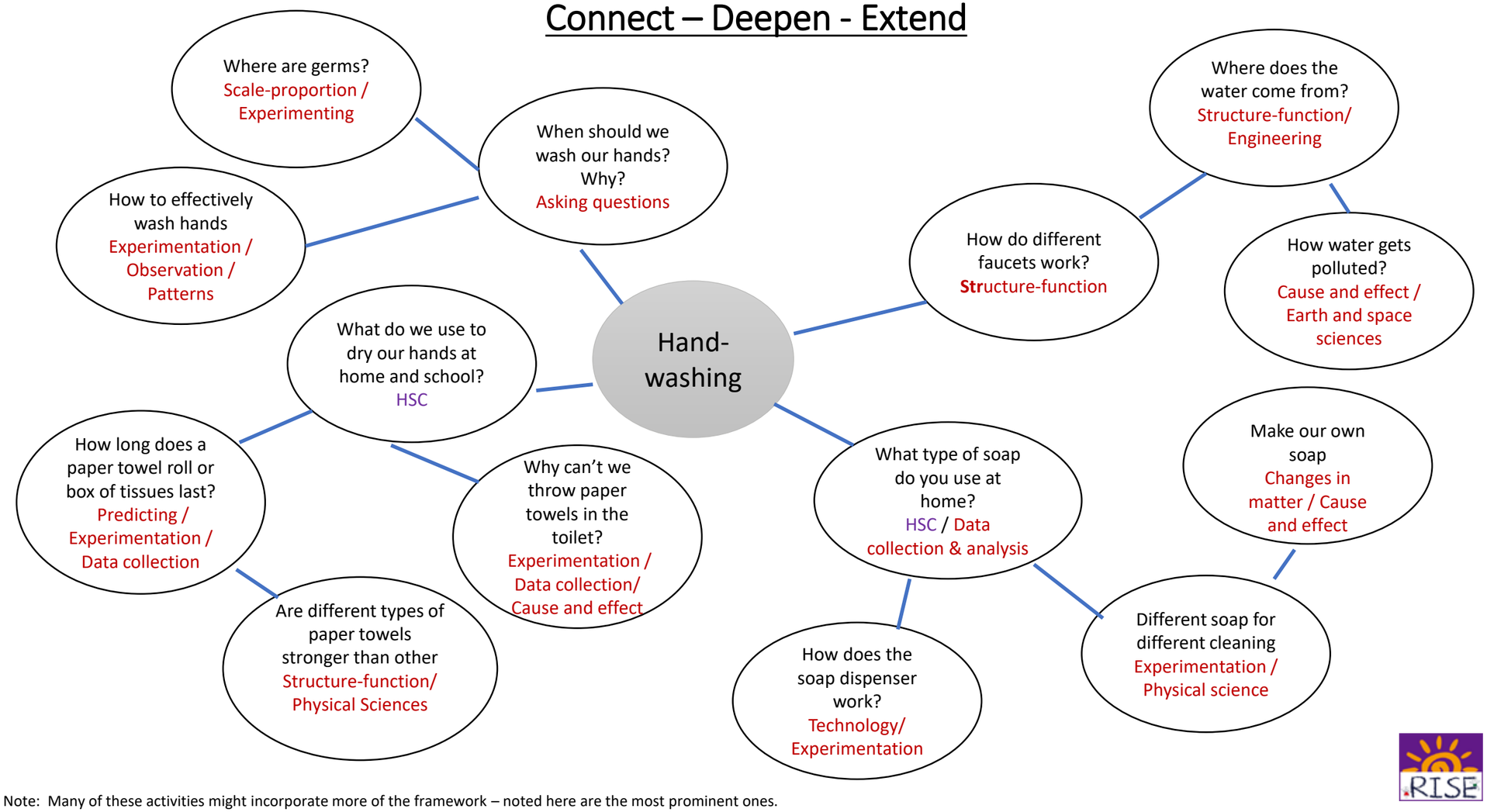
Color	X if found
 Red	
 Orange	
Yellow	
 Green	
 Blue	
 Purple	

Connect – Deepen – Extend Health and Safety Webs

Curriculum webs are an exercise in expanding a curriculum focus to provide opportunities to Deepen – Extend – Connect learning.

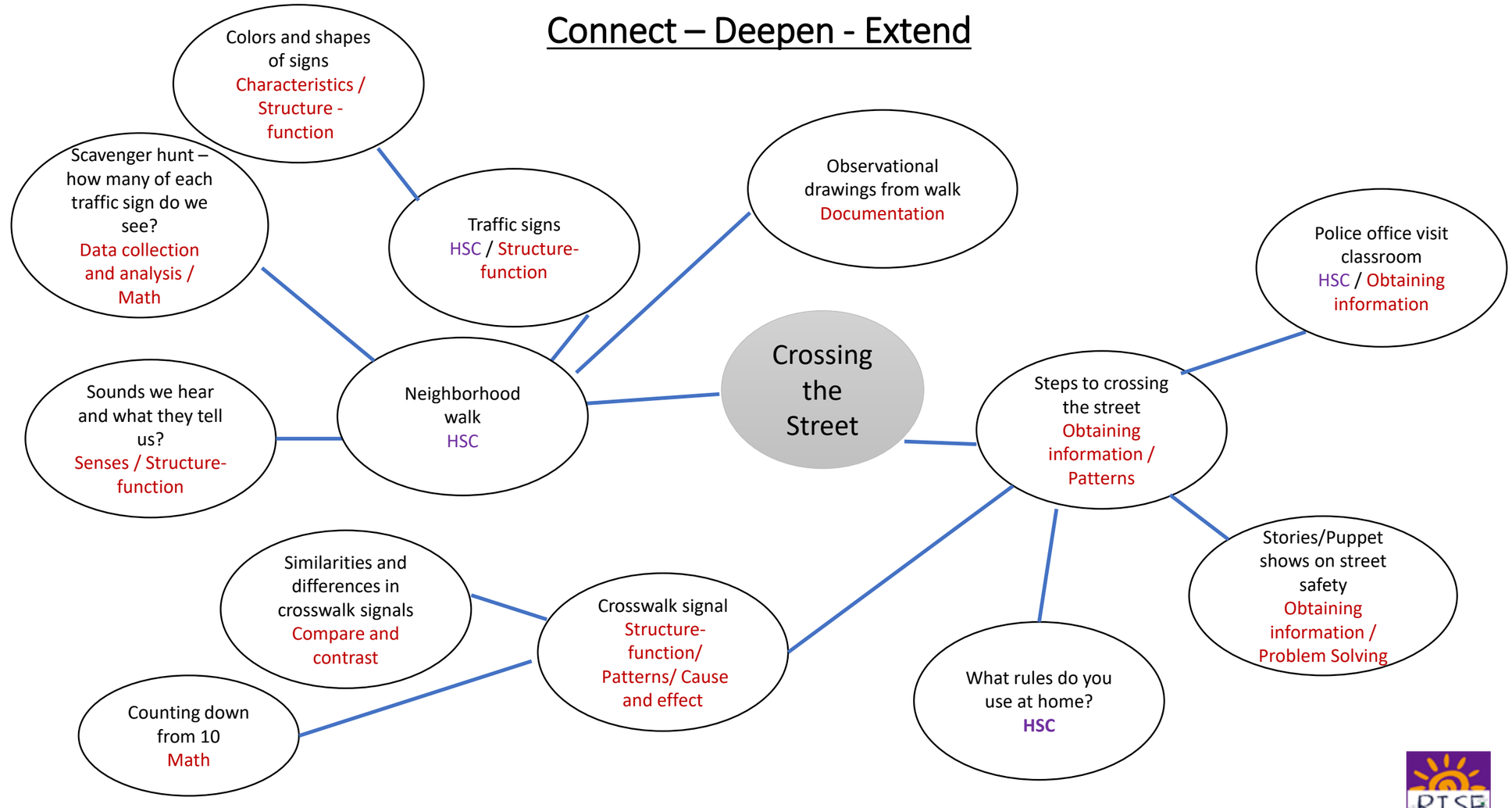
Below are webs that were co-constructed by teachers. They were built from health and safety skills they taught the children at the beginning of every school year.
Notice how, as they grow, new ideas support current learning as well as provide possibilities for new projects in addition to opportunities for exploring other parts of the framework.

Connect – Deepen - Extend



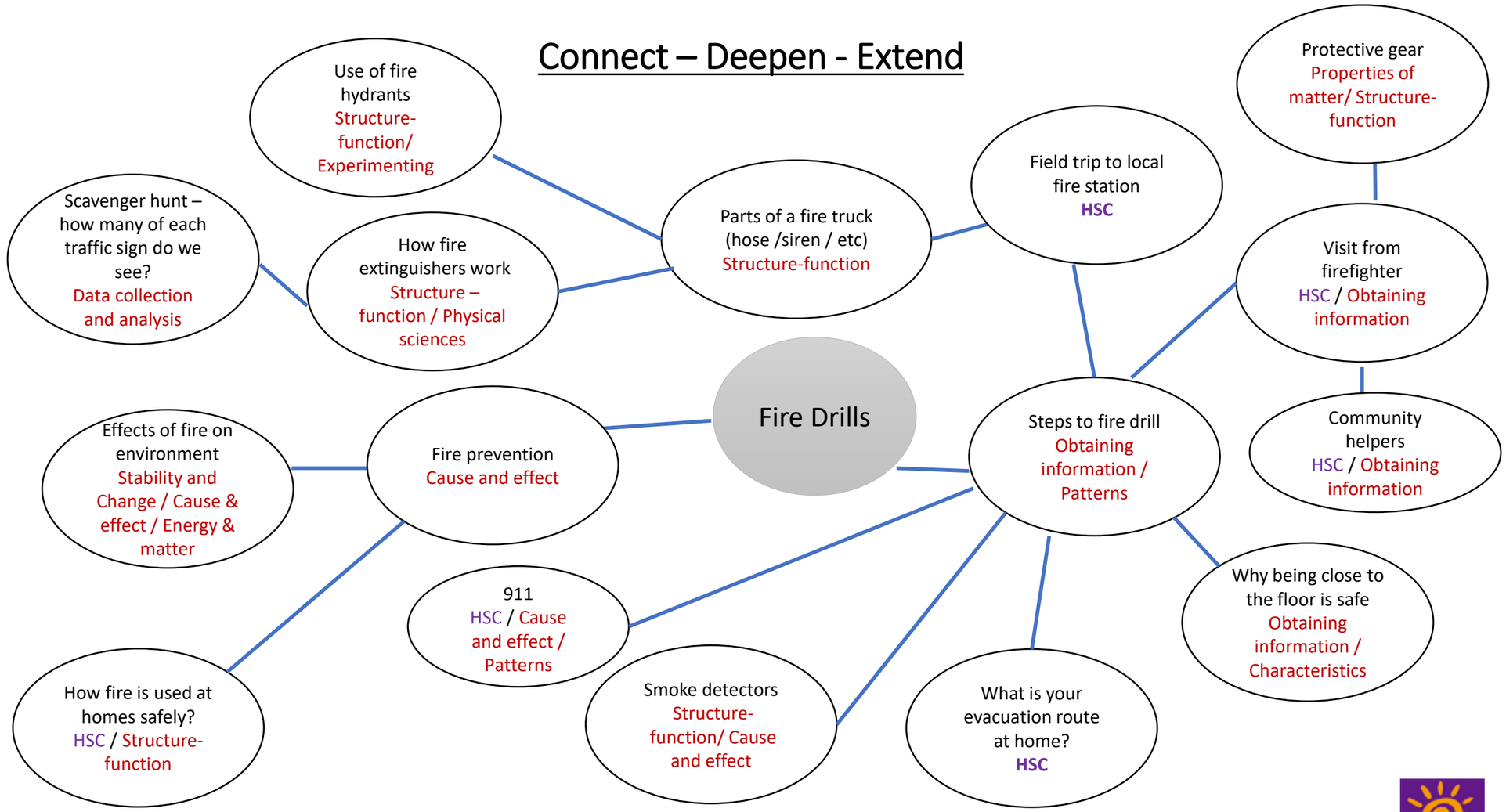
Note: Many of these activities might incorporate more of the framework – noted here are the most prominent ones.

Connect – Deepen - Extend



Note: Many of these activities might incorporate more of the framework – noted here are the most prominent ones.

Connect – Deepen - Extend



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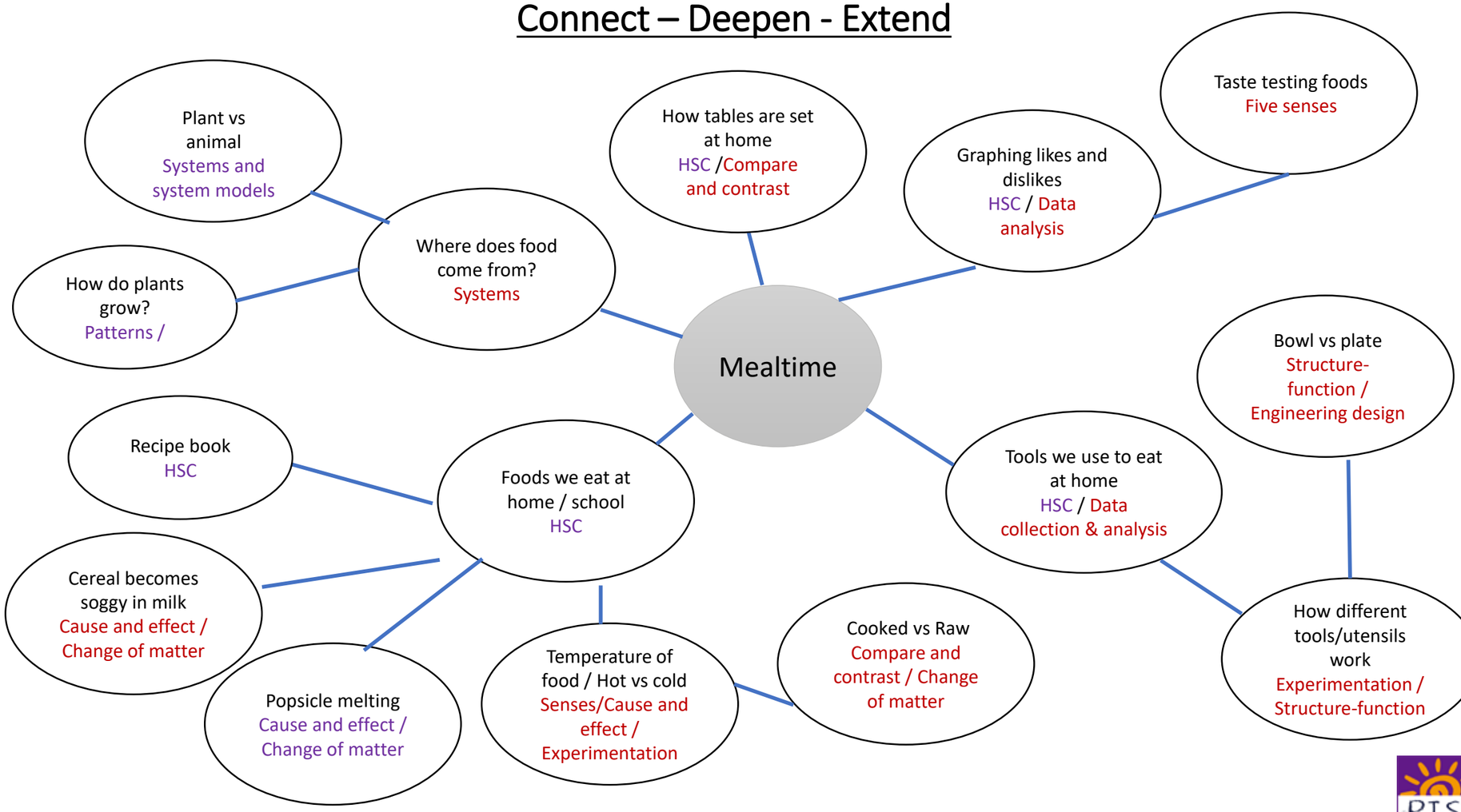
Connect – Deepen - Extend



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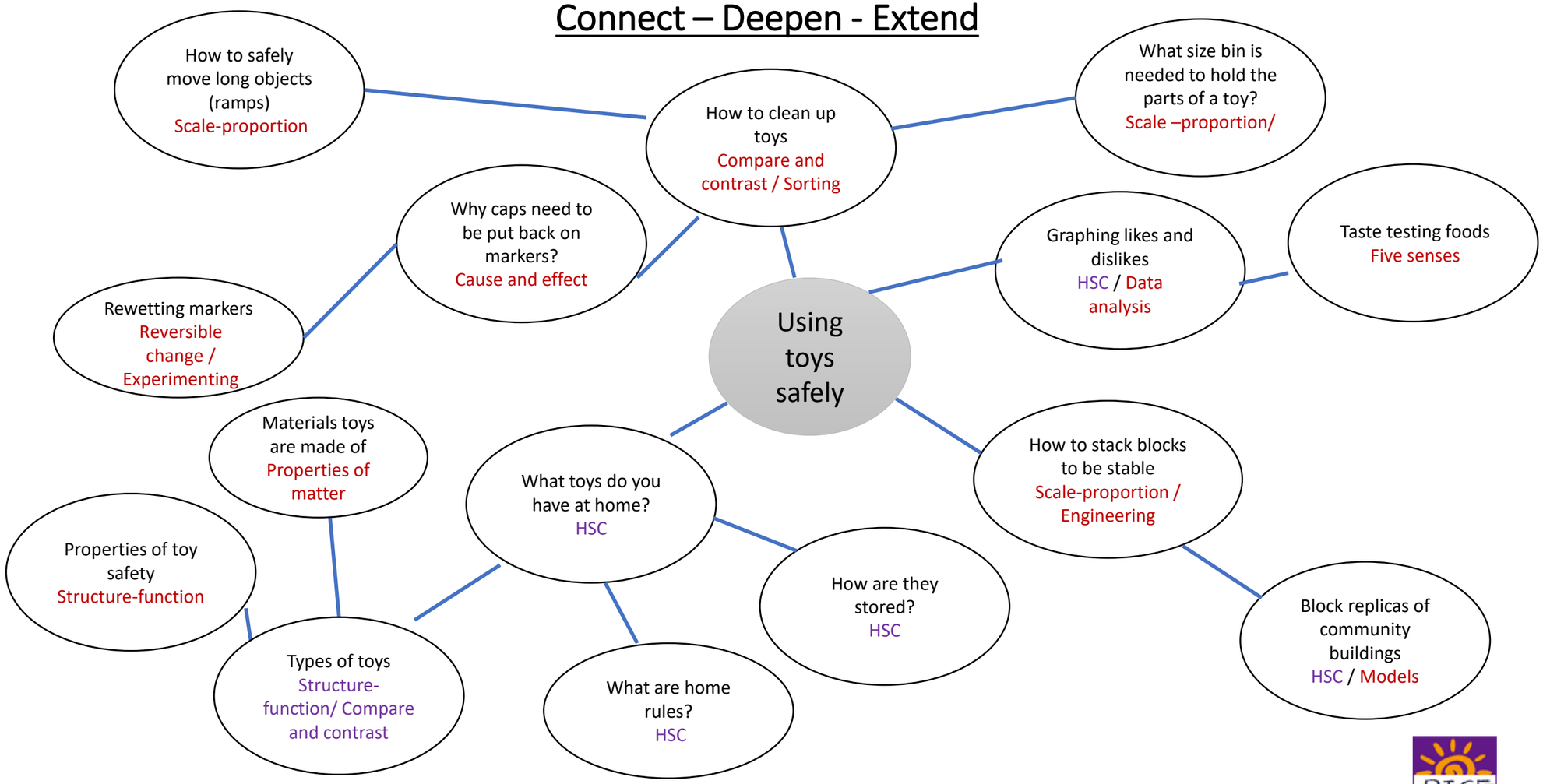
Connect – Deepen - Extend



Note: Many of these activities might incorporate more of the framework – noted here are the most prominent ones.

Safety Signs Scavenger

Take children on a neighborhood walk. Encourage them to notice various signs and match them to those on this list. Discuss with children the function of the signs and how they help to keep people safe. Document observations by placing an "X" in the corresponding column.

Sign	X if found	Sign	X if found
			
			
			
			
			

How to Plant a Seed

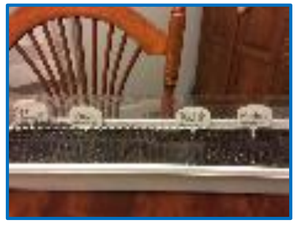
Provide each child a copy. Provide them all materials and allow them the opportunity to independently plant their own seeds using this page as a reference. Encourage their literacy, sequencing, independence, and problem-solving skills.

1. Gather materials: seeds, soil, planters, name tags, water.

2. Fill each planter with soil. Sprinkle one type of seed into each planter. Use 3-4 seeds.

3. Cover seeds with a small amount of soil.

4. Water all planters.



5. Label stakes and insert in each planter.

6. Place entire planter in a sunny spot. Water as necessary to keep soil moist.

STE That Can Happen During Meals

Below lists many of the topics discussed while preparing a salad. You can see all of the rich details shared and how they connect to the STE Frameworks! Consider how these topics could be extended into other experiences. Meal time is a wonderful time for STE!

Crosscutting Concepts (CCs)
Patterns - Making a salad typically follows a pattern: 1) choose the ingredients, 2) chop up the larger ones into bite size, 3) mix in a bowl, 4) add condiments and salad dressing, 5) mix again.
Cause and effect: Mechanism and explanation - A specific ingredient adds a unique taste - Some ingredients, for example cod, will change the overall flavor too much.
Scale, proportion, and quantity - "Add a little bit." - "3 bowls of____." - "How much of each ingredient?"
Systems and system models - How do the parts of the plant work together to support the growth of the fruit we eat?
Energy and matter - Temperature affects the growth of various vegetables?
Structure and function - Function of spoon + knife: different tools but can have the same function - Center (talking about what part of a plant the artichoke is & how does its structure let you know it's the part you eat) - Stem, leaf, seeds, flower, roots each have their function in the plant's growth - Plants grow under and above ground – how does this benefit the plant?
Stability and change - Colors of vegetables - some change and some don't - Cut a whole fruit/vegetable into smaller pieces to make a salad

Science and Engineering Practices (SEPs)
Asking questions (science) and defining problems (engineering) - What ingredient causes which flavor? - Observe smells of various foods. - What is _____? - What is a vegetable? - Describe the artichoke plant. - Talk about how to remove salt from the salted cod fish. - Observe textures of the foods. - Two layers within the salad dressing - what happens when it's still & when you shake? - Do you need a spoon or a knife to open the avocado?
Developing and using models - Creating replicas of the bamboo studied in a classroom.

Planning and carrying out investigations - After getting the first round of ingredients/dressing, talk about what ingredients they want and need to get more of. - Mix the ingredients + identify each ingredient added. - Tasting yellow vs. orange pepper and compare/describe flavors. Some description words included: "quiet vs kick" "softer vs harder". - Trying foods you have never tasted before.
Analyzing and interpreting data - Combine lemon + vinegar + olive oil + salt + pepper + garlic. Shake it up. Does it taste good? - Compare what everyone chooses for ingredients. - Group determining ingredients based on the question "who will eat ____?" - Review what ingredients were put in the prepared salad.
Using mathematics and computational thinking - We used 3 of _____ and 2 of _____ for the recipe
Constructing explanations (science) and designing solutions (engineering) - Comment of temperature required to grow peppers discussed - -Decision of salt cod negative- will change taste of the salad as a whole→ more sweet w/ clementine is needed
Engaging in argument from evidence - No onion in salad decided because of smell. - Debate on what ingredients the salad dressing needs.
8. Obtaining, evaluating and communicating information - It's kind of _____, adds sweet flavor. - Share how an artichoke grows. - Keep draining the salted cod to make it less salty. - Make a book, children draw observations. - Identify the name/taste of a specific ingredient.

Rich Vocabulary Words During Experience		
carrot	crunchy	layer
lettuce	smell	observe
cucumber	sound	tools
paper	cut	growth
spices	mix	similarities
tomatoes	add	differences
root	chop	diet
colors (red/orange, yellow, green, purple),	shake	balanced
	separate	culture
taste (sweet, salty, strong, light, spicy, bitter, sour)	still	fresh
	drain	texture
flavor	blend	swallow
crispy	stir	

Volume	Pitch	Duration
• Using one tool, which item is the loudest? • Using different tools but one bowl, which tool makes the loudest sound? Softest? • Using one tool and one item, can you make a loud sound? Soft sound?	• Using one tool, which of the items makes a high sound? Which makes a low sound? • How can you sort these instruments as high or low sounds? • How can you use your voice to make a high/low sound?	• Using one tool, which item makes a long sound? Which item makes a short sound? • Using one tool and one bowl, how can you create a long sound? Short sound? • Can you follow these musical patterns?

Sound Cards

Sound cards can support children's observational skills through the sense of hearing. They support visual and kinesthetic learning by offering a child something to hold and look at while building their awareness to sounds in their environment. Print and cut the pictures, laminate if possible. Provide each child 1 or 2 cards each. Take children on a walk inside and outside, encouraging them to listen closely for the sound represented in their picture. Upon returning to class, sort cards into groups of those that were heard and those that were not.