

2023



Utah STEM Action Center's Math Introduction and Learning Opportunities (MILO) and Friends Program: 2022-2023 Report



Bridging Research, Policy, and Practice

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1 | Overview

Math Introduction and Learning Opportunities (MILO) and Friends is a campaign designed by Utah's STEM Action Center to support families in helping young children develop early math skills (<https://stem.utah.gov/milo/>). As part of this campaign, STEM Action Center staff engaged in three key activities during the 2022-2023 evaluation period: 1) tabling events, 2) seminar-style events, and 3) *Play to Learn* kit development. A description of each activity is provided in Table 1 along with a brief description of associated evaluation efforts by the Utah Education Policy Center (UEPC).

Table 1. Description of STEM Action Center's MILO activities and UEPC's evaluation activities

<i>Activity Type</i>	<i>Activity Description</i>	<i>Evaluation Description</i>
1 <i>Tabling Events</i>	Tabling events were designed to allow STEM Action Center staff or trained designees to interact informally with families. During these events, program staff or designees typically introduced families to activities and resources available through the MILO and Friends campaign, played board games with preschool-age children, and distributed math-related board games to families.	Families who received board games and provided contact information during a tabling event were invited via email to complete a short survey shortly after the event. The survey was designed to assess caregivers' perceptions of the games, including their impact on their confidence and interest in helping their child(ren) build early math skills. The survey also assessed caregivers' general perceptions of math and math learning and their self-reported engagement in math skill-building activities with their children.
2 <i>Seminar-Style Events</i>	Seminar-style events were designed to allow STEM Action Center personnel or trained designees to share information with families about the importance of working with their children to build early numeracy skills in a more structured setting than tabling events. During these events, program staff or trained designees typically shared their insights and knowledge about building early numeracy skills, introduced families to activities and resources available through the MILO and Friends campaign, provided an opportunity for caregivers and children to play one or more board games, and distributed board games to participating families.	Families who participated in seminar-style events were asked to complete pre- and post-event surveys . Surveys were designed to assess participants' perceptions of the event and the game, including their impact on participants' confidence and interest in helping children build early math skills. Parents of preschool-age children were also asked to report on their typical engagement in math skill-building activities with their children. Following one event, preschool teachers participated in interviews designed to assess their perceptions of the event and areas for improvement. Finally, UEPC staff conducted observations at two of these events.
3 <i>Play to Learn Kit Development</i>	The STEM Action Center continues to create <i>Play to Learn</i> kits that are designed to encourage young children and their families "to see math as part of everyday life." Kits focus on a range of mathematics skills including categorization, measuring, estimating, and arithmetic. Each kit contains materials (e.g., puzzles pieces) and activity cards that provide a description of the activity, instructions, and "family tips."	Based on preliminary findings from surveys administered to families who received <i>Play to Learn</i> kits in 2021-2022, the UEPC conducted "cognitive interviews" with caregivers to better understand how information or instructions included the kit might be revised to improve their usefulness. The UPEC plans to conduct additional interviews after kits are revised in collaboration with a new manufacturing partner.

Report Organization

The report is divided into six sections. In the first section, we provide an overview of the MILO and Friends campaign. In this section, we also introduce key program activities and key evaluation activities during the 2022-2023 evaluation period. In the second section, we offer background for the current report by providing a brief review of the research literature that speaks to the importance of supporting caregivers in helping their children build early numeracy skills. In the third section, we summarize key findings from surveys administered at tabling events. In the fourth section, we summarize key findings from surveys, interviews, and observations conducted during or following seminar-style events. In the fifth section, we summarize key findings from cognitive interviews conducted with caregivers about *Play to Learn* kit materials. Finally, in the sixth section, we offer recommendations for implementing and expanding the program in years to come to achieve proposed outcomes. Recommendations are based on artifact reviews, survey responses, observations, interviews, and a review of the extant literature on supporting early numeracy.

The current report provides a summative evaluation of 2022-2023 MILO and Friends activities. The Utah Education Policy Center has also produced five interim reports that were designed to provide formative, “just in time” feedback to MILO and Friends program personnel throughout the year. These interim reports are collated in an addendum to this report.

2 | Background

What are early numeracy skills?

Early numeracy encompasses a range of mathematical skills that begin to develop in children before they start kindergarten. These skills include recognizing number symbols, such as “5”, understanding the meaning of number words, like “three”, comprehending ordinality or the count sequence (e.g., 1, 2, 3, 4, 5 ...), and identifying quantities. Typically, children learn these skills before or outside of formal schooling, often through activities in the home. These activities may be direct, such as counting objects or reading number-related picture books, or indirect, such as playing card games, cooking, or playing store (LeFevre, Skwarchuk, Smith-Chant, Fast, Kamawar, & Bisanz, 2009).

Importantly, not all children have the same opportunities to develop their numeracy skills at home. For example, research indicates that children from lower socioeconomic backgrounds often have fewer opportunities to engage in everyday math activities compared to their more affluent peers (Blevins-Knabe & Musin-Miller, 1996; Jordan, Huttenlocher, & Levine, 1992).

Are Early Numeracy Skills Related to Later Academic Achievement?

Although early literacy has received more attention from researchers than early numeracy (Raghubar & Barnes, 2017), analyses of data from multiple, large datasets have shown that math skills at the start of school – including knowledge of numbers and ordinality – are stronger predictors of later academic achievement than both reading skills or attention skills at the same age (Duncan et al., 2007; Foster, 2010; Pagani, Fitzpatrick, Archambault, & Janosz, 2010; Romano, Babchisin, Pagani, & Kohen, 2010). On average, children from lower socioeconomic backgrounds have poorer mathematical competence than children from higher socioeconomic backgrounds. These disparities are present at kindergarten and are predicted by differences in children’s “exposure to math-related talk, number-related activities, books, board games, educational toys, and educational television programs” (McNeil, Fuhs, Keultjes, & Gibson, 2010).

Findings from one recent study indicate that disparities in advanced math skills also emerge very early – by the end of kindergarten – and are strongly linked to both family socioeconomic status and advanced math skills at the end of fifth grade. The authors conclude that the underrepresentation of some racial and ethnic groups in STEM fields may be largely explained by factors that exist before kindergarten. They propose that one solution is to broaden opportunities for children from all backgrounds to have early exposure to math content (Morgan, Hu, Farkas, Hillemeier, Oh, & Gloski, 2022).

“Addressing the early onset and over-time stability of ... disparities in advanced science and mathematics achievement through economic and educational policies and programs prior to or by school entry may be necessary for expanding racial and ethnic representation in gifted education and the STEM workforce as well as ensuring the nation’s scientific innovation and resulting economic competitiveness.”

Morgan et al. (2022).

"Children's mathematical competence is highly sensitive to environmental influences. Some environments facilitate understanding and performance, whereas others hinder it Environments with high levels of mathematically-relevant speech and activities support children's early mathematics achievement better than do those with lower ones."

McNeil et al. (2010)

Are Home Interventions Effective in Building Early Numeracy Skills?

There is some evidence that interventions designed to improve the numeracy skills of preschool and early school-age children – through, for example, explicit instruction, corrective feedback, or the use of concrete manipulatives – are moderately effective (Charitaki, Tzivinikou, Stefanou, & Soulis, 2021; Nelson & McMaster, 2019). However, most of these interventions have been implemented in school settings by experienced teachers or trained researchers (e.g., Nelson & McMaster, 2019).

It is unclear whether interventions designed to change the ways in which caregivers interact with children in everyday settings in the home can be effective in improving early numeracy skills or whether home-based interventions might be effective for children from historically underrepresented groups. Importantly, however, several recent studies have shown promising results for home-based numeracy interventions (see Lore, Wang, & Buckley, 2016). In one unpublished experimental study, parents in the treatment condition received information about the importance of early mathematics development and strategies for incorporating numeracy into their child's daily activities. Compared to children in the control condition, parents in the treatment condition reported that they engaged in more numeracy activities in the home and their children showed greater improvement in numeracy skills (Napoli, 2019). Starkey and Klein (2000) report similar results for home-based interventions with families whose children were enrolled in Head Start.

What are Key Challenges in Building Early Numeracy Skills at Home?

The potential effectiveness of home-based interventions is consistent with correlational research indicating that caregivers play an important role both in children's early literacy development (e.g., Baker & Scher, 2002; Bus, van Ijzendoorn, & Pelligrini, 1995; Flouri & Buchanan, 2004) and early numeracy development (e.g., Bernabini, Tobia, Guarini, & Bonifacci, 2020; Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010; Kleemans, Segers, & Verhoeven, 2016). Specifically, stronger home literacy and home numeracy environments both predict stronger academic performance.

Although there is little doubt that caregivers can play an important role in fostering strong early math skills in preschool-age children, there is also evidence that many caregivers of young children do not engage in numeracy activities for a variety of reasons (Smith-Chant, 2010; Sonnenschein et al., 2021) including *misperceptions* that a) early numeracy is less important than early literacy, b) mathematics skills are innate skills, c) early numeracy is not something that can be taught, d) preschool-age children are too young to learn math, and e) parents lack the skills necessary to teach mathematics. Blevins-Knabe (2008) argues

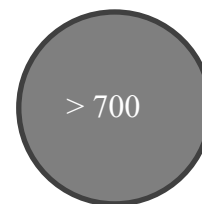
that more work is needed to communicate to parents that the development of basic mathematics skills is critical for later academic success, that parents can play an important role in the development of these skills by embedding mathematics in everyday activities, and that parents generally have a good understanding of the mathematical concepts that children need to learn in their early years, such as counting, recognizing number patterns, and identifying quantities.

3 | Tabling Events

Overview of Tabling Events

Tabling events are planned events that allow organizers or volunteers to interact with the public. During these events, program staff or trained designees typically introduced families to activities and resources available through the MILO and Friends campaign, played games with young children, and distributed math-related board games to families. From October 2022 to May 2023, the STEM Action Center hosted or supported tabling events at 17 sites. The STEM Action Center estimates that more than 700 games were distributed at these events.

Most families received one board game at a tabling event, while some received more than one board game. Among the board games that were distributed at tabling events were *Happy Bunny* and *Tiny Polka Dot*. Details about these board games are provided in Table 2. Other games that were distributed to families included *Set* and *Pengoloo*.



of games distributed at
MILO and Friends seminar-
style events

Table 2. Descriptions of two board games distributed during tabling events

Name	Overview	Description
<i>Happy Bunny</i>	Ages 3 and up 1 – 4 players Play time: 15 mins	"In this cooperative game, everyone helps the bunny pick the best carrots to bring home to his family, plucking them from the box just like you would from the ground. The trick with carrots? You need to test them first to find the most delicious ones! Make sure to pick carefully- all the bitten carrots are for the bunny, while the untouched ones are for the farmer who is also working in the fields. Line up the bunny's carrots at the end of the day and compare them with the farmer's harvest to see who picked the tastiest bunch! This adorable game is perfect to teach teamwork and counting."
<i>Tiny Polka Dot</i>	Ages 3 and up 1 – 6 players Play time: varies	" <i>Tiny Polka Dot</i> is the playful way for children ages 3 – 8 and up to fall in love with numbers. With eye-catching, colorful cards and 16 easy-to-learn games, <i>Tiny Polka Dot</i> is built to grow with your child, teaching critical skills in counting, arithmetic, and logic along the way"

Sources. See product websites at <https://www.blueorangegames.com/index.php/games/happy-bunny> and <https://mathforlove.com/games/tiny-polka-dot/>

Evaluation of Tabling Events

Families who received board games during a tabling event were invited via email to complete a short survey shortly after the event. The survey was designed to assess caregivers' perceptions of the game, including its impact on their confidence and interest in helping their child(ren) build early math skills. The survey also assessed caregivers' general perceptions of math and math learning and their self-reported engagement in math skill-building activities with their children.

To guide MILO and Friends program activities “in real time,” the UEPC provided interim reports on tabling event survey findings in December 2022 ($n = 19$) and April 2023 ($n = 60$). The second interim report is included in full in the addendum to this report. Here, we provide a summative evaluation of tabling events that relies on survey findings as well as artifact reviews and ongoing discussion with STEM Action Center personnel during biweekly meetings.

Survey Respondent Characteristics

By April 20th, 2023, 60 respondents had completed the tabling event survey. As shown in Table 3, the majority of respondents identified as “female” (83.3%) and “White” (70.0%), indicated that they had completed at least some college (78.0%), and reported that English was spoken in their home (86.7%). Among respondents, the median number of children in the home was 2, while the median number of children in the home who were five years of age or younger was 1.

Table 3. Demographic characteristics of survey respondents for tabling events

Variable	Number	%
Gender		
Female	50	83.3%
Male	10	16.7%
Race/Ethnicity		
American Indian of Alaska Native	0	0.0%
Asian	3	5.0%
Black or African American	0	0.0%
Hispanic or Latinx	12	20.0%
Native Hawaiian or Pacific Islander	1	1.6%
White	42	70.0%
Prefer to describe/not to say	2	3.3%
Level of Education		
Less than high school	3	5.1%
High school graduate	10	16.9%
Some college	17	28.8%
2-year degree	9	15.3%
4-year degree	12	20.3%

Graduate or Professional degree	8	13.4%
Languages Spoken at Home		
English only	42	70.0%
English and Spanish	10	16.7%
Spanish only	3	5.0%
Other (i.e., Portuguese, Norwegian, Vietnamese)	8	13.3%
Number of children		
1 child	7	11.6%
2 children	24	40.0%
3 children	18	30.9%
4 children	6	10.0%
5 children	4	6.7%
6 children	1	1.7%
Number of children 5 years of age or younger		
0 children	12	20.0%
1 child	24	40.0%
2 children	17	28.3%
3 children	7	11.7%

Note. Percentages sum to more than 100% for “languages spoken in the home” because respondents could report more than one language.

Caregivers’ Use of Board Games

As shown in Table 4, the majority of survey respondents reported receiving a single board game with most (83.3%) reporting that they received the *Happy Bunny* game. More than half of respondents (52.7%) indicated that they played the game two or more times.

Table 4. Self-reported board game usage of tabling event survey respondents

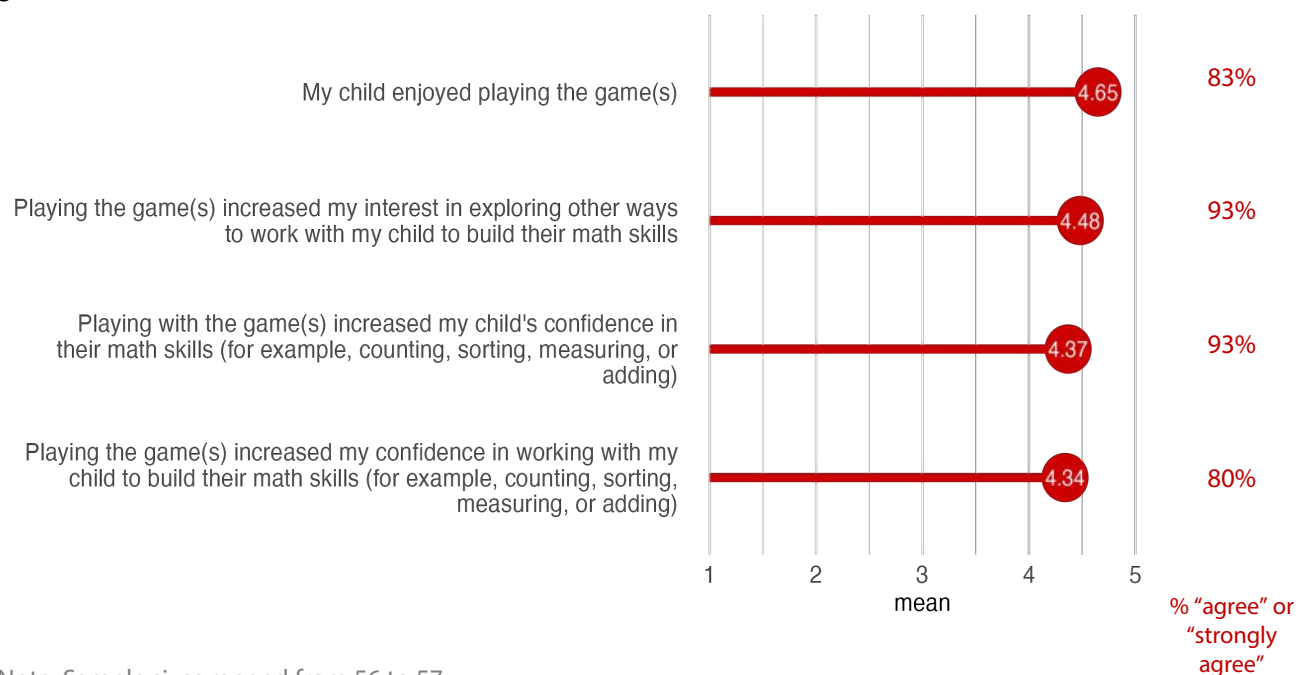
Board game(s) received	<i>n</i>	percent
<i>Happy Bunny</i>	50	83.3%
<i>Tiny Polka Dot</i>	3	5.0%
Both	3	5.0%
Other/ Did not report	4	6.7%
Number of times board game(s) played		
1 time	27	47.4%
2 times	5	8.8%
3 or more times	25	43.9%

Caregivers' Perceptions of Board Games

Caregivers were asked to provide ratings for four items designed to assess the degree to which their children enjoyed the game and to ascertain the perceived impact of the game (e.g., in increasing caregivers' interest in exploring other ways to work with their children to build math skills). Respondents rated all five items on scales that ranged from 1 ("strongly disagree") to 5 ("strongly agree"). Mean ratings and the percent of respondents who "agreed" or "strongly agreed" with each item are provided in Figure 1.

As shown in Figure 1, survey respondents' ratings ranged from 4.34 to 4.65. These ratings indicate that, as a group, caregivers agreed that their children enjoyed the game(s), that playing the games increased their own interest and confidence in working with their children to build math skills, and that playing the game(s) increased their children's confidence in their math skills. Indeed, 80% or more of caregivers "agreed" or "strongly agreed" with each of these four items.

Figure 1. Mean ratings (and percent agreement) for items assessing caregivers' perceptions of board games



Note. Sample sizes ranged from 56 to 57.

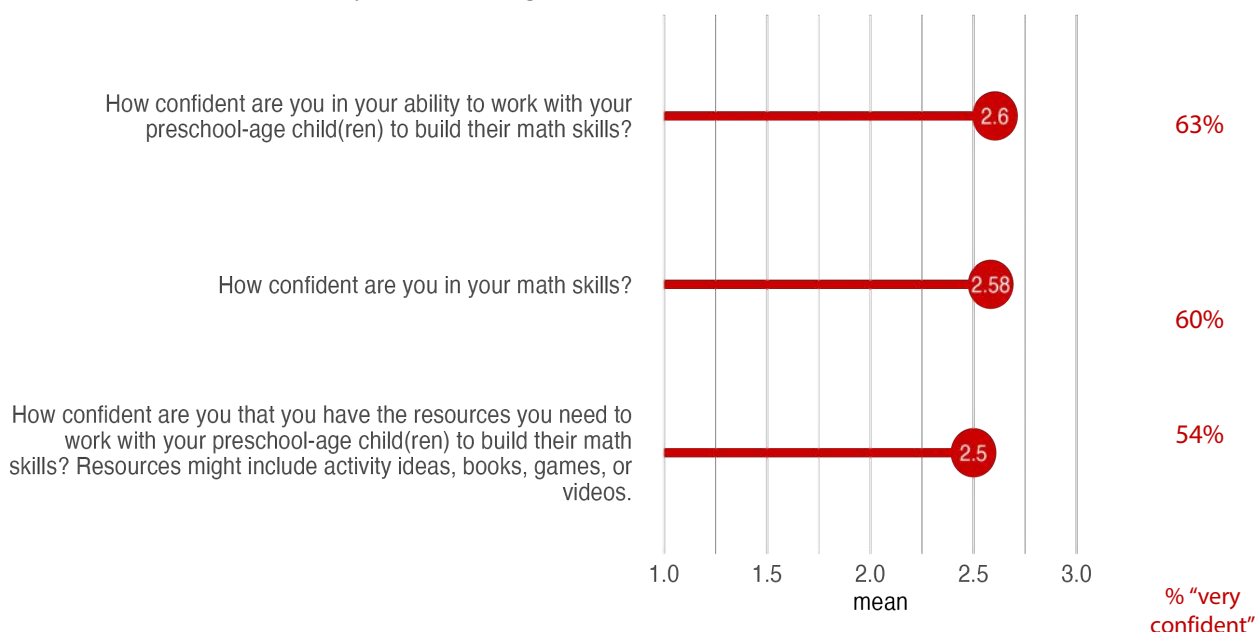
Caregivers' General Attitudes about Math and Early Math Learning

To gauge caregivers' general attitudes about math and early math learning, respondents with preschool-age children were asked to respond to three items designed to assess their confidence that they have the ability and resources needed to help their preschool-age children build early math skills. Respondents rated all three items on scales that ranged from 1 ("not at all confident") to 3 ("very confident"). Mean ratings and the percent of respondents who reported feeling "very confident" for each item are provided in Figure 2.

As shown in Figure 2, survey respondents' ratings ranged from 2.50 to 2.60. These ratings indicated that, as a group, caregivers felt relatively confident in their own math skills and in having the ability

and resources to work with their children to build math skills. At the same time, there was room for improvement – even among this group of caregivers who reported that the board games increased their confidence (see Figure 2). For example, fewer than two-thirds of respondents (63%) reported feeling “very confident” in their ability to work with their preschool-age child(ren) to build math skills and just over half (54%) reported feeling “very confident” that they had the appropriate resources (e.g., activity idea, books, games, or videos) to help their preschool age children build early math skills.

Figure 2. Mean ratings (and percent “very confident”) for items assessing caregivers’ general attitudes related to math and early math learning



Note. Analyses were limited to survey respondents who had at least one preschool age child. Sample size = 48.

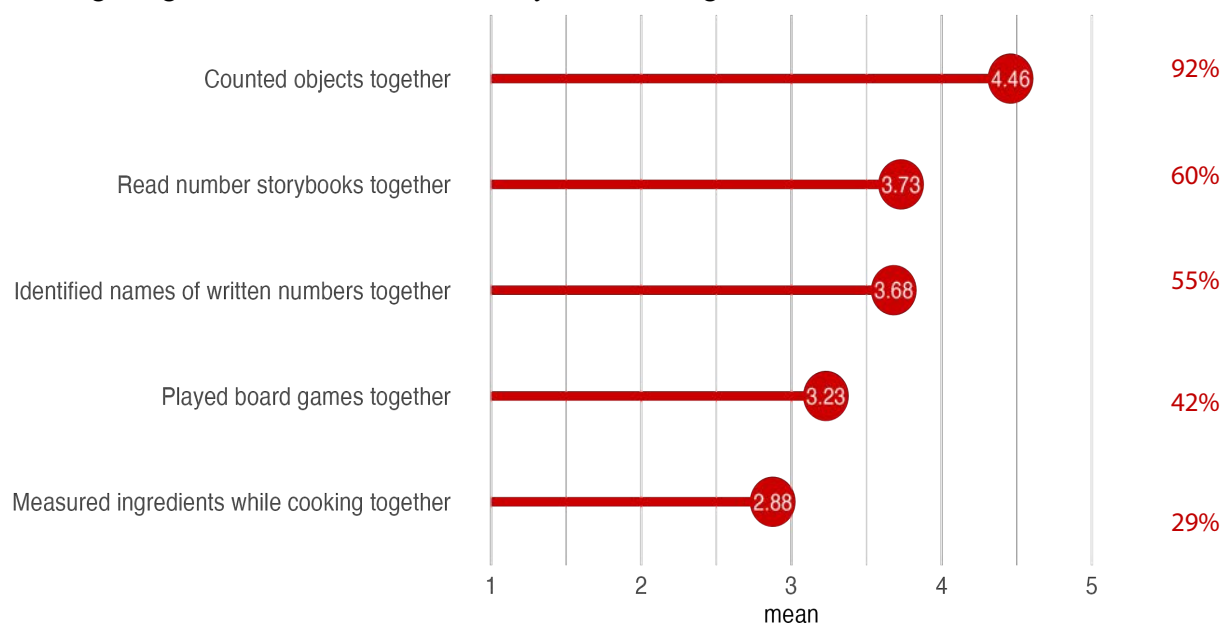
Caregivers’ Behaviors Related to Early Math Learning

To gauge caregivers’ self-reported engagement in math skill-building activities, respondents were asked to respond to five items designed to assess the frequency with which they had – in the past month – engaged in math-related activities with their child(ren). Respondents rated all five items on scales that ranged from 1 (“never”) to 5 (“almost daily”). Mean ratings and the percent of respondents selecting “a few times per week” or “almost daily” are provided in Figure 3.

As shown in Figure 3, survey respondents’ ratings ranged from 2.88 to 4.46. These ratings indicate considerable variability in engagement across activity types with participants, as a group, indicating that they were more likely to engage in activities that allowed them to “count objects” with their preschool-age children than “measure ingredients while cooking together.” For example, while 92% of respondents indicated that they counted objects together “a few times per week” or “almost daily” only 29% of respondents indicated that they measured ingredients while cooking together this frequently. These estimates should be interpreted with some caution insofar as a) activities may vary considerably from month to month and b) estimates for counting objects and playing board games may be inflated because caregivers who responded to the survey had received a board game from the

STEM Action Center that supported both activities. Still, these estimates suggest considerable room for improvement in the frequency with which caregivers engage in many math-related activities.

Figure 3. Mean ratings (and percent selecting “a few times per week” or “almost daily”) for items assessing caregivers’ behaviors related to early math learning



Note. Analyses were limited to survey respondents who had at least one preschool age child. Sample sizes ranged from 47 to 48.

% “a few times per week” or “almost daily”

Conclusions

Survey data indicate that caregivers who were provided with board games by the STEM Action Center during tabling events reported that their children enjoyed the game(s). Moreover, caregivers reported that playing the games increased their own interest and confidence in working with their children to build math skills and increased their children’s confidence in their math skills (e.g., counting). Although survey respondents indicated that they felt relatively confident that they have the ability and resources to build math skills with their preschool-age children, there was also considerable room for improvement both in confidence in and actual engagement with math-related activities (e.g., finding opportunities to identify names of written numbers or to measure ingredients together).

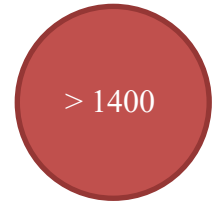
These findings provide early support for the value of resources being developed by or provided by the STEM Action Center via the MILO and Friends program to support families in building early math skills in Utah’s children. At the same time, the results should be interpreted with considerable caution given that the number of respondents is small and may not be representative of the population of individuals who attended the tabling events or received the board games. Respondents also likely different in important ways from Utahns with preschool-age children. Most notably, survey respondents were overwhelmingly female.

4 | Seminar-Style Events

Overview of Seminar-Style Events

Seminar-style events were designed to allow STEM Action personnel or trained designees to share information with families about the importance of working with their children to build early numeracy skills in a more structured setting than tabling events. During seminar-style events, program staff or trained designees typically took 5 – 10 minutes at the beginning of the event to share their insights and knowledge about building early numeracy skills and to introduce families to activities and resources available through the MILO and Friends campaign. During the remainder of the event, STEM Action Center personnel explained game instructions and families were given an opportunity to play one or more board games and ask questions. At the conclusion of the event, board games were distributed to participating families.

From October 2022 to May 2023, the STEM Action Center hosted or supported tabling events at four sites including preschool and family engagement programs associated with United Way, Head Start, Alpine School District, and Davis School District. The STEM Action Center estimates that more than 1400 games will be or have been distributed to families at these events. The most frequently distributed game is *Happy Bunny*.



of games distributed at
MILO and Friends seminar-
style events

Evaluation of Seminar-Style Events

Attendees of seminar-style events were invited to complete a short survey at the beginning of the event and at the end of the event. Together, the pre- and post-event surveys were designed to assess participants' perceptions of the event and the *Happy Bunny* game, including their impact on participants' confidence and interest in helping child(ren) build early math skills. Parents of preschoolers were also asked to report on their typical engagement in math skill-building activities with their children.

To guide MILO and Friends program activities "in real time," the UEPC provided interim reports on seminar-style event survey findings following events at Liberty Elementary School (in January 2023) and Farm Fun Preschool (in April 2023). Both interim reports are included in the addendum to this report. Here, we provide a summative evaluation of tabling events that relies on artifact reviews, ongoing discussions with STEM Action Center personnel during biweekly meetings, survey findings from the [Liberty Elementary School](#) and Farm Fun Preschool events, observations of Liberty Elementary School and Farm Fun Preschool events, and interviews with preschool teachers at Liberty Elementary School.

Survey Respondent Characteristics

By May 25th, 2023, 53 attendees had completed surveys at two sites: Liberty Elementary School ($n = 23$), and Farm Fun Preschool ($n = 30$). As shown in Table 5, across the two sites, the majority of respondents identified as "female" and most as White or Hispanic or Latinx. The majority reported having completed at least some college and most indicated that English and/or Spanish was spoken in their home. Among respondents, the median number of children in the home was 2 or 3, while the median number of children in the home who were five years of age or younger was 1 or 2. Most respondents were parents to the child with whom they played the *Happy Bunny* board game.

Table 5. Demographic characteristics of survey respondents

Variable	Site			
	Liberty Elementary		Farm Fun Preschool	
Gender	<i>n</i>	percent	<i>n</i>	percent
Female	16	69.6%	26	86.7%
Male	7	30.4%	4	13.3%
Race/Ethnicity	<i>n</i>	percent	<i>n</i>	percent
American Indian or Alaskan Native	2	8.7%	1	0.0%
Asian	2	8.7%	1	0.0%
Black or African American	2	8.7%	1	0.0%
Hispanic or Latinx	12	52.2%	1	3.3%
White	10	43.5%	29	96.7%
Level of Education	<i>n</i>	percent	<i>n</i>	percent
Less than high school	1	4.3%	0	0%
High school graduate	6	26.1%	2	6.7%
Some college	3	13.0%	6	20.0%
2-year degree	3	13.0%	2	6.7%
4-year degree	5	21.7%	12	40.0%
Professional degree	4	17.4%	3	10.0%
Masters or Doctorate	1	4.3%	5	16.7%
Languages Spoken at Home	<i>n</i>	percent	<i>n</i>	percent
English	18	78.2%	30	100.0%
Spanish	12	52.2%	1	3.3%
Other (i.e., Arabic, French, Tagalog)	2	8.6%	3	10.0%
Number of children	<i>n</i>	percent	<i>n</i>	percent
0 children	1	4.3%	0	0.0%
1 child	8	34.8%	3	10.0%
2 children	7	30.4%	6	20.0%
3 children	2	8.7%	12	40.0%
4 children	4	17.4%	8	26.7%
5 children	1	4.3%	1	3.3%
Number of children <= 5 years of age	<i>n</i>	percent	<i>n</i>	percent
0 children	4	17.4%	10	33.3%
1 child	15	65.2%	12	40.0%

2 children	2	8.7%	7	23.3%
3 children	2	8.7%	1	3.3%
Relationship to Preschool-Age Child	<i>n</i>	percent	<i>n</i>	percent
Parent	19	82.6%	30	100.0%
Grandparent	1	4.3%	0	0.0%
Teacher	2	8.7%	0	0.0%
Other (e.g., family friend)	1	4.3%	0	0.0%

Note. Percentages can sum to more than 100% for “race/ethnicity” and “languages spoken in the home” because respondents could select more than option.

Participants’ Perceptions of Event Activities

Participants were asked to provide ratings for five items designed to assess their perceptions of the event and the *Happy Bunny* board game. Respondents rated all five items on scales that ranged from 1 (“strongly disagree”) to 5 (“strongly agree”). Mean ratings and the percent of respondents who “agreed” or “strongly agreed” with each item are provided in Figure 4 (see page 22).

As shown in Figure 4, survey respondents’ ratings ranged from 4.07 to 4.95 across items and sites. These ratings indicate that, as a group, participants “agreed” to “strongly agreed” that participating children enjoyed playing the *Happy Bunny* board game, that the event increased their own interest and confidence in working with children to build math skills, and that playing the game increased children’s confidence in their math skills.

Participants’ positive perceptions of the event were supported by responses to an open-ended survey item that asked how the event might be improved. Many participants took this opportunity to simply provide positive feedback. For example:

“Great job. Great information to help pre-k kids.”

“Great presentation and explanation of the game rules and objectives. My child really enjoyed the game.”

“I can't think of anything. The information was delivered & explained very well. Very enjoyable for everyone, thank you!”

“Everything was really good, we enjoyed having time with our kids.”

Figure 4. Mean ratings for items assessing participants' perceptions of event activities by site



Other participants indicated that they appreciated learning more about how they could meet the needs of their preschool-age children. For example:

"I thought it was great and now that I know what to do (and how easy it can be), I'm looking forward to this. I just feel bad I didn't know these simple (yet highly effective) games before for my older children."

"This was fabulous! Breaking down what age specific math looks like is so helpful. I can focus on those skills instead of thinking math for my two-year-old needs to be addition."

Finally, several participants indicated that they would welcome additional opportunities, resources, or tips for building math skills among preschool-age children.

“This was great! I’d love info on finding more resources for math learning.”

“It would be nice to have info for kids who already know basic math and how to help them continue to advance. Great game, thank you!”

“This was great. I would love a list of additional resources/games with the associated math objectives you can learn from them.”

“Very informative. Eye opening and I really appreciate what you’re doing. Maybe other ideas for teaching math concepts.”

“The only issue we ran into was a short attention span.”

“Maybe some more at home ideas and worksheets we can take with us on the way home, and ideas to keep my child attention to keep interest with math when at home. This event did help a lot and made me understand ways to help my daughter.”

Changes in Participants’ Confidence

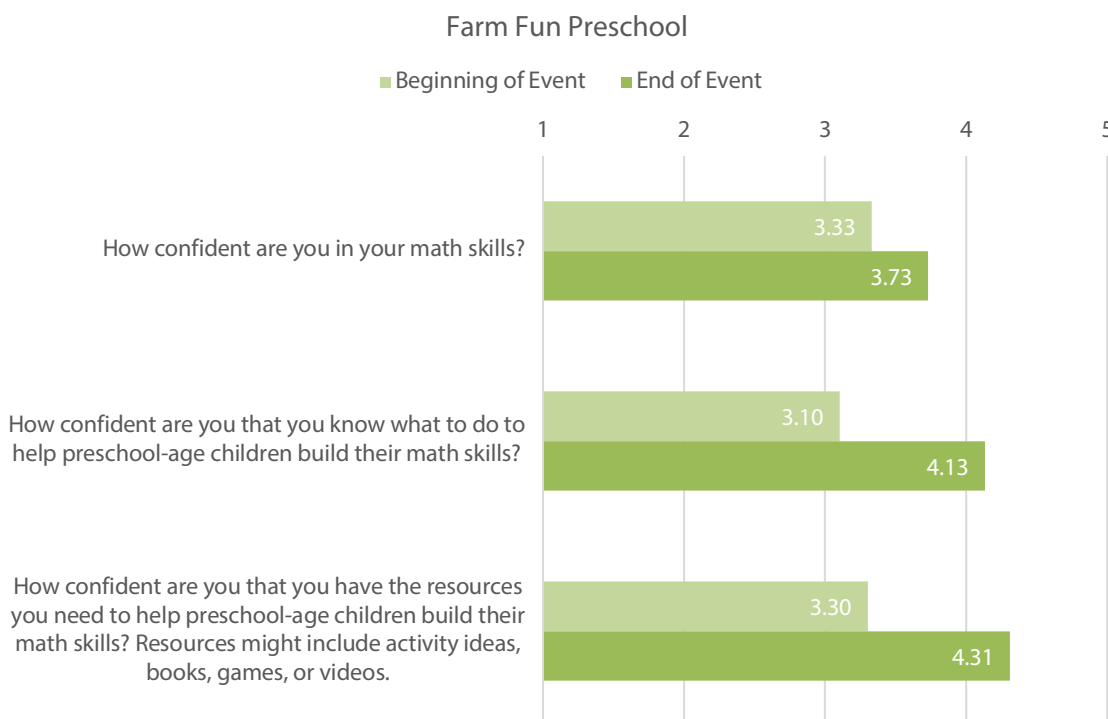
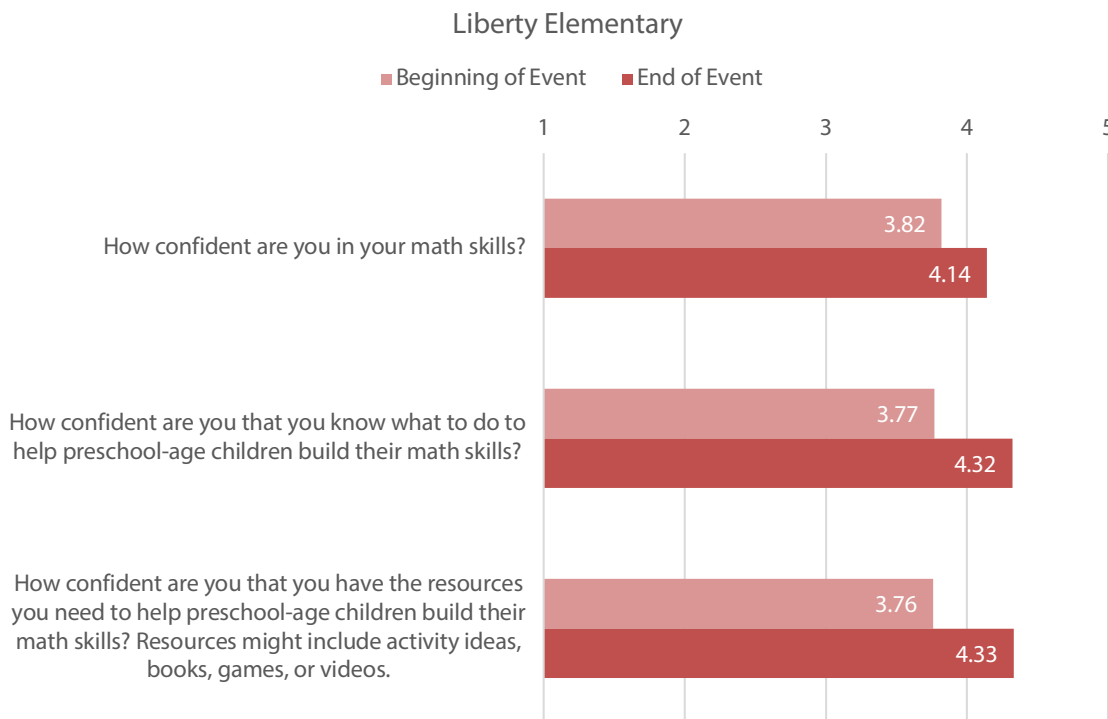
At both the beginning of the event and the end of the event, survey respondents were asked to respond to three items designed to assess changes in participants’ confidence that they have the ability and resources needed to help preschool-age children build early math skills. Respondents rated all three items on scales that ranged from 1 (“not at all confident”) to 5 (“very confident”). Mean ratings and the percent of respondents who reported feeling “pretty confident” or “very confident” for each item are provided in Figure 5.

As shown in Figure 5, survey respondents’ ratings ranged from 3.10 to 3.82 on the survey administered at the beginning of the event and from 3.73 to 4.33 on the survey administered at the end of the event. These ratings indicated that, as a group, caregivers felt between “somewhat confident” and “pretty confident” in their own math skills and in having the ability and resources to work with their children to build math skills at the beginning of the event, and that confidence levels increased such that the average participant was feeling “pretty confident” to “very confident” by the end of the event. Although results should be interpreted with caution given the relatively small sample sizes ($ns = 22$ to 29), dependent t -tests¹ indicated that gains in confidence were statistically significant, $ts > 2.30$, $ps < .05$.²

¹ A dependent t -test, or paired samples t -test, is used to determine whether the mean difference between two sets of observations (here, “before” and “after”) is zero.

² A statistically significant result is one that is unlikely to occur by chance. When p values are less than .05, there is less than a 5% chance of finding a difference this large or larger if the null hypothesis is true. Here, the null hypothesis is that there are no differences in “before” and “after” ratings. When p values are greater than .05, this chance is greater than 5% which is traditionally considered unacceptable for rejecting the null hypothesis.

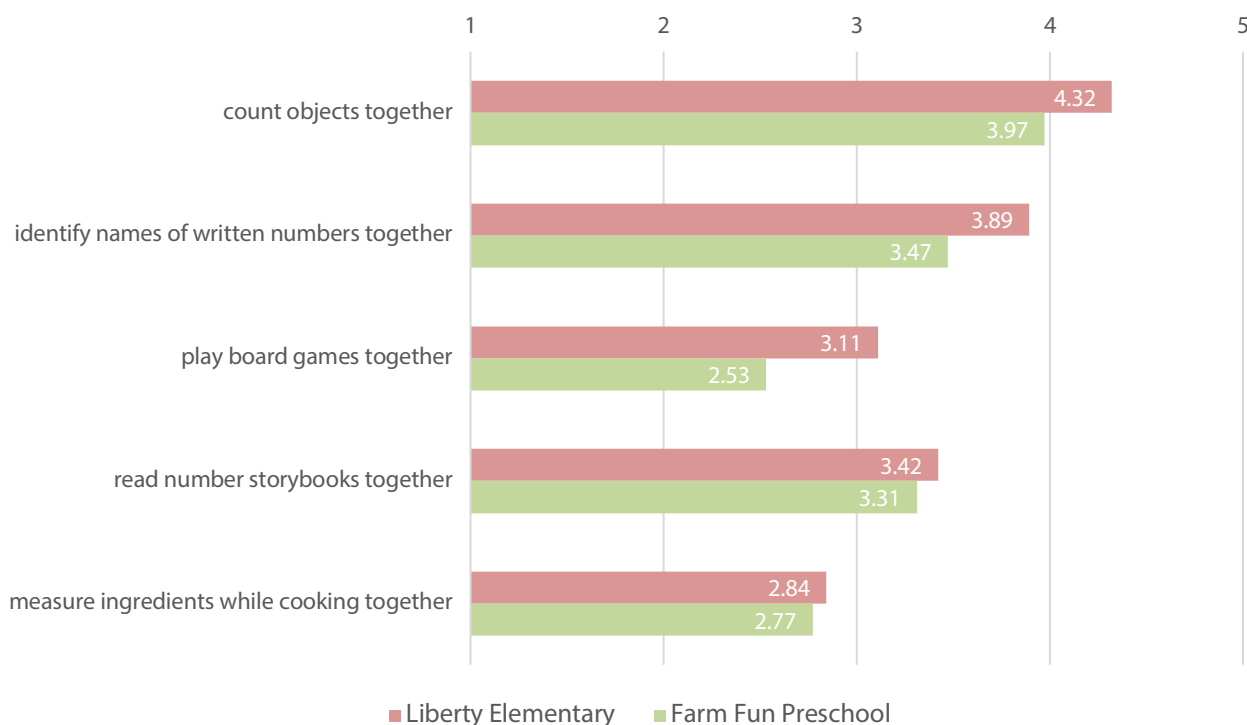
Figure 5. Mean ratings for items assessing changes in participants' confidence by site



Caregivers' Behaviors Related to Early Math Learning

To gauge caregivers' self-reported engagement in math skill-building activities, respondents who were caregivers (i.e., parents or guardians) to preschool-age children were asked to respond to five items designed to assess the frequency with which they had – in the past month – engaged in math-related activities with their child(ren). Respondents rated all five items on scales that ranged from 1 (“never”) to 5 (“almost daily”). Mean ratings and the percent of respondents selecting “a few times per week” or “almost daily” are provided in Figure 6.

Figure 6. Mean ratings for items assessing caregivers' behaviors related to early math learning across sites



As shown in Figure 6, caregivers' ratings ranged from 2.53 to 4.32 across items and sites. These ratings indicate considerable variability in engagement across activity types with participants, as a group, indicating that they were more likely to engage in activities that allowed them to “count objects” with their preschool-age children than “measure ingredients while cooking together” or “play board games together.” These estimates should be interpreted with some caution insofar as activities may vary considerably from month to month and caregivers' self-reports may not reflect actual behavior. Still, these estimates suggest considerable room for improvement in the frequency with which caregivers engage in many math-related activities with their preschool-age children.

Preschool Teachers' Perceptions of Seminar-Style Events

To gain additional insights about seminar-style events, the UEPC conducted a focus group with educators at Liberty Elementary School. Two pre-kindergarten teachers from Liberty Elementary School participated in this focus group. Both were recruited via email, starting with a contact provided by the STEM Action Center. During the focus group, participants were prompted to recall the January 26th event, describing its strengths and opportunities for improvement. Participants were also asked to describe their understanding of the event's goals and their perceptions of the educational materials used during the event. Finally, participants reflected upon the support provided by the STEM Action Center and provided suggestions for future events.

An interim report from focus group interviews was provided to MILO and Friends personnel in February 2023. The full interim report is included in an addendum to this report. Key findings are summarized here:

- Educators noted that both caregivers and children enjoyed playing *Happy Bunny* and were highly engaged in the event. At the same time, educators noted that instructions provided with the game were difficult to understand.
- Educators offered several suggestions for how to increase caregiver focus during the presentation, including caring for children in a separate location (e.g., an adjoining room) during the presentation and waiting to distribute games to families until after the presentation.
- Educators expressed interest in stocking their classrooms with additional age-appropriate, math-related board games.
- Educators expressed interest in learning more about how to turn everyday activities into math learning opportunities.

Conclusions

Findings from interviews with preschool teachers and from surveys administered to attendees at the MILO and Friends seminar-series events provide early support for the value of resources and learning opportunities being provided by the STEM Action Center to support families in building early math skills among Utah's preschool-aged children. Key findings include the following:

- Although few caregivers indicated that they routinely (i.e., a few times per week or more) play board games with their preschool-aged children, respondents overwhelmingly agreed that their preschool-aged children enjoyed playing the *Happy Bunny* board game. Having these and similar games available both at home and in their preschool classrooms may be helpful in ensuring that children have multiple opportunities to build their skills including with same-age peers.
- Survey respondents and preschool teachers overwhelmingly agreed that the event was valuable. Survey respondents indicated that the event increased their knowledge, interest, and confidence in working with preschool-aged children to build math skills.
- The majority of respondents agreed or strongly agreed that playing *Happy Bunny* increased preschool-aged children's own confidence in their math skills (e.g., counting).
- Participants reported statistically significant gains from the beginning to the end of the event in their confidence that they have the ability and resources needed to help preschool-age children

build early math skills. STEM Action Center might enhance these gains by ensuring that parents can focus on the presentation at the beginning of the event and by ensuring that the instructions for playing the game are clear.

- Both caregivers and educators expressed interest in learning more about how to turn everyday activities into opportunities for preschool-age children to build their math skills.

5 | *Play to Learn* Kit Development

Overview of *Play to Learn* Kits

As part of the MILO and Friends campaign, the STEM Action Center is developing *Play to Learn* kits that are designed to encourage young children “to see math as part of everyday life.” The first iteration of *Play to Learn* kits were developed through partnerships with Project Child Success and Clever Octopus and focus on a range of mathematics skills including pattern identification, categorization, measuring, estimating, and arithmetic.³ Each kit contains materials (e.g., a deck of playing cards or puzzles pieces) and activity cards that provide a description of the activity, instructions, and “family tips.”

From January to May 2022, approximately 4,200 kits were distributed to more than 20 sites in several counties including Davis, Salt Lake, and Weber. Distribution sites included district-affiliated preschools, Head Start programs, and Boys and Girls Clubs. Caregivers who received a *Play to Learn* kit were asked to complete a contact information form. All caregivers who completed the form were sent a survey designed and administered by the Utah Education Policy Center (UEPC) to understand how the kits were being used and to assess caregivers’ perceptions of the effectiveness of the kits in engaging young children in mathematics.

By May 2022, 21 caregivers had completed the survey. Responses were quite positive. For example, 75% or more of respondents indicated that the kits were easily accessible, had clear directions for use, and included structured math lessons or activities and “family tips” that encouraged additional learning. Importantly, caregivers reported that the structured math lessons or activities were more useful than “family tips.”

Evaluation of *Play to Learn* Kits

Based on preliminary survey findings from 2021-2022, a key focus of the UEPC’s 2022-2023 evaluation efforts was to develop a process for getting a more nuanced understanding of caregivers’ perceptions of *Play to Learn* kits including an understanding of where families might need more support in implementing kit activities or where information or instructions included in the kit might be revised to improve their usefulness. Toward this end, the UEPC developed a “cognitive” or “think aloud” interview protocol that was designed to capture caregivers’ perceptions of *Play to Learn* materials in “real time” as they reviewed these materials with the interviewer. In an initial round of interviews, five parents of preschool-age children were asked to review several activity cards including the “Towers” activity card (see Figure 7) that was the focus of the interview. A full report of findings from these interviews was shared with STEM Action Center and is included in an addendum to this report. Here, we provide a summative evaluation of *Play to Learn* kit materials that relies on artifact reviews, ongoing discussion with STEM Action Center personnel during biweekly meetings, and the initial set of five interviews. The UEPC plans to conduct additional interviews after STEM Action Center staff revise *Play to Learn* materials in collaboration with a new manufacturing and distribution partner, Lakeshore Learning (<https://www.lakeshorelearning.com/>).

³ <https://stem.utah.gov/stem-action-center-expanding-to-learn-program/>

Figure 7. *Play to Learn Towers Activity*

ACTIVITY 2:

TOWERS

In this activity, students will guess how many blocks it will take to make towers of varying heights, then build their towers and compare the number of blocks they used with their guess.

MATERIALS:

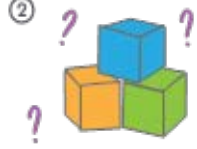
- Blocks

INSTRUCTIONS

①



②



③



④



STEP 1:
Decide how tall of a tower you think you can build before it falls over. Is it as tall as your knees? As tall as a chair? A couch?

STEP 2:
Guess how many blocks you will need to build a tower that high.

STEP 3:
Build your tower!

STEP 4:
Once the tower can no longer stand, it falls! How many blocks did you use? Compare your guess to how many blocks you used. Did you guess more blocks than you needed? Less? What if you used bigger blocks? What if you used smaller blocks?

This activity meets many of Utah's Core Standards for Early Learning Math, including:

Standard Math 3 yr.4.5 Explore shapes using a variety of media (for example, blocks, stickers, play dough/clay, art supplies).

For more information on Early Learning Standards, visit schools.utah.gov

FAMILY TIPS:

The purpose of this activity is to determine how many blocks are needed to build a tower a certain height. Learners should also discover that you need more of the smaller blocks to make a tower the same height as the bigger blocks. Ask questions of your student such as:

- What did you notice changes when using smaller or bigger blocks?
- How many blocks were you able to stack of bigger blocks before they fell? How many blocks were you able to stack of smaller blocks before they fell? Why do you think there is a difference?
- What other shaped towers can you create with the blocks?
- What is the tallest tower you can make? How many blocks did you use?

BUILD TO LEARN

STEM ACTION CENTER

stem.utah.gov

Cognitive Interview Methods

Recruitment for the initial round of cognitive interviews began in October 2022. The target audience was caregivers of 2- to 5-year-old children. Common procedures for reaching this audience were utilized (see Yaremych & Persky, 2022). Specifically, the UEPC posted to parenting groups on Facebook, hung flyers around the University of Utah campus, sent emails to University of Utah campus daycare centers, and reached out to College of Education faculty members and personal contacts.

As a result of these recruitment efforts, the UEPC set up five interviews. Four out of five participants were female and White. All five participants held a 4-year, graduate, or professional degree, and all had two or fewer children. This sample size is consistent with research indicating that iterative usability testing with a small number of participants maximizes the return on investment (Nielsen & Landauer, 1993). One interview was conducted in person, one interview was conducted over the phone, and the remaining three interviews were conducted through the Zoom platform.

The interviewer began each in-person and Zoom interview by modeling the “think aloud” technique to increase participants’ comfort level in sharing their thoughts (see Shafer & Lohse, 2006). Participants were asked to share their general impressions of the *Play to Learn* kit materials and then to share their thoughts about each section of the Towers activity card including the description, materials, instructions, standards, and “family tips.” Finally, at the end of the interview, participants were asked to comment on the perceived value of the materials including their level of interest in using the kits with their children and perceived challenges in doing so.

Findings from Cognitive Interviews

Theme 1. All participants had positive first impressions of the Play to Learn kit materials, in general, and the “Towers” activity card, in particular.

As they looked through the different activities in the kit and on the card, participants remarked that they found the materials to be “neat,” “fun,” “colorful,” and “engaging.” Parents noted that the materials looked inviting for children and indicated that they believed their children would be interested in engaging with the materials. Several participants noted that they appreciated that the kits included familiar materials like blocks, encouraged hands-on learning, and incorporated a variety of formats and resources including text, pictures, tips, and core standards. One participant mentioned that the structure of the activity plans was easy to understand. These points are reflected in several representative responses:

“My kids would be excited about the Legos. Talking about shapes and measurement. I think they’d be excited about the Tangrams because it’s about being creative with putting that together. My four-year-old would be excited about the lesson plan and the colors.”

“[The “Towers” activity card] is organized in a way that makes sense to me. Like, there’s a learning objective in the beginning, the materials, the instructions, and then the step-by-step of how to do it. And then I love the tips at the end as well. And, the mention of the core standards there too. I think those were all aspects, just from my experience, that make a lesson plan really high quality. I thought it was fun that there’s a lot of colors on the page and shapes and, um, like the visual instructions I think are nice, especially, you know, that they go together with the steps. So overall, I think just at first glance it looks, it’s a really high-quality lesson plan.”

Theme 2. Participants saw value in using the kits to spend time with their children and appreciated the reminder to build math learning activities into their daily lives.

All five participants indicating that they would be interested in using the materials with their children, noting that they found particular value in the focus on simultaneously playing with their children and building early math skills.

“I think my daughter would have fun because she’s also just playing with me. It is helpful to remind myself that these things are important ... It’s reminding me like, oh, ask math questions while we’re doing almost anything. We can add that in.”

“I think it’s just more like just sitting down and playing together ... I think my children would just appreciate having mom sit on the floor and play with them for 20 minutes.”

“I think they’re a good reminder to just ask more questions when doing math or really any activities with your kids – learning activities especially.”

“I’ve never really thought to count how many blocks were in a tower before or after it crashed. So, [it’s a good reminder about] just kind of finding secret ways to expose [young children] to math.

Theme 3. Several participants indicated that the alignment between the goals of the activity and the Utah Core Standard(s) could be clearer.

The “Towers” activity card indicates that the activity meets many of the Utah Core Standards for Early Math Learning including exploring shapes using a variety of media. Although the activity card emphasizes that the “shape” standard is only one of the many standards this activity addresses, some participants expressed unease about the standard or confusion about the alignment between the described activity and the single standard included on the card. For example:

“I think that’s a bad standard. It’s not concrete or specific. It’s vague.”

“I think the activity [is mostly about] estimation and the counting ... I don’t think [including the standard] is bad, but there are definitely more math skills in progress here than just looking at the shapes.”

“The standard is about exploring shapes and it feels like that is not happening in this activity. It seems to be about numeracy and the magnitudes of numbers. The goal of the standard might be to give direction to the activity, provide a goal. This activity does not make sense for this standard. It does not really seem helpful and unnecessary to some extent. The standard would [better] match with an activity that is about a variety of block shapes and comparing them.”

Theme 4. Several participants expressed confusion about the picture-based instructions or indicated that there appeared to be a misalignment between the text-based and picture-based instructions.

Although participants expressed appreciation for the visual representation of the steps, several also expressed confusion about the picture-based instructions or commented on a perceived misalignment between text-based and picture-based instructions. For example, after reading Step 1, one participant

noted that they expected to see a visual representation of objects that might be used for measurement, such as chair or couch. Instead, the picture corresponding to Step 1 shows a set of blocks stacked in a way that does not appear particularly well-suited to the goal of building a tower of maximum height. Other participants expressed similar concerns. For example:

“In general, the pictures seem related to the text, but the design of the blocks can cause confusion, the goal seems to be to build a tower that’s as big as you can. The design part seems incongruent with the goal.”

“The pictures imply that there’s a specific type of tower to build. The shapes of the blocks don’t seem to match in the different pictures. It’s unclear what the numbers and bigger or smaller refers to.”

The pictures describing the steps [show] the numbers to count to. I don’t think my daughter can count to 25. Lower numbers might make it easier, such as a range in the 10 – 12. Maybe they could also picture fewer blocks. The picture seems complex.”

“If I don’t look at the steps, the pictures confuse me a bit, just because when I look at the first one, you think it’s probably about the type of tower what you’re going to build. For the second one I have no idea. The third one, it’s probably about how high it can get, but number four is unclear. What do the numbers mean, like 20, 25 blocks? Should we use bigger or smaller ones? Pictures are not the clearest but give me an idea of how to use materials. If I would just look at the pictures, I’d like to know the objective. Is it asking for a specific type of tower and what blocks to use?”

“I like the first one, the penguin thinking blurb where it kind of shows a picture of like, kind of what’s expected to build something. Um, number two, I like it. I definitely think they’re trying to say like, here you’re building and the question marks are like guessing. I don’t know that that one’s like totally necessary. Number three I feel like is also maybe a little repetitive of number one. For number four ... I don’t think all the words and numbers and question marks are necessary. Number four just seems unnecessary.”

“It feels like there could be a better way to illustrate number 4. I think it’s because of the words used, because in the other pictures there are no words. Like they should just illustrate bigger and smaller blocks.”

Theme 5. Several participants expressed concern that the activities may be too difficult for younger children or expressed interest in clearer scaffolding for how to approach the activities with children of different ages.

All interviewees had at least one child between the ages of 2 and 5. Although all participants indicated that their children were likely to be interested in the “Towers” activity, several interviewees noted that the activities and questions might be too challenging for this age group and many indicated an interest in additional scaffolding for how to adapt or modify these and other activities for children of different ages. For example:

“I would love to see the age range, maybe at the top.”

“With my kid, we do play with blocks, but we’ve never really counted the blocks that we used. Being able to estimate how many blocks, I feel like she’s already at a disadvantage because we’ve

never done that before. Not that we couldn't, but I just, I think it would almost be easier or better to build a tower this tall, now let's count how many blocks and do that a few times. And then estimate just because we couldn't, she would have no idea. We're also not great counters yet so anything above 15 gets a little wishy-washy."

"It feels like too many things are happening. Are we building tall [towers] or [looking at] designs and shapes? Splitting up the tips into different goals might help Having these questions per age range focused on scaffolding would be helpful. Tip 1 and 4 seem to be more open and provide opportunities for children to draw their own conclusions and seem to be appropriate for older children."

"Not for my child, but it could be hard. The biggest challenge would be to make them build something specific when they just want to build something imaginary."

"I could see them not play the way the instructions are. Like I don't wanna build this anymore. I wanna do this instead. Or just kind of having to change in the middle of it. Or their attention span not lasting long enough to answer some of the questions."

"I think my three-year-old putting the shapes, you know, finding the correct shape to match on the picture cards would be challenging. But, mostly doable, especially with a little bit of guidance. And, then, maybe my five year old, it says that step number three is choose one of the challenge cards and recreate the picture using all the tangram pieces with no gaps or overlaps. So, the kind of the really specific fine motor part of that would be challenging, but also really good for him in his writing."

Conclusions

To date, the UEPC has conducted “cognitive interviews” with five parents who shared their impressions of *Play to Learn* kit materials, including the “Towers” activity as they examined the materials in real time. Impressions of the materials were positive, with all five participants indicating that they would be interested in using the materials with their children. At the same time, participants offered valuable insights for how the materials might be improved. Based on the interviews and the UEPC’s own review of the materials, the UEPC recommends the following:

- Increase alignment between *Play to Learn* activity goals and the Utah Core Standard(s) provided on activity cards. Alignment could be improved in a number of different ways including: a) selecting standards that are more closely connected to the core activity and ensuring that the core activity aligns with the standard, b) focusing the core activity or “family tips” on a smaller number of goals or standards, or c) highlighting the point that each activity covers multiple standards by designating primary versus secondary standards addressed.
- Create clear alignment between the visual and textual representations of the instructions. Modifications to the pictures, to the steps, or to both will increase the ease of understanding the instructions and make them easier to follow.
- Participants indicated that caregivers might benefit from additional information on the age groups to which particular activities are targeted. Additionally, participants indicated that they would welcome clearer guidelines on how to scaffold, modify, or adapt activities – especially activities included in “Family Tips” – for children of different ages, skill sets, or interests.

Importantly, all participants expressed interest in incorporating more math activities with their children into their daily lives. To meet this need, the STEM Action Center can utilize existing resources such as updating the MILO website and *Play to Learn* kit materials with recommendations for additional math games, connections to daily math encounters, and suggestions for other resources. To expand equitable access, recommendations might include resources that are available in multiple languages, resources that are free or that can be rented or borrowed, and resources that are tailored to different audiences (e.g., parents/guardians, teachers, or librarians). One participant noted that the language used in kit materials (e.g., “child” vs. “student”) should be aligned with the audience (i.e., “child” rather than “student” for materials that are intended for parents or other caregivers).

6 | Recommendations and Next Steps for 2023-2024 Evaluation

The UEPC offers the following recommendations and next steps for evaluation for sustaining and strengthening STEM Action Center's efforts to support early numeracy among children in Utah via the MILO and Friends Program. Recommendations and next steps are based on artifact and literature reviews, survey responses, observations, and interviews from the 2022-2023 evaluation period.

1

Prioritize structured family engagement events that allow STEM Action Center personnel or trained designees to have dedicated time to communicate with families about the importance of building early math skills and about the resources available through the MILO and Friends Program.

Although tabling events have provided STEM Action Center personnel valuable opportunities to distribute board games, to interact informally with families, and to make connections with individuals and entities who provide programming for children and families, MILO and Friends project leaders have noted that tabling events present a host of programming challenges. These challenges include:

- difficulties in engaging families in conversation when there are multiple vendors or other presenters all vying for the attention of caregivers,
- difficulties in engaging with caregivers who are attending to young children, and
- difficulties in balancing the multiple demands on presenters' time (e.g., communicating with families, securing contact information from families, and distributing games).

Tabling events also present evaluation challenges including low response rates on surveys sent to families via text or email following the events.

In response to these challenges, program personnel have begun to phase out tabling events in favor of seminar-style events and have begun to test a scalable "train-the-trainer" model in which STEM Action Center personnel train educators to engage families in a presentation highlighting the importance of building early math skills and introducing resources available through the MILO and Friends Program.

During the 2023-2024 evaluation period, the UEPC plans to use **participation metrics** and data from **pre/post surveys and interviews** to answer questions about some of the factors that influence the impact of seminar-style events. Key evaluation questions will include:

- Are seminar-style events led by trained designees more, less, or equally as effective as seminar-style events led by STEM Action Center personnel?
- Are seminar-style events more likely to lead to gains in confidence in helping young learners build early math skills among caregivers with lower or high levels of education?

The answers to these questions can be used by STEM Action Center personnel to modify presentation protocols for seminar-style events and to improve train-the-trainer sessions to maximize trainees' ability to effectively communicate important information about early numeracy and the MILO and Friends program.

2

Prioritize efforts to understand “when” and “why” MILO and Friends resources and events have their greatest impact.

Data from surveys administered following tabling events, at seminar-style events, and following the distribution of *Play to Learn* kits (in 2021-2022) all suggest that MILO and Friends resources are well-received by caregivers and have the potential to have significant impact on how families think about and engage in everyday math activities. As a group, caregivers who played board games with their children during tabling or seminar-series events or who utilized *Play to Learn* kits indicated that the materials were accessible, the events were well-orchestrated, and that having an opportunity to learn more about the importance of early numeracy and the opportunity to play math-related games with their children increased both their interest and confidence in looking for additional opportunities to work with their children to build early math skills.

Despite these early successes, much remains to be learned about the conditions under which MILO and Friends resources, events, and messaging will have their greatest impact. More work in this area is needed given evidence that the effectiveness of mathematical interventions varies widely based on myriad factors including the background characteristics of children (e.g., their prior experience with board games or math-related talk) and the ways in which math problems are presented (McNeil et al., 2010).

During the 2023-2024 evaluation period, the UEPC plans to conduct **observations** of and administer **surveys** to families and children as they work with MILO and Friends-designed or -provided materials to gain insights into which types of caregiver-child interactions are most likely to yield positive attitudinal changes in caregivers and both positive attitudinal and knowledge changes in children. Key research and evaluation questions will include:

- How willing are caregivers to let preschool-age children struggle productively with math problems?
- How often and in what ways do parents address mathematical misperceptions when working with preschool-age children?
- How frequently do parents express negative attitudes about math when working with their preschool-age children on early math skills?
- Which types of caregiver-child interactions leave parents feeling most (and least) excited about finding new ways to incorporate math-related talk into their everyday interactions with their preschool-age children?

The answers to these questions can be used by STEM Action Center personnel to develop new or improve existing support materials for families. These supports might include FAQs included with board games, tips included with *Play to Learn* kits, or videos developed or curated for the MILO and Friends website about best practices (or pitfalls) in engaging in math-related talk with preschool-age children.

3

Prioritize efforts that seek to ensure that MILO and Friends materials are meeting the needs of caregivers and other stakeholders (e.g., preschool teachers or librarians).

Results from an initial round of “cognitive interviews” for *Play to Learn* kits indicate that caregivers have positive perceptions of these materials, describing them as “fun,” “engaging,” and “high-quality.” Caregivers also noted that engagement with these materials provided a useful reminder about the importance of early numeracy and the relative ease which math-related talk can be incorporated into their daily interactions with their preschool-age children.

At the same time, caregivers offered myriad suggestions for how the kits might be improved by, for example:

- ensuring stronger alignment between text-based and picture-based instructions,
- making sure that the activities are age-appropriate, and
- providing additional scaffolding for how to adapt or modify the kits for children of different ages, ability levels, or prior experiences.

Much remains to be learned. The initial set of interviews focused on a single activity card (i.e., for the “Towers” activity). Moreover, the sample for the initial set of interviews was disproportionately female, White, and highly-educated. In future work, it will be important to evaluate additional materials and to secure a sample of interviewees that more clearly reflects the population of parents and other caregivers in Utah. Seminar-style events are a new – and potentially valuable – recruitment resource.

During the 2023-2024 evaluation period, the UEPC plans to conduct additional **cognitive interviews** with caregivers as they share their impressions of *Play to Learn* kits that are being developed in collaboration with a new manufacturing and distribution partner, Lakeshore Learning. Key research and evaluation questions will include:

- What are caregivers’ overall impressions of *Play to Learn* materials?
- Are there ways to improve the clarity of instructions?
- Do activities feel age-appropriate?
- What kinds of challenges do caregivers envision in using *Play to Learn* kits to support their children in building early numeracy skills?

The answers to these questions can be used by STEM Action Center personnel to revise activity cards for *Play to Learn* kits, re-envision manipulatives included in *Play to Learn* kits, or develop additional support materials to accompany these kits.

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