***Supplementary Material***

These materials accompany the article entitled:

“Evaluation of a Community-Based, Hybrid STEM Family Engagement Program at Pre-Kindergarten Entry”

# Supplementary Tables

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**Table SM1**

*Methods and Materials Description: Funshop Units and Components Teaching Together STEM*

|  |  |  |
| --- | --- | --- |
| **Modality, Unit Name: Descriptiona** | **Key STEM Dimensions of Activitiesb** | **Sample Extension Text Messagesa** |
| **1. Virtual, “What’s the Big Idea”** STEM Language: Parents were introduced to the overarching concept that you can increase your child’s curiosity about the world through rich conversations that include asking open-ended questions and routinely explaining technical and scientific vocabulary. | ● **Asking questions**: Invent a color / Inventa un color● **Carry out investigations:** Water Drop Art / Arte de Gotas de Agua● **Planning investigations**: Nature Detective/ Detective de la Naturaleza | **Tip:** Teach Big Words - Help [child\_first\_name] get ready for Kinder by teaching [him\_her] big words with simple explanations. For example, say, “When we cook, we use cooking equipment.”**Extension**: Using big words can help build your child's vocabulary. Follow this link for a fun activity: https://BLIND.org/sensory-popcorn/ |
| **2. Virtual, “Math Rules!”** Early Math: Parents learned how to integrate counting, number identification, and comparison talk into everyday family activities and informal science activities. | ● **Using computational thinking**: Pom – Pom Toss / Lanzamiento de Pom-Pom● **Observing patterns**: Pattern Bracelets / Pulseras de Patrón● **Using mathematics and estimating:** The Right Fit / Encájalos Perfectamente | **Tip:** Count Together - Counting and recognizing numbers are some of the first early math skills children need to learn. Encourage your child to count items during everyday routines! For example, when cleaning up ask your child to pick up a set number of objects and count with [him\_her]. **Extension:** Exploring different ways to group and compare objects helps children learn math and language skills. Follow this link for a grouping activity: https://BLIND.org/super-sort/ |
| **3. In-Person, “Show What You Know”** Gather Data like a Scientist: Parents explored how to gather information as you interact with their child to include counting, tallies, and charts as simple forms of data in daily life. | ● **Structure and function:** Animal Hatchlings / Cría de Animales● **Communicating information:** Starburst Graph / Gráfica de Starburst● **Structure and function:** Test Flight / Vuelo de Prueba● **Using computational thinking**: Dr. Vet / Dr. Vet● **Analyzing an interpreting data:** Catapult / Catapulta | **Tip:** Gather and Record Data - Collecting data is simple and easy. When you ask "How long" or "How many,” those numbers are data! When doing a daily routine (dishes, bathing, etc.), time yourself and [child\_first\_name] say, "Let's see how long it takes us to do this." Do this throughout the week and keep track of your data.**Extension:** By gathering data and understanding findings, you help your child build tools for doing science. Follow this link for a fun activity: https://BLIND .org/water-and-ice/ |
| **4. In-Person, “Dream it Build it”** Engineering: Parents were presented with ways to encourage tinkering and creative problem solving within playful activities and common household materials. | ● **Engineering process:** Bridge Builders / Constructores de Puentes● **Engineering design/creativity:** Invent A Tool / Inventa una Herramienta● **Engineering design/tinkering:** Hoop Gliders / Aros Voladores● **Designing Solutions** Material Mix-Up / Mezcla de materiales● **Designing Solutions**: Lego Dog House / Casa de Legos para perros | **Tip:** Take on a Challenge - Encouraging [child\_first\_name] to look for many ways to solve problems helps [him\_her] think like an engineer. Design a solution to a problem at your house, ask "How can we fix this broken object?" or "How can we better organize these materials?"**Extension:** Challenge your child to think of ways to build a bridge strong enough to hold toy animals. Follow this link for a fun building activity: https://BLIND .org/build-a-bridge/ |

*Note*. The TT STEM units are available to utilize here: <https://public.cliengage.org/tools/quality/family-engagement-resources/hosting-family-events-to-support-childrens-development/>

**Table SM2**

*Method Description: Sample Text Messages and Communication Structure for One FunShop Theme*

|  |  |  |
| --- | --- | --- |
| **Timing relative to funshop** | **Communication Type** | **Contents**  |
| 10 days prior to funshop | Invitation to funshop event | Invite to session with event location details. Included brief synopsis of the funshop theme“Join the Children's Museum [Blind] for a Fun\*Shop called "What's the Big Idea?" to discover ways to unlock your child's curiosity about the world on…” |
| 9 days prior to funshop | Material pick-up | A reminder to pick-up materials for the funshop from their child’s teacher, if a virtual session. |
| 4 days and 1 day prior to funshop | Funshop event reminders  | Friendly reminder that it is a funshop week. Second reminder that funshop is tomorrow with zoom link (virtual). |
| Funshop Day! | Printed stickers on students | Each student was wearing a sticker at pick-up notifying parents of funshop event  |
| 1 day after funshop | Parent strategy tip  | A tip aligned to the funshop theme goal and personalized with child’s name:“Teach Big Words - Help [child\_first\_name] get ready for Kinder by teaching big words with simple explanations. For example, say, “When we cook, we use cooking equipment.” |
| 3 days and 7 days after funshop  | Family extension activity  | A link to Family Activity Collection content that is aligned to the funshop theme“Using big words can help build your child's vocabulary. Follow this link for a fun activity: <https://cliengagefamily.org/sensory-popcorn/>”  |
| 10 days after funshop | Parent request | Request for reply and/or send photo of family learning experience “Tell us about an activity you did with [child\_first\_name] this week to support [his\_her] learning. Include a photo if you like.” |
| 11 days after funshop  | Museum reminder  | Invitation to visit Children’s Museum Houston with update on special activities on the museum’s schedule “Plan a Museum Visit: Use your family pass to the Children’s Museum Houston. The museum offers great indoor and outdoor learning activities.” |
| 14 days and 16 days after funshop  | Linked activity kit reminder | Reminders orienting parents to specific STEM activities in their take-home STEM kits “Use Family Kit "Life Cycle". Understanding the life cycles of plants and animals is important science knowledge that helps children understand the world around them.” |

**Table SM3**

*Materials Description: Take-Home Kits Teaching Together STEM*

|  |  |
| --- | --- |
| **Linked Unit** | **English or Bilingual English/Spanish kit contents** |
| Unit 1- STEM Questions and Language | **Kit 1**: Ocean animals floor puzzle and book *Hello Ocean* by Pam Muñoz Ryan**Kit 2**: Sink or float activity with foam pieces and weights to build a boat and test |
| Unit 2 - Early Math | **Kit 3**: Counting butterflies board game**Kit 4**: Plastic insect counting manipulatives and *How Many Snails?: A Counting Book* by Paul Giganti |
| Unit 3 - Gather Data | **Kit 5**: Plastic links for non-standard measurement of household objects**Kit 6**: Tangram pieces and sample puzzles to create shapes |
| Unit 4 - Engineering  | **Kit 7**: Wheels, axels, foam pieces and other materials to build balloon-powered cars**Kit 8**: Plastic blocks and vehicle building pieces with photos of sample vehicles |
| Supplemental Activities  | **Kit 9**: Animal life cycle manipulatives for frog, chicken, or butterfly. One matching title was given *From Tadpole to Frog* by Wendy Preffer or *Where do Chicks Come from*? by Amy E. Sklansky or *From Caterpillar to Butterfly* by Deboarah Heiligman |

*Note.* Estimated total cost $155 per family.

**Table SM4**

*Descriptive Statistics for Analytic Sample Outcomes & Covariates*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Control |  | Treatment |
| **Parent Outcomes** | N | Mean | SD |  | N | Mean | SD |
| Parent Involvement STEM - Pre | 22 | 2.21 | 0.66 |  | 34 | 2.73 | 0.70 |
| Parent Involvement STEM - Post  | 22 | 2.18 | 0.49 |  | 34 | 2.41 | 0.65 |
| Parent Contingent Responsiveness - Pre | 22 | 3.23 | 1.31 |  | 35 | 2.06 | 0.91 |
| Parent Contingent Responsiveness - Post | 22 | 3.36 | 1.29 |  | 35 | 2.57 | 1.31 |
| Parents' Efficacy for Math - Pre | 22 | 5.48 | 0.84 |  | 33 | 6.11 | 0.88 |
| Parents' Efficacy for Math - Post | 22 | 5.64 | 0.87 |  | 34 | 6.07 | 0.70 |
| Parents' Efficacy for Science - Pre | 22 | 5.15 | 0.87 |  | 33 | 5.69 | 1.03 |
| Parents' Efficacy for Science - Post | 22 | 5.36 | 0.91 |  | 34 | 5.76 | 0.87 |
| Parent Effort/Cost for Math - Pre | 22 | 2.24 | 0.99 |  | 34 | 3.06 | 1.66 |
| Parent Effort/Cost for Math - Post | 22 | 2.21 | 0.99 |  | 34 | 2.84 | 1.41 |
| Parent Effort/Cost for Science - Pre | 22 | 2.36 | 1.14 |  | 34 | 3.12 | 1.54 |
| Parent Effort/Cost for Science - Post | 22 | 2.55 | 1.07 |  | 34 | 2.44 | 1.26 |
| Parents' Expect Child Math - Pre | 22 | 6.09 | 0.98 |  | 33 | 6.24 | 1.06 |
| Parents' Expect Child Math - Post | 22 | 6.16 | 0.97 |  | 34 | 6.34 | 0.84 |
| Parents' Expect Child Science - Pre | 22 | 6.00 | 1.06 |  | 33 | 6.24 | 1.02 |
| Parents' Expect Child Science - Post | 22 | 6.07 | 1.08 |  | 34 | 6.21 | 0.86 |
| Parent STEM Value Math - Pre | 22 | 6.27 | 0.80 |  | 33 | 6.50 | 0.67 |
| Parent STEM Value Math - Post | 22 | 6.50 | 0.65 |  | 34 | 6.59 | 0.50 |
| Parent STEM Value Science - Pre | 22 | 6.16 | 0.85 |  | 33 | 6.47 | 0.67 |
| Parent STEM Value Science - Post | 22 | 6.43 | 0.66 |  | 34 | 6.34 | 0.71 |
| Parent Treatment Satisfaction | - | - | - |  | 23 | 2.35 | 0.71 |
| **Child Outcomes** |  |  |  |  |  |  |  |
| Child Verbal Engagement/Enthusiasm - Pre | 22 | 3.00 | 1.02 |  | 35 | 2.17 | 0.95 |
| Child Verbal Engagement/Enthusiasm - Post | 21 | 2.81 | 1.54 |  | 35 | 2.17 | 1.27 |
| WJ Applied Problems Total Raw Score - Pre | 22 | 13.09 | 4.48 |  | 33 | 11.82 | 4.88 |
| WJ Applied Problems Total Raw Score - Post | 22 | 15.18 | 4.12 |  | 33 | 14.45 | 3.72 |
| WJ Science Total Raw Score - Pre | 24 | 7.13 | 3.39 |  | 35 | 7.46 | 2.91 |
| WJ Science Total Raw Score - Post | 24 | 8.00 | 2.77 |  | 35 | 8.34 | 3.01 |
| **Covariate** |  |  |  |  |  |  |  |
| KEA Attention – Post | 20 | 31.90 | 5.60 |  | 27 | 33.37 | 8.35 |
| KEA Inhibition – Post | 20 | 1.00 | 1.26 |  | 27 | 0.93 | 0.96 |

*Note.* Parental Involvement items used a 4-point scale (*1*=not at all; *2*=once or twice a week; *3*=three or more times a week, but not daily; *4*=every day). Self-Efficacy, Expectancy, Value, and Cost items used a 7-point scale (*1*= not true at all, *7*=very true) where higher scores are more positive for self-efficacy, expectancy and value, but lower scores for cost are preferred. Parent Responsiveness was measured with a 5-point scale with higher scores indicate the parent accommodates the child’s interest and provides support (*5*=Almost always warmly responsive to child’s signal; *1*=Almost never responsive or highly negative). STEM Engagement/Enthusiasm was measured using a 5-point scale (*5*=Almost always enthusiastic/engaged; *1*=Almost never enthusiastic/engaged).

**Table SM5**

*Descriptive Statistics: Item Level Parental Involvement in Math and Science*

|  |  |  |
| --- | --- | --- |
|  | Control | Treatment |
|   | Pretest | Posttest | Pretest | Posttest |
| Item | N | Mean | SD | N | Mean | SD | N | Mean | SD | N | Mean | SD |
| How many times in the past week have you talked to your child about **shapes** (e.g., triangle, square)? | 22 | 2.41 | 0.85 | 22 | 2.41 | 0.91 | 34 | 3.12 | 0.95 | 34 | 2.59 | 1.08 |
| How many times in the past week have you compared **sizes** of objects or toys with your child (e.g., big, little, shorter, longer, etc.)?  | 22 | 2.32 | 0.89 | 22 | 2.09 | 0.81 | 34 | 2.85 | 0.89 | 34 | 2.32 | 0.88 |
| How many times in the past week have you played **counting games** with your child (e.g., singing songs with numbers or reading books with numbers)? | 22 | 2.45 | 0.96 | 22 | 2.50 | 0.80 | 34 | 3.18 | 0.83 | 34 | 2.59 | 0.82 |
| How many times in the past week have you **counted** different **objects** with your child (e.g., spoons, grapes, cans, pieces of fruit)? | 22 | 2.59 | 0.85 | 22 | 2.41 | 0.80 | 34 | 3.00 | 0.95 | 34 | 2.50 | 0.86 |
| How many times in the past week have you played **board games** or card games with your child? | 22 | 1.64 | 0.79 | 22 | 1.82 | 0.59 | 34 | 2.00 | 0.89 | 34 | 1.82 | 0.94 |
| How many times in the past week have you talked with your child about plants, animals, or other **living things**? | 22 | 2.68 | 0.99 | 22 | 2.41 | 0.91 | 34 | 2.82 | 0.87 | 34 | 2.68 | 0.77 |
| How many times in the past week have you talked with your child about **weather**, seasons, or the environment?  | 22 | 2.41 | 1.01 | 22 | 2.27 | 0.77 | 34 | 2.74 | 1.02 | 34 | 2.53 | 0.99 |
| How many times in the past week have you talked with your child about how to **make objects or toys move** faster/slower or in different directions (e.g., cars roll faster on smooth surfaces)? | 22 | 1.55 | 0.60 | 22 | 1.73 | 0.70 | 34 | 2.32 | 1.04 | 34 | 2.24 | 0.99 |
| How many times in the past week have you talked with your child about **adding or subtracting** objects from a group? | 22 | 1.86 | 1.04 | 22 | 1.95 | 0.58 | 34 | 2.53 | 0.90 | 34 | 2.38 | 0.78 |

*Note*. Scale is *1* = not at all; *2* = once or twice; *3* = three or more times, but not daily; *4* = every day

**Table SM6**

*Participant Baseline Outcome Measures and Balance Check for Posttest Analytic Sample (n = 58)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Control(*n* = 24) |  | Intervention(*n* = 35) |  |
| Variable | Mean | SD |  | Mean | SD | Difference as Effect Size |
| Baseline Parent Outcome Measures |
| Parent Involvement | 2.21 | 0.66 |  | 2.73 | 0.70 | 0.76\* |
| Math Self-Efficacy | 5.48 | 0.84 |  | 6.11 | 0.88 | 0.73\* |
| Science Self-Efficacy  | 5.15 | 0.87 |  | 5.69 | 1.03 | 0.55\* |
| Math Expectancy | 6.09 | 0.98 |  | 6.24 | 1.06 | 0.15 |
| Science Expectancy | 6.00 | 1.06 |  | 6.24 | 1.02 | 0.23 |
| Math Value | 6.27 | 0.80 |  | 6.50 | 0.67 | 0.31 |
| Science Value | 6.16 | 0.85 |  | 6.47 | 0.67 | 0.42 |
| Math Effort/Cost | 2.24 | 0.99 |  | 3.06 | 1.66 | 0.57\* |
| Science Effort/Cost | 2.36 | 1.14 |  | 3.12 | 1.54 | 0.54 |
| Contingent Responsiveness  | 3.23 | 1.31 |  | 2.06 | 0.91 | -1.09\* |
| Baseline Child Outcome Measures |
| Engagement/Enthusiasm | 3.00 | 1.02 |  | 2.17 | 0.95 | -0.84\* |
| WJ Applied Problem Raw Score | 13.09 | 4.48 |  | 11.82 | 4.88 | -0.27 |
| WJ Science Raw Score | 7.13 | 3.39 |  | 7.46 | 2.91 | 0.11 |
| \*p-value < .05 *Note.* Parental Involvement items used a 4-point scale (*1*=not at all; *2*=once or twice; *3*=three or more times, but not daily; *4*=every day). Self-Efficacy, Expectancy, Value, and Cost items used a 7-point scale (*1*= not true at all, *7*=very true) where higher scores are more positive for expectancy and value, but lower scores for cost are preferred. Parent Responsiveness was measured with a 5-point scale with higher scores indicate the parent accommodates the child’s interest and provides support (*5*=Almost always warmly responsive to child’s signal; *1*=Almost never responsive or highly negative). STEM Engagement/Enthusiasm was measured using a 5-point scale (*5*=Almost always enthusiastic/engaged; *1*=Almost never enthusiastic/engaged). |

**Table SM7**

Family Attendance Counts by Virtual or In-Person Modality

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total Events Attended (by Modality)** | **Count of families** | **% of 35 treatment families** |
| **Virtual Events** | 0 | 17 | 48.57% |
|  | 1 | 14 | 40.00% |
|  | 2 | 4 | 11.43% |
| **In-Person Events** | 0 | 16 | 45.71% |
|  | 1 | 13 | 37.14% |
|  | 2 | 6 | 17.14% |
| **Total of Both Modalities**  | 0 | 11 | 31.43% |
|  | 1 | 10 | 28.57% |
|  | 2 | 7 | 20.00% |
|  | 3 | 5 | 14.29% |
|  | 4 | 2 | 5.71% |

**Table SM8**

Checklist for Hosting Successful Hybrid Informal STEM Family Events

|  |  |
| --- | --- |
| **Component** | **Key Activities** |
| Marketing and Preparations  | * Choose a date, time, and modality – in person or virtual. If in-person, organize the event space (library space, cafeteria, gym, community center meeting room, etc.)
* Advertise with flyers that explain the virtual or in-person approach for each event
* Prepare a materials list for a set of 3 to 5 STEM activities that relate to each theme.
* For each activity, prepare instructions that include step-by-step photos of how to complete the STEM activity with bilingual instructions, if needed.
* Ensure families provide address for mailing kits that matches where they will be located during the upcoming virtual events
* Ship STEM activity kits to home addresses or plan a kit pickup station (e.g., send home via classroom teacher) a 3 to 7 days in advance of virtual event
* For in-person events, ensure sufficient activity supplies for expected number of attendees
* For in-person events, consider offering snacks or a light meal as families arrive to promote initial social connections amongst families and rapport with the ISE who welcomes families
* Ensure families have the location for in-person events (e.g., hosted at school, library, etc.)
* If possible, offer multiple virtual event times
* If possible, offer virtual events in common home languages
* Send reminders to parents one week and one day before event (e.g., texts, flyer)
* Test the QR code and link to videoconference events to ensure correct
* Resend QR codes and link for the videoconference link to flyers to improve ease of access
 |
| Virtual Events | * Welcome families as they join with warm tone
* Consider having a welcome slide/music with norms listed (e.g., mute unless speaking, use chat, avoid driving during event)
* Encourage brief family introductions
* Consider a quick STEM icebreaker activity to immediately engage families
* Introduce your content/theme with visual aids such a video or slides
* Encourage participants to share their ideas or learning during the event to encourage social participation
* Preview the asynchronous activities to build excitement and explain where to find more detailed instructions
* Provide instructions for any families that did not receive the kits in advance to obtain materials
* Explain how families can contact the ISE with questions as they start the activities
* Encourage families to post photos and videos doing the activities with a tag that links to the museum or organization’s social media
 |
| In-Person Event | * Arrange the event room before families arrive. Set up tables and activity stations with all required materials, including table toppers with activity instructions. Check technology and internet access.
* Welcome families as they enter the event space and ask them to sign in and pick up a handout.
* Consider having a welcome slide/music with norms listed (e.g., Monitor your child’s behavior, Restrooms are located at..)
* Introduce your topic/strategies as you orient families to parent handout, video, or other tools for explaining the focal learning objectives.
* Encourage participants to share their ideas during the event to encourage social participation.
* Review the importance of reading together to stimulate child interest in science and model strategies during an interactive read-aloud.
* Encourage parents to take the opportunity to rotate through STEM activity stations with their child. Design activities to support parents to practice the strategies that stimulate children’s curiosity, and introduce STEM topics and vocabulary in playful ways
* Provide a 5-minute warning at the end of the event and encourage families to take home anything they have made at the activity stations.
 |

**Figure SM1.** Theory of Change for TT STEM Hybrid Program



**Figure SM2.** CONSORT Flowchart Showing Participant Progress through Research Activities

Lost at posttest – reason = non-responsive to > 6 attempts to schedule posttest (n = 16)

Allocated to TT STEM intervention (J = 11, n = 51)

 Received all 4 intervention workshops (n = 4)

 Received 3 intervention workshops (n = 5)

 Received 2 intervention workshops (n = 9)

 Received 1 intervention workshop (n = 12)

Declined all intervention workshops (n = 21)

Lost at posttest – reason = non-responsive to >6 attempts to schedule posttest (n = 15)

Allocated to control/waitlist (J = 10, n = 39)

 Received delayed intervention workshop

(n = 2)

Declined delayed workshops (n = 37)

Analyzed (n = 24)

**Analysis**

**Attrition at Posttest**

**Enrollment**

*Note*. J = classrooms within schools. n = parent-child dyads consented. 15 schools were recruited but only 10 met inclusion criteria of >3 consents for randomization.

Assessed for eligibility (n = 108)

Excluded (n = 18)

  Declined or non-responsive to attempts to schedule pretest

(n = 17)

  Neurodevelopmental disorder (n = 1)

Analyzed (n = 35)

-Received all 4 intervention workshops (n = 2)

-Received 3 intervention workshops (n = 5)

-Received 2 intervention workshops (n = 7)

-Received 1 intervention workshop (n = 10)

-Declined all intervention workshops (n = 11)

**Randomization**

Pretested and Randomized (J = 21; n = 90)