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Utah STEM Action Center's *To-Learn* Math Program: 2021-2022 Report

June 2022

UTAH EDUCATION POLICY CENTER
THE UNIVERSITY OF UTAH

Prepared by the Utah Education Policy Center
on behalf of the STEM Action Center

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THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

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Andrea K. Rorrer, Ph.D., Director
Phone: 801-581-4207
andrea.rorrer@utah.edu

Cori Groth, Ph.D., Associate Director
Phone: 801-581-4207
cori.groth@utah.edu

Ellen Altermatt, Ph.D., Assistant Director for Research and Evaluation
ellen.altermatt@utah.edu

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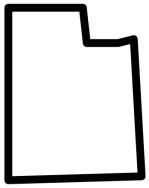
Overview

The *To-Learn* math program was initiated by Utah's STEM Action Center to support the development of early math skills in young children (ages 2 – 4 and 5 – 8) by developing and distributing resources to families that are designed to "encourage students to see math as part of everyday life." The *To Learn* kits were developed through partnerships with Project Child Success[1] and Clever Octopus[2] 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." The *To-Learn* program currently includes five kits: *Paint to Learn*, *Move to Learn*, *Build to Learn*, *Explore to Learn*, and *Play to Learn*. A sample activity card from the Build to Learn kit is included in Appendix A.

Following a Summer 2020 pilot program which involved distributing approximately100 kits to families through the Tooele City Public Library, the STEM Action Center received additional funding and support to expand the program to reach more children in Utah. Beginning in January 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.

~ 4,200 *To Learn* Kits

> 20 Sites



multiple counties

Caregivers who received a 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.

Report Organization

The report is divided into three sections. In the first section, we offer background for the current report by providing a brief review of the research literature on early numeracy and an overview of demographic, economic well-being, and education data that speak to the need to support early numeracy for children in the state of Utah. In the second section, we summarize key findings from caregivers who received *To Learn* kits and completed a survey assessing their perceptions of the kits. In the final section, we offer recommendations for implementing and expanding the program in years to come to achieve proposed outcomes. Recommendations are based on interviews with STEM Action Center staff, survey responses, a review of the extant literature on supporting early numeracy, and a review of demographic, economic well-being, and education data from KIDS COUNT and publicly-available data on kindergarten readiness from the Utah State Board of Education (USBE).

[1] https://projectchildsuccess.org/
[2] https://www.cleveroctopus.org/
[3] https://stem.utah.gov/stem-action-center-expanding-to-learn-program/

1 | Background

Early Numeracy

Definition of Early Numeracy and Associations with Academic Performance

Early numeracy is a collection of mathematical skills that begin to develop in the pre-kindergarten years. These skills include

- recognizing number symbols (e.g., 5),
- knowing the numerical meaning of number words (e.g., "three"),
- understanding ordinality or the count sequence (e.g., 1, 2, 3, 4, 5 …. 10),
- recognizing quantities,
- recognizing number patterns,
- comparing numerical magnitudes, and
- manipulating quantities (e.g., by adding or subtracting objects from a set).

Although early numeracy has received less research attention than early literacy (Raghubar & Barnes, 2017), findings from analyses of multiple large longitudinal datasets[4] by several research teams indicate that math skills at school entry – including knowledge of numbers and ordinality – are a stronger predictor of later academic achievement than both reading skills at school entry and attention skills at school entry. Importantly, early math skills predict both later math achievement and later reading achievement (Duncan et al., 2007; Foster, 2010; Pagani, Fitzpatrick, Archambault, & Janosz, 2010; Romano, Babchisin, Pagani, & Kohen, 2010).

Math skills at school entry are a stronger predictor of later academic achievement than both reading skills at school entry and attention skills at school entry.

Acquisition and Assessment of Early Numeracy Skills

The home numeracy environment is not the same for all children. Children from low socioeconomic backgrounds have fewer experiences with everyday math activities.

Early numeracy skills are typically acquired prior to or outside of the school setting through activities in the home. These activities may include "direct numeracy activities" including using number words, counting objects, or reading number-related picture books as well as "indirect numeracy activities" including playing card games or board games and engaging in housework or pretend play (e.g., cooking or playing store) (LeFevre, Skwarchuk, Smith-Chant, Fast, Kamawar, & Bisanz, 2009). However, the home numeracy environment is not the same for all children. In particular, children from low socioeconomic backgrounds have fewer experiences with everyday math activities (Blevins-Knabe & Musin-Miller, 1996; Jordan, Huttenlocher, & Levine, 1992).

There are numerous tools available to assess early numeracy, and more schools across the nation are beginning to implement these assessments. Consistent with this trend, the Utah State Board of

[4] Datasets included the Early Childhood Longitudinal Study, the National Longitudinal Survey of Youth, the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, the Infant Health and Development Program, the Montreal Longitudinal-Experimental Preschool Study, and the British Birth Cohort Study.

Education has, since 2017, required that all LEAs in Utah administer the Kindergarten Entry and Exit Profile (KEEP) to all incoming and exiting kindergarten students. Among the key goals of collecting and using KEEP assessment data is to identify students in need of early intervention and to promote differentiated instruction for all students.[5]

The Promise of Early Numeracy Interventions

Supporting the wide-spread use of early numeracy assessments is growing evidence that early numeracy is amenable to intervention. Although the number of rigorous intervention studies is still small, two recent meta-analyses indicate that a variety of interventions – including explicit instruction, corrective feedback, the use of concrete manipulatives and visual representations, and the use of one-on-one tutoring – can be moderately effective in improving the numeracy skills of preschool and early school-age children (Charitaki, Tzivinikou, Stefanou, & Soulis, 2021; Nelson & McMaster, 2019). Although, as a group, interventions appear less effective for children from low socioeconomic backgrounds (Nelson & McMaster, 2019), some interventions appear equally effective for families with low- and middle-incomes (Starkey, Klein, & Wakeley, 2004). Importantly, most existing interventions are implemented in school settings by experienced teachers or trained researchers, and some include explicit and systematic instruction (e.g., scripted lesson plans; see Nelson & McMaster, 2019).

It remains unclear whether interventions designed to change the ways in which caregivers interact with children in everyday settings (e.g., in the home) can be effective in improving early numeracy skills or whether these types of interventions might be effective for children from low socioeconomic backgrounds. However, several recent studies show promising results for home-based numeracy inventions (e.g., 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.

The potential effectiveness of home-based interventions is consistent with correlational research indicating that caregivers play an important role in both 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. Furthermore, the need for such interventions is supported by evidence that many parents of young children do not engage in numeracy activities for a variety of reasons (Smith-Chant, 2000; Sonnenschein et al., 2021) including *misperceptions* that

The potential effectiveness of home-based interventions is consistent with evidence that stronger home numeracy environments predict stronger academic performance.

- early numeracy is less important than early literacy,
- mathematics skill is an innate skill, not something that can be taught,

[5] https://www.schools.utah.gov/file/5d7c6cdb-cf74-44b2-83b4-5641bfdc9ddf

- preschool-age children are too young to learn math, and
- parents lack the skills necessary to teach mathematics.

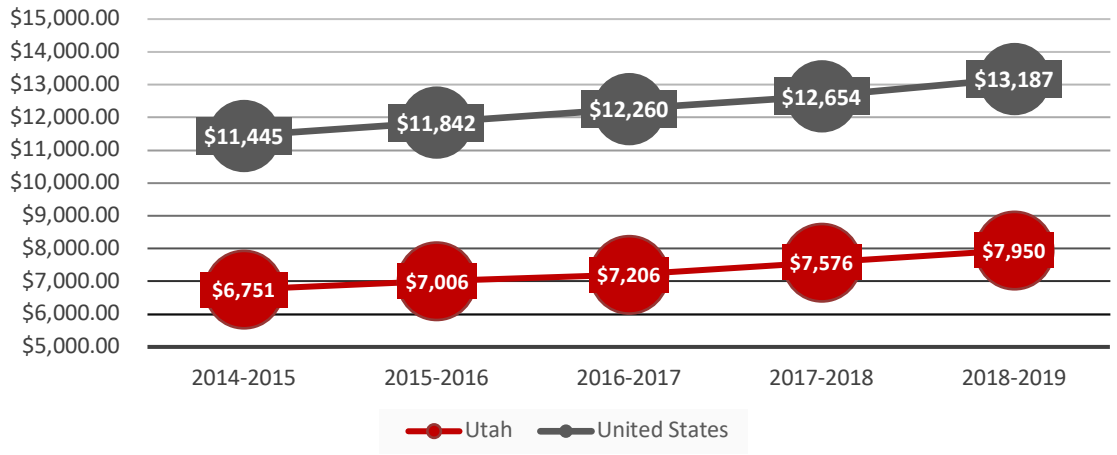
Blevins-Knabe (2008) argues that mathematics suffers from "bad public relations" and that more work is needed to communicate to parents that the development of basic mathematics skills is critical for later academic success, that parents can play an important role in the development of these skills by embedding mathematics in everyday activities, and that the mathematics concepts children need to learn in the early years (e.g., counting, recognizing number patterns) are typically well-comprehended by parents.

Demographic Data and Indicators of Educational Well-Being in Utah

The need to bolster efforts to help young children in Utah develop early numeracy skills is supported by demographic and educational data. State-wide demographic, economic well-being, and education data from the 2021 KIDS COUNT data book are presented in Appendix B. Similar KIDS COUNT data for the three counties – Davis, Salt Lake, and Weber – that were the initial focus of distribution efforts for the *To Learn* kits are presented in Appendix C.

One key finding from these data is that, in 2019, 29.8% of the state's population was below the age of 18 (see Appendix B, Table 1), making Utah the youngest state in the nation (KIDS COUNT Utah, 2022). However, the state ranks 50th out of 51 in funding per student (KIDS COUNT Utah, 2022) which, as shown in Figure 1, is well below the national average.

Figure 1. Per student expenditures in the United States and Utah



Note. This figure represents expenditures per student in fall enrollment in public elementary and secondary schools. Expenditures are in current dollars and have not been adjusted to compensate for inflation.

Data Source. U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics. Data provided by datacenter.kidscount.org.

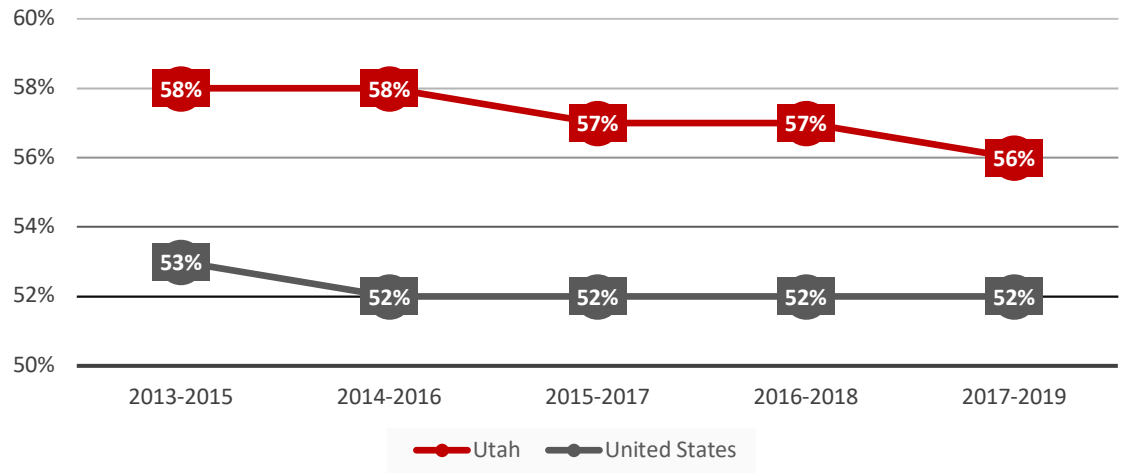
Although the relationship between per student funding and student achievement is a matter of some debate (see Riddle & White, 2019) and appears to vary across contexts (see Jacobson et al., 2021), it is clear that there is considerable room for improvement in student achievement outcomes in the state of Utah. In 2020-2021, only 39.0% of students in the state were proficient in math. Among students who are economically-marginalized the percentage was 23.2% (see Appendix B, Table 3).

In 2020-2021, 25% of incoming kindergarteners in Utah did not have the prerequisite knowledge in numeracy to succeed in kindergarten without some or significant intervention.

These disparities begin early. In 2020-2021, 25% of the incoming kindergarten population in Utah received scores on the Kindergarten Entry and Exit Profile (KEEP) assessment that indicated that they did not have the prerequisite knowledge in numeracy to succeed in kindergarten without some or significant intervention. By the end of kindergarten, this percentage decreased to 21%, but was still at 32% among students who are economically-marginalized, 35% among students who are racial minorities, and 45% among the students who are English learners (Utah's 2020-2021 KEEP Report).

There is ample evidence that high-quality pre-kindergarten programs can improve school readiness, especially for children identified as high-risk (Kids Count Data Book, 2021). However, as shown in Figure 2, the percent of young children not in school in Utah – where the compulsory age for school enrollment is six – is above the national average.

Figure 2. Percent of 3- to 4-year-old children not in school in Utah and the United States

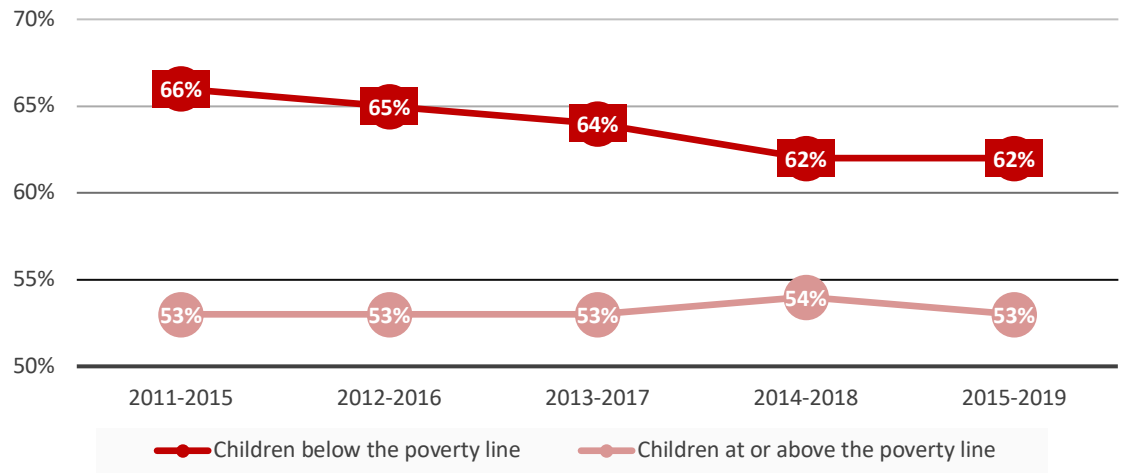


Note. This figure represents the percent of children ages 3 to 4 not enrolled in school, including nursery school, preschool school or kindergarten, during the previous three months. These data are based on a pooled three-year average of 1-year American Community Survey responses to increase the accuracy of the estimates.

Data Source. Population Reference Bureau, analysis of data from the U.S. Census Bureau, pooled 2007-09 to 2017-19 one-year American Community Survey. Data provided by datacenter.kidscount.org.

As shown in Figure 3, there are also disparities in school participation, with more children in Utah who are living below the poverty line not in school than children who are living at or above poverty line.

Figure 3. Percent of 3- to 4-year old children not in school in Utah by poverty status



Note. This figure represents the percent of children ages 3 to 4 not enrolled in school, including nursery school, preschool, or kindergarten, during the previous three months by poverty status. The federal poverty definition consists of a series of thresholds based on family size and composition. In 2019, a 200% poverty threshold for a family of two adults and two children was $51,853. Poverty status is not determined for people in military barracks, institutional quarters, or for unrelated individuals under age 15 (such as foster children).

Data Source: Population Reference Bureau, analysis of data from the U.S. Census Bureau, 2005-09, 2010-14, 2011-15, 2012-16, 2013-2017, 2014-2018, and 2015-2019 five-year American Community Survey. Data provided by datacenter.kidscount.org.

2 | Evaluation Findings

Overview

To inform its evaluation of the *To-Learn* program, UEPC staff reviewed program artifacts (e.g., activity cards), conducted interviews with three STEM Action Center staff members, administered surveys to caregivers who completed a data collection form upon receipt of a *To Learn* kit, reviewed key findings from the extant literature on early numeracy, and reviewed demographic, economic well-being, and education data from KIDS COUNT and the USBE. The recommendations outlined in Section 3 of this report draw on all of these data sources. This section focuses on a summary of findings from the survey administered to caregivers.

Survey Sample

Twenty-one caregivers completed the survey by May 15, 2022. This represents a response rate of 23% of the 92 individuals who completed the data collection form by April 25, 2022. It is unclear whether the sample of individuals who completed the data collection form is representative of the population of caregivers who received kits. Likewise, it is unclear if the sample of survey respondents is representative of the population of individuals who completed the data collection form. As a result, findings should not be generalized and should be interpreted with caution.

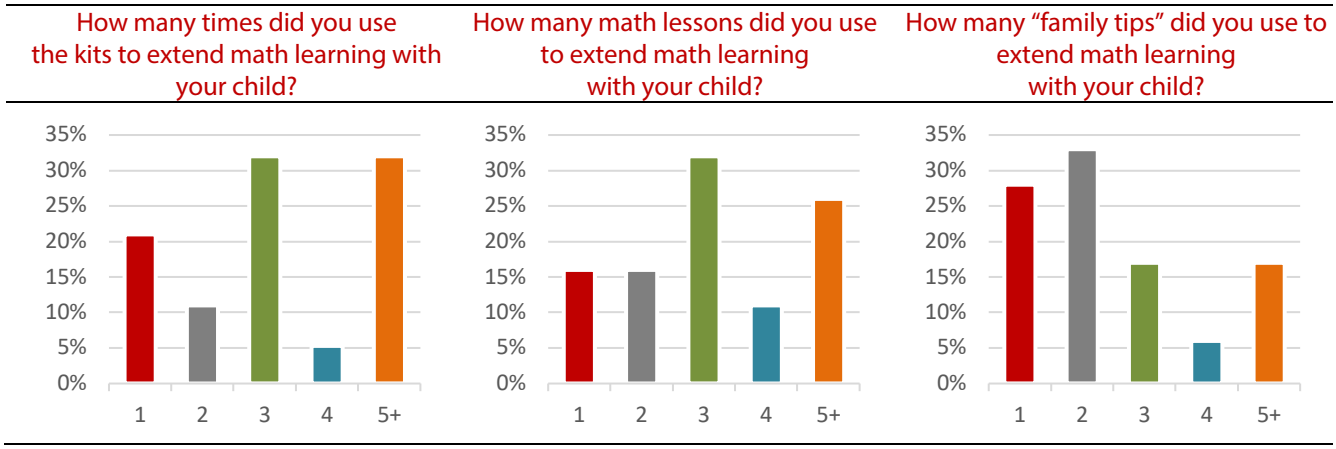
Table 1. Characteristics of survey respondents

Item (number of respondents)	Count (Percent)
How many children do you have at home under the age of 18? (*n* = 20)	
1 child	5 (23.8%)
2 children	8 (38.1%)
3 children	6 (28.6%)
4 or more children	1 (4.8%)
Do preschool age children in your home attend preschool? (*n* = 11)	
Yes	11 (100%)
No	0 (0%)
What type of preschool do they attend? (*n* = 11)	
Head Start	9 (82%)
Title 1 Preschool	2 (18%)
What was the role of the person who used the *To Learn* kit with your child/children? (*n* = 21)	
Parent/Guardian	16 (76.2%)
Grandparent	1 (4.8%)
Sibling	2 (9.5%)
Other (teacher, therapist)	2 (9.5%)
What is the zip code you currently live in? (*n* = 21)	
Davis	1 (4.7%)
Salt Lake	15 (71.4%)
Weber	3 (14.3%)
Tooele	2 (9.5%)

Survey Findings

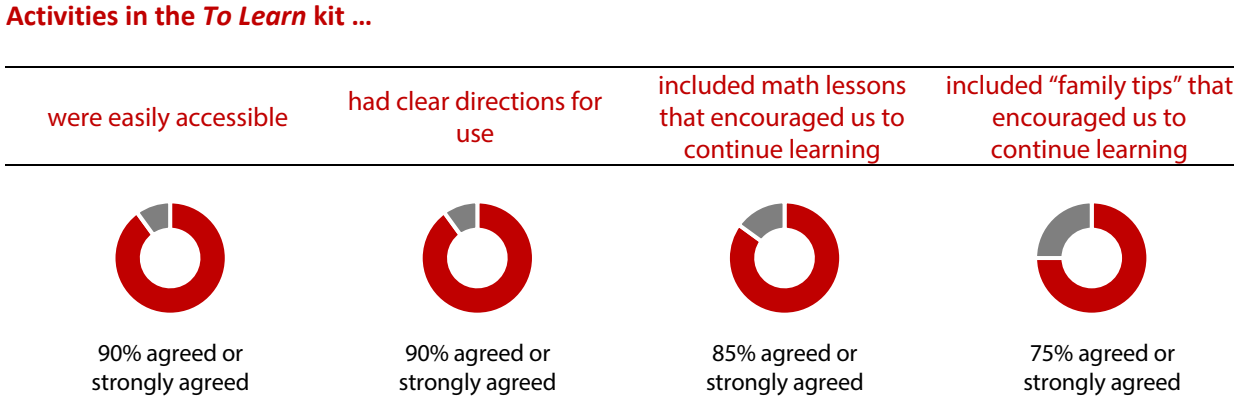
The frequency with which caregivers used *To Learn* kits was assessed with a series of items. As shown in Figure 4, most respondents indicated that they used the kits multiple times and that they completed both multiple lessons and multiple "family tips" with their child. When asked which type of activity was most useful in extending math learning with their child, 88% indicated that the math lessons were most useful while 12% indicated that the "family tips" were most useful.

Figure 4. Caregivers' self-reported use of *To Learn* kits



To tap their general impressions of the kits, caregivers were asked to indicate their level of agreement with a series of items designed to assess accessibility and ease of use. As shown in Figure 5, 75% or more of respondents indicated that the kits were easily accessible, had clear directions for use, and included math lessons and "family tips" that encouraged learning.

Figure 5. Caregivers' general perceptions of *To Learn* kits

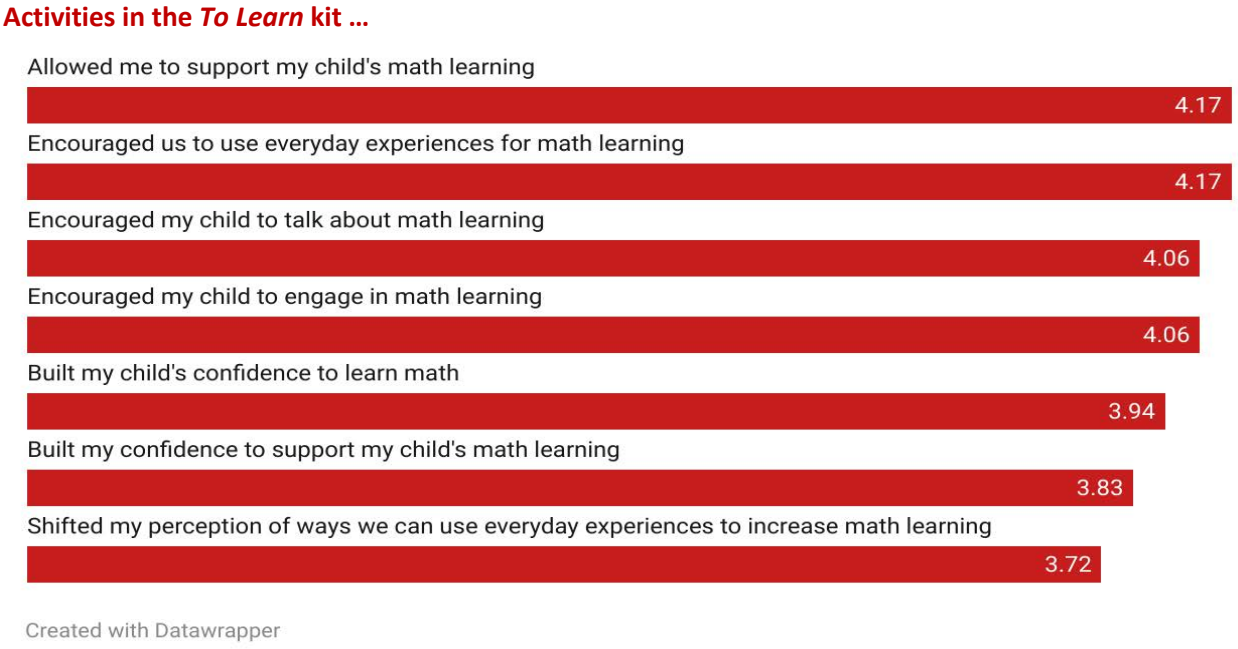


When asked to indicate what strategy would be most effective in increasing the accessibility of kits, 15% of respondents indicated that it would be helpful if "family tips" were shared via email or text, 60% indicated that it would be helpful if kits were available to be picked up at school, and 25% indicated that it would be helpful if kits could be picked up at another location. When asked what other resources they use to create math learning opportunities for their child, 53% indicated that they

used school resources, 24% indicated that they used community resources, and 24% indicated that that used other resources including books that they have at home and books that they buy.

To assess caregivers' perceptions of the effectiveness of the kits in supporting their own and their children's engagement and confidence in math learning, survey respondents were asked to indicate the degree to which they agreed with seven statements on scales ranging from 1 (strongly disagree) to 5 (strongly agree). As shown in Figure 6, means (n = 18) for all seven items were well above the midpoint of the scale (i.e., neither agree nor disagree) with the highest average rating emerging for items tapping the effectiveness of the kit in allowing caregivers to support children's math learning and to use everyday experiences for math learning. More than 94% of respondents "agreed" or "strongly agreed" with both items. Open-ended surveys or interviews with caregivers would be helpful in gaining insight into *how* or *in what* ways use of the kit shifted caregivers' perceptions of the way everyday experiences could be used to increase math learning. With larger n sizes, correlational analyses could be conducted to examine associations among items (e.g., to determine if levels of use impact perceptions of effectiveness).

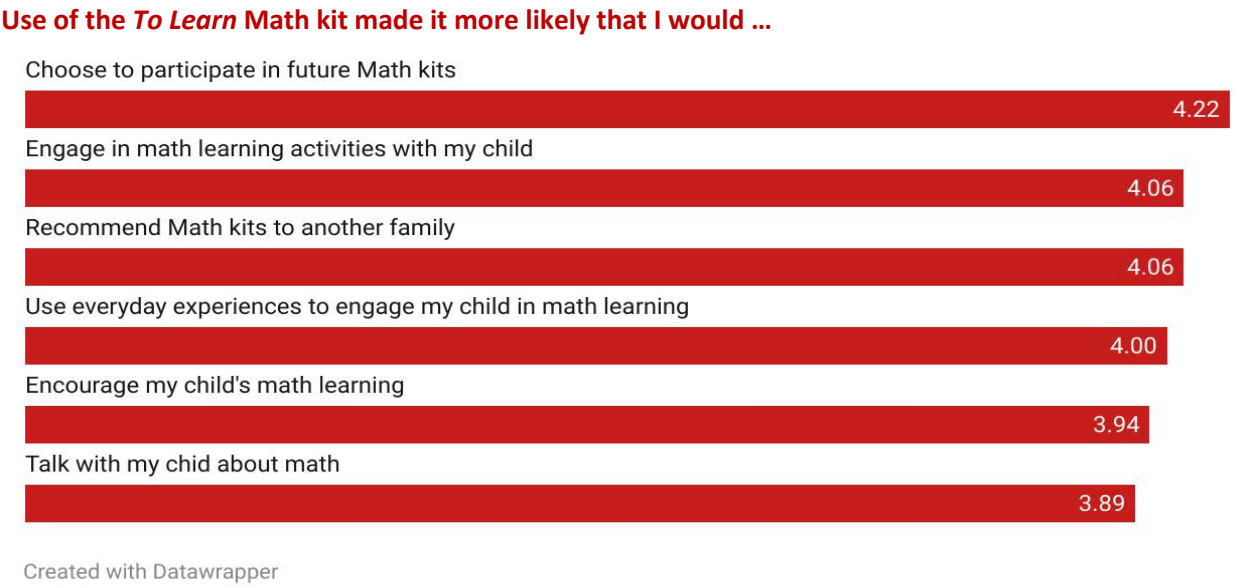
Figure 6. Caregivers' perceptions of the effectiveness of *To Learn* kits



Note. Response scale ranged from 1 (strongly disagree) to 5 (strongly agree).

To assess caregivers' perceptions of the degree to which using the kits might change their future behavior, survey respondents were asked to indicate the degree to which they agreed with six statements on scales ranging from 1 (strongly disagree) to 5 (strongly agree). As shown in Figure 7, means (n = 18) for all six items were well above the midpoint of the scale (i.e., neither agree nor disagree) with the highest average rating emerging for the item tapping the degree to which use of the kits made it more likely that caregivers would choose to participate in future math-focused kits. More than 94% of survey respondents "agreed" or "strongly agreed" with this item.

Figure 7. Caregivers' ratings of the impact of *To Learn* kit use on future behavior



Note. Response scale ranged from 1 (strongly disagree) to 5 (strongly agree).

Importantly, 83% of survey respondents indicated that the kits were "very valuable" or "extremely valuable" in supporting math learning and 67% of survey respondents indicated that would be "likely" or "very likely" to use additional information (e.g., instructions on how to make a Do-It-Yourself" kit) to further engage their child/children in math learning. Most caregivers (94%) indicated that they would prefer to use the *To Learn* kits at home rather than at a community local/event or in some other setting.

3 | Recommendations

The UEPC offers the following recommendations for sustaining and strengthening STEM Action Center's efforts to support early numeracy among children in Utah. These recommendations are based on interview responses, survey responses, a review of the extant literature on supporting early numeracy, and a review of demographic, economic well-being, and educational data from KIDS COUNT and the USBE.

1. *As the To-Learn program expands and evolves, efforts should be made to explicitly address questions and concerns families may have about supporting early numeracy.* Interviews with STEM Action Center staff indicate enthusiasm for continuing to reimagine and expand the *To-Learn* program to "get parents the tools" they need to "shift how they talk about and think about math." Efforts to date have focused on developing and distributing *To Learn* kits to families, including the many families in Utah who are economically-marginalized or whose children are at risk for poor educational outcomes. Interviewees noted that new initiatives for 2022-2023 (and beyond) include revising and improving kit materials, creating new resources for even younger children (i.e., less than two years of age), shifting assembly and distribution efforts to a third party to better meet demand (especially for kits for 2- to 4-year-olds) and to allow program staff to focus on resource development and support activities, launching a public awareness campaign, and hosting school- or community-based events (e.g., Family Nights). These approaches are well-aligned with previous, successful approaches to family literacy programs (see van Steensel, McElvany, Kurvers, & Herppich, 2011) and with recommendations offered by the National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM) on providing high-quality mathematics education and family support for three- to six-year-old children (2002).

   An important component in revising current resources and implementing new initiatives will be to understand that families often have questions about *why* to support early mathematics learning and concerns about their *capacity* to do so effectively. Whenever possible, efforts should be made to explicitly address these questions and concerns. Question and concerns might be addressed through direct conversations with families, through written materials included in kits or online, through online videos, or through training provided directly to families or to educators working with families. In one recent study, even highly-educated parents report that they lack confidence in their ability to support their children's early math learning and would welcome input about their children's progress and about helpful resources and activities (Sonnenschein, Stites, & Dowling, 2021). The Development and Research in Early Mathematics Education (DREME) program at Stanford University offers helpful resources both for addressing caregiver questions and concerns and for enhancing the home numeracy environment.[6]

2. *Efforts should be made to understand ways in which* To Learn *kits, as currently designed, might be improved to better support families in growing children's early numeracy skills.* As a group, caregivers who completed the survey indicated enthusiasm for the *To Learn* kits, noting, for example, that the kits helped them to use everyday experiences to foster math learning and helped build their confidence in supporting their child's math learning. Importantly, caregivers reported that math lessons were more useful than "family tips." Likewise, caregivers reported using math lessons more than "family tips." One interpretation of these findings is that caregivers may need more guidance in how to think about, structure, or effectively implement "family tips." For example, in the tangrams activity included in

[6] https://familymath.stanford.edu/for-educators/answering-families-questions-about-early-math/

Appendix A, caregivers may need additional help in distinguishing a flat shape from a solid shape. Alternatively, this standards-based language may be unnecessary if the goal is to encourage caregivers to talk with their child about how the shape of a ball is similar to and different from the shape of a can.

Observations and cognitive interviews may help to clarify where families might need more support or where instructions included in the kit might need to be revised. Conducting observations and cognitive interviews will be the focus of UEPC's 2022-2023 evaluation efforts. In observations, the interactions of caregivers and children will be recorded as they work through activities together. In cognitive interviews, caregivers will be asked to "think aloud" as they review *To Learn* kit materials. A draft cognitive interview protocol is included in Appendix D and will be deployed in Summer 2022. As noted by STEM Action Center staff in interviews, future evaluation efforts should focus on student outcomes including determining whether children who use *To Learn* kits develop more positive attitudes toward math and exhibit better school performance (including kindergarten readiness) than children who do not use the kits. These analyses would require collecting student identifiers (e.g., names) from families.

3. *Efforts should be made to ensure that current and new initiatives to support early numeracy are developmentally-appropriate and culturally responsive.* Although research-based and practice-informed guidelines for supporting early numeracy are still under development, there is evidence that the effectiveness of common strategies for teaching early mathematics – including the use of manipulatives – varies by both content (e.g., teaching arithmetic vs. fractions) and age (see Laski, Jor'dan, Daoust, & Murray, 2015)[7]. Moreover, the National Association for the Education of Young Children and the National Council of Teachers of Mathematics (2010) jointly recognize that "young children have varying cultural, linguistic, home, and community experiences on which to build mathematics learning" and that "children's confidence, competence, and interest in mathematics flourish when new experiences are meaningful and connected with their prior knowledge and experience" (p. 4; see also Huntsinger, Jose, Liaw, & Ching, 1997).

   The STEM Action Center has positioned itself to address the diversity of family experiences by including staff members on the *To-Learn* program team with expertise in math education, Utah's Core Standards, and bilingualism and numerical cognition. The UEPC will contribute to these efforts in 2022-2023 and beyond by conducting observations, interviews, and surveys of families and educators to identify areas where there may be a disconnect between program materials/messaging and children's development and/or families' values, beliefs, and assumptions about early mathematics learning.

4. *Special efforts should be made to connect with families who do not attend preschool.* Distribution records provided by the STEM Action Center indicated that the majority of *To Learn* kits were distributed to preschools, including Head Start programs and preschools affiliated with school districts. Consistent with distribution records, all of the survey

[7] For a compelling summary, see https://www.aft.org/sites/default/files/periodicals/ae_fall2017_willingham.pdf Consistent with this summary, Laski et al. 2015) offer four general principles for using manipulatives: (a) use a manipulative consistently, over a long period of time; (b) begin with highly transparent concrete representations and move to more abstract representations over time; (c) avoid manipulatives that resemble everyday objects or have distracting irrelevant features; and (d) explicitly explain the relation between the manipulatives and the math concept (p. 2).

respondents indicated that their children attended preschool. In Utah, however, more than half of 3- to 4-year-old children are not enrolled in school and this percentage is even higher (i.e., 60% or more) among children living below the poverty line.

Given the important role than families can play in supporting the development of children's early math skills, it will be important to explore ways to connect with families whose children do not attend preschool, especially families who are economically-marginalized. As noted by one STEM Action Center staff member, this can be challenging as there is "no centralized contact information" which means that "students who don't have contact with regular community resources are getting left out." The planned public service campaign is designed to address this need by taking the program to "locations like parks and grocery stores." In addition, the STEM Action Center might seek out guidance from statewide policy advocacy organizations (e.g., Voices for Utah Children) and organizations facing similar challenges in promoting early childhood literacy. For example, the Utah Kids Ready to Read (utahkidsreadytoread.org) – an organization focused on providing information, training, technical assistance, and resources on emergent literacy for Utah librarians and their community partners" – may serve as a useful resource.

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Appendix A.

Sample *To-Learn* Program Materials

ACTIVITY 1:

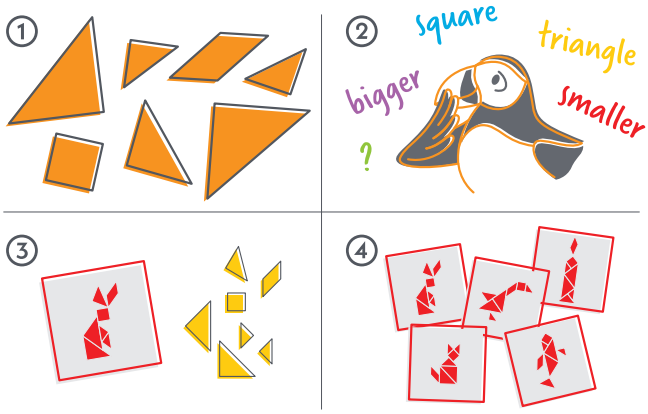
TANGRAMS

In this activity, children will look at examples of shapes being combined to make new shapes and images. Tangrams will be used to make pictures built of different shapes. A tangram is a puzzle made up of seven specific shapes that can be arranged to form many different designs.

MATERIALS:

- Tangrams
- Tangram challenge cards

INSTRUCTIONS



STEP 1:
Look at your set of tangrams. How many pieces do you have?

STEP 2:
What words describe the shapes of the tangram pieces? What do the pieces have in common? What is different about the pieces?

STEP 3:
Choose one of the challenge cards and recreate the picture using all of your tangram pieces with no gaps or overlaps.

STEP 4:
Use all of your tangram pieces to recreate the rest of the challenge cards with no gaps or overlaps.

BUILD TO LEARN

This activity meets many of Utah's Core Standards including:

Standard K.G.3 Identify shapes as two-dimensional ("flat") or three-dimensional ("solid").

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

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FAMILY TIPS:

- Make a more challenging 3D shape — maybe a home for a toy?
- Help children identify different flat and solid shapes, for example, a ball is a type of solid circle. A can is also a type of solid circle. Who are they the same and different?
- Connect different flat and solid shapes to make new flat and solid shapes.
- What is the smallest/tallest/longest/widest/strongest structure you can make with the straws and connectors?
- Make a 3D shape that is a specific distance long/tall, such as 12 inches long and 8 inches tall. Also describe if the solution needs to be flat or solid.

Appendix B.

Demographics Data, Economic Well-Being Data, and Education Data in Utah

Note. Data and graphics are from the Data Book on the Measures of Child Well-Being in Utah, 2021. These resources are publicly available at: https://www.utahchildren.org/images/pdfs-doc/2021/NEW_Kids_Count_data_book_2021.pdf

UTAH DEMOGRAPHICS DATA

POPULATION

American Community Survey 5-Year Estimates	2018 #	2018 %	2019 #	2019 %
Total Population	3,045,350	100.00%	3,096,848	100.00%
Under 5 Years	252,865	8.30%	250,885	8.10%
5-9 Years	261,429	8.50%	261,845	8.50%
10-14 Years	257,411	8.50%	260,447	8.40%
15-19 Years	237,276	7.80%	243,211	7.90%
Under 18 Years	919,049	30.20%	923,583	29.80%

HOUSEHOLD

Total Households	957,619	100.00%	977,313	100.00%
Family Households	716,884	74.90%	729,183	74.61%
Married Couple Family	587,505	61.30%	596,099	60.99%
Married Couple Family, with own children under 18	291,774	30.50%	293,896	30.07%
Male Households, no spouse present	40,763	4.30%	43,142	4.41%
Male Household, no spouse, with own children under 18	20,469	2.10%	21,532	2.20%
Female Households, no spouse present	88,616	9.30%	89,942	9.20%
Female Household, no spouse with own children under 18	49,279	5.20%	48,725	4.99%

RACE/ETHNICITY

Race

American Indian or Alaskan Native	32,657	1.10%	33,721	1.09%
Asian	69,810	2.30%	71,977	2.32%
Black or African American	35,862	1.20%	36,849	1.19%
Native Hawaiian & Other Pacific Islander	32,657	1.10%	27,557	0.89%
Some Other Race	157,990	5.20%	156,229	5.04%
Two or More Races	89,879	3.00%	94,036	3.04%
White	2,632,056	86.40%	2,676,482	86.43%

Ethnicity

Hispanic or Latino, can be any race	422,123	13.90%	438,832	14.17%

UTAH ECONOMIC WELL-BEING DATA

Living Below the Poverty Line	2019	2020
Family of Four	$26,172	$26,496

Total Population in Poverty (U.S. Census Small Area Income & Poverty Estimates (SAIPE))	2018		2019	
	#	%	#	%
All Persons	283,562	9.10%	279,435	8.80%
Under 18 Years of Age	89,015	9.70%	88,325	9.60%
5-17 Years of Age	59,921	9.00%	58,514	8.70%
Under 5 Years of Age	26,242	10.60%	25,728	10.60%

Medium Household Income	$71,381.00	$75,705.00

Intergenerational Poverty, (IGP)	DEC 2019	SEP 2020
Number of IGP – Adults	41,506	48,838
Number of IGP – Children	52,795	56,508

Participation in Work Support Programs	SEP 2020	SEP 2021
Households Receiving Food Stamps (SNAP)	73,337	73,189
Households Receiving TANF	2,871	2,312

	#	%	#	%
Unemployment Rates	69,160	4.20%	40,111	2.40%

Labor Force (The Annie E. Casey Foundation KIDS COUNT Data Center)	2018		2019	
	#	%	#	%
Children Under 6 w. No Parent in Labor Force	13,177	4.44%	12,500	4.24%
Children in Low-Income Working Families	211,000	23.00%	200,000	22.00%

UTAH EDUCATION DATA

Utah Public School Statistics, K-12
Source: Utah State Board of Education

	OCT 2020		OCT 2021	
	#	%	#	%
Fall Enrollment	666, 208		663,570	
Free ore Reduced Lunch Participants	227,019	33.20%	214,866	37.38%
Student-Teacher Ratio	21.40		21.07	
Student Chronically Absent		8.90%		19.80%

Children Age 3-4 Not Enrolled in Preschool

	2018 ACS 5-Year		2019 ACS 5-Year	
	#	%	#	%
	58,498	57.00%	57,625	56.46%

Student Proficiency Results for Utah

	2018-2019 School Year	2020-2021* School Year
Language Arts		
All Students	47.00%	43.00%
Economically Disadvantaged Students	29.50%	27.00%
Mathematics		
All Students	45.00%	39.00%
Economically Disadvantaged Students	29.20%	23.20%
Science		
All Students	46.60%	44.00%
Economically Disadvantaged Students	29.20%	28.20%

*2019-2020, March 19, 2020, Utah State Board of Education Suspend Assessments Amid COVID-19 Pandemic.
https://www.schools.utah.gov/file/40c9cf6a-90f7-42c3-a2e4-995674a3b922

Children under age six whose family member read to them less than four days per week in Utah
Source: AECF Kids Count Data Center

	2017-2018		2017-2018	
	#	%	#	%
	128,557	42.00%	120,658	42.00%

Appendix C.

Demographics Data and Education, Economics, and Health Data in Davis County, Salt Lake County, and Weber County in Utah

Note. Data and graphics are from the Data Book on the Measures of Child Well-Being in Utah, 2021. These resources are publicly available at: https://www.utahchildren.org/images/pdfs-doc/2021/NEW_Kids_Count_data_book_2021.pdf

DAVIS COUNTY

2021 Utah Kids Count Data Card

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THE ANNIE E. CASEY FOUNDATION

VOICES FOR UTAH Children

DEMOGRAPHICS

American Community Survey (ACS) 5-Year, 2019

32.50% *of the population are children under age 18*

90.19% *of the total population is White* **9.81%** *all other racial groups*

56.20% *Child Dependency Ratio*

Population	#	%
Total	345,767	100%
Under 5-Years	29,789	8.60%
Under 18-Years	112,266	32.50%

Race*	#	%
American Indian or Alaskan Native	1,583	0.46%
Asian	6,143	1.78%
Black or African American	4,603	1.33%
Native Hawaiian & Other Pacific Islander	2,392	0.69%
Some Other Race	7,618	2.20%
Two or More Races	11,573	3.35%
White	311,855	90.19%

Ethnicity*	#	%
Hispanic or Latino, can be any race	33,434	9.67%

*Race & ethnicity data reflects both adult & child populations combined

Household	#	%
Total Households	104,551	
Family Households	84,662	81.00%
Married Couple Family	71,215	68.12%
Male Household, no spouse present with own children under 18	2,143	2.05%
Female Household, no spouse present with own children under 18	5,137	4.91%

EDUCATION

19.10% *Participate in Free/Reduced Lunch*

Utah Public School Statistics K-12	Fall 2021
Fall Enrollment	80,507
Student/Teacher Ratio	26.7
Number of Free/Reduced Lunch Participants	15,785
Percent Free/Reduced Lunch Participants	19.10%
Percent Students Chronically Absent	13.00%

	#	%
3-4 Year Olds Children Not Enrolled in School, 2019 ACS 5-Year	7,018	58.46%

ECONOMICS

$87,610 *Median Household Income*

Living Below the Poverty Line-2019 Small Area Income and Poverty Estimates (SAIPE), U.S. Census

Total Population in Poverty	#	Poverty %
All Persons	19,344	5.50%
Under 18-Years	6,868	6.10%

Participation in Work Support Programs

September	2020	2021
Households Receiving Food Stamps (SNAP)	5,691	5,504
Households Receiving TANF	223	200
Unemployment Rate #	6,825	3,458
Unemployment Rate %	3.90%	1.90%

HEALTH

4.50% *Uninsured Children under 19*
2019: American Community Survey (ACS) 5-Year

Utah Department of Health, Public Health Indicator-Based Information System (IBIS)

	#	%
Receiving Prenatal Care, 2020	3,913	81.18%
Low Birth Weight Babies (Less than 2,500 grams), 2016-2020	1,861	7.06%
Infant Mortality (Per 1,000 live births), 2016-2020	Rate 5.23	# 138
Teen Birth Rate (Per 1,000 females age 15-17), 2016-2020	2.6	116
Percent 2-Years Old Immunized, 2019		75.10%

SALT LAKE COUNTY

2021 Utah Kids Count Data Card

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THE ANNIE E. CASEY FOUNDATION

VOICES FOR UTAH Children

DEMOGRAPHICS

American Community Survey (ACS) 5-Year, 2019

27.50% *of the population are children under age 18*

79.08% *of the total population is White* **20.92%** *all other racial groups*

43.30% *Child Dependency Ratio*

Population	#	%
Total	1,133,646	100%
Under 5-Years	86,358	7.60%
Under 18-Years	311,413	27.50%

Race*	#	%
American Indian or Alaskan Native	9,127	0.80%
Asian	46,123	4.07%
Black or African American	21,602	1.90%
Native Hawaiian & Other Pacific Islander	16,294	1.44%
Some Other Race	105,495	9.31%
Two or More Races	38,568	3.40%
White	896,437	79.08%

Ethnicity*	#	%
Hispanic or Latino, can be any race	208,061	18.35%

*Race & ethnicity data reflects both adult & child populations combined

Household	#	%
Total Households	374,820	
Family Households	261,996	69.90%
Married Couple Family	204,427	54.54%
Male Household, no spouse present with own children under 18	9,467	2.53%
Female Household, no spouse present with own children under 18	19,871	5.30%

EDUCATION

36.10% *Participate in Free/Reduced Lunch*

Utah Public School Statistics K-12	Fall 2021
Fall Enrollment	206,572
Student/Teacher Ratio	25.2
Number of Free/Reduced Lunch Participants	77,142
Percent Free/Reduced Lunch Participants	36.10%
Percent Students Chronically Absent	15.00%

	#	%
3-4 Year Olds Children Not Enrolled in School, 2019 ACS 5-Year	18,551	52.44%

ECONOMICS

$79,941 *Median Household Income*

Living Below the Poverty Line-2019 Small Area Income and Poverty Estimates (SAIPE), U.S. Census

Total Population in Poverty	#	Poverty %
All Persons	103,036	9.00%
Under 18-Years	32,162	10.60%

Participation in Work Support Programs

September	2020	2021
Households Receiving Food Stamps (SNAP)	30,530	30,740
Households Receiving TANF	1,314	1,053
Unemployment Rate #	31,315	14,238
Unemployment Rate %	4.90%	2.20%

HEALTH

8.40% *Uninsured Children under 19*
2019: American Community Survey (ACS) 5-Year

Utah Department of Health, Public Health Indicator-Based Information System (IBIS)

		#	%
Receiving Prenatal Care, 2020		11,180	73.71%
Low Birth Weight Babies (Less than 2,500 grams), 2016-2020		6,215	7.64%
Infant Mortality (Per 1,000 live births), 2016-2020	Rate 6.01	# 490	
Teen Birth Rate (Per 1,000 females age 15-17), 2016-2020		6.55	822
Percent 2-Years Old Immunized, 2019			74.70%

WEBER COUNTY

2021 Utah Kids Count Data Card

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THE ANNIE E. CASEY FOUNDATION

VOICES FOR UTAH Children

DEMOGRAPHICS

American Community Survey (ACS) 5-Year, 2019

28.50% *of the population are children under age 18*

Population	#	%
Total	251,498	100%
Under 5-Years	19,550	7.80%
Under 18-Years	71,662	28.50%

89.15% *of the total population is White* **10.85%** *all other racial groups*

Race*	#	%
American Indian or Alaskan Native	1,725	0.69%
Asian	2,904	1.15%
Black or African American	2,745	1.09%
Native Hawaiian & Other Pacific Islander	659	0.26%
Some Other Race	10,407	4.14%
Two or More Races	8,842	3.52%
White	224,216	89.15%

Ethnicity*	#	%
Hispanic or Latino, can be any race	46,159	18.35%

*Race & ethnicity data reflects both adult & child populations combined

47.40% *Child Dependency Ratio*

Household	#	%
Total Households	83,632	
Family Households	61,040	72.99%
Married Couple Family	47,200	56.44%
Male Household, no spouse present with own children under 18	2,647	3.17%
Female Household, no spouse present with own children under 18	5,271	6.30%

EDUCATION

37.20% *Participate in Free/Reduced Lunch*

Utah Public School Statistics K-12	Fall 2021
Fall Enrollment	49,717
Student/Teacher Ratio	24.4
Number of Free/Reduced Lunch Participants	19,123
Percent Free/Reduced Lunch Participants	37.20%
Percent Students Chronically Absent	24.90%

	#	%
3-4 Year Olds Children Not Enrolled in School, 2019 ACS 5-Year	4,833	61.48%

ECONOMICS

$71,835 *Median Household Income*

Living Below the Poverty Line-2019 Small Area Income and Poverty Estimates (SAIPE), U.S. Census

Total Population in Poverty	#	Poverty %
All Persons	17,647	6.90%
Under 18-Years	5,720	8.00%

Participation in Work Support Programs

September	2020	2021
Households Receiving Food Stamps (SNAP)	8,580	8,681
Households Receiving TANF	388	339
Unemployment Rate #	5,812	2,964
Unemployment Rate %	4.40%	2.20%

HEALTH

6.40% *Uninsured Children under 19*
2019: American Community Survey (ACS) 5-Year

Utah Department of Health, Public Health Indicator-Based Information System (IBIS)

	#	%
Receiving Prenatal Care, 2020	2,833	79.40%
Low Birth Weight Babies (Less than 2,500 grams), 2016-2020	1,416	7.70%
Infant Mortality (Per 1,000 live births), 2016-2020	Rate 5.97	# 110
Teen Birth Rate (Per 1,000 females age 15-17), 2016-2020	6.53	191
Percent 2-Years Old Immunized, 2019		74.60%

Appendix D.

Draft Cognitive Interview Protocol

Cognitive Interview Protocol for Parents, Community Providers, or Educators

Method: 45-minute interviews. Participants will be asked to take 15 minutes BEFORE the interview to review two *To Learn* activities.

Introduction (3 minutes)	Thank you for participating in this interview. Your feedback will help the STEM Action Center continue to develop *To Learn* materials that meet the needs of families and educators. We will be doing a cognitive interview today. This type of interview may be unfamiliar to you, but the goal is to have participants "think aloud" as they engage in a set of tasks. My plan is to ask you to review some *To Learn* materials while sharing your thoughts and experiences as you do so. To aid you in doing this, I asked you to take 15 minutes or so before the interview to review two *To Learn* activities. Were you able to do so? [If not, reschedule interview] The interview should take no more than 45 minutes. All responses will be kept confidential. This means that the UEPC research and evaluation team will ensure that any information we include in our report does not identify you as the respondent. You don't have to answer any question you don't want to answer, and you may end the interview at any time. Are you willing to participate in this interview? With your permission, I would like to audio-record the session so that I don't miss any of your comments. Do I have your permission to do so? Please keep in mind that there are no wrong answers, impressions, or responses. I did not design any of the materials, and you will not hurt my feelings. Feel free to say anything you are thinking throughout the interview. Do you have any questions before we begin?
Key Questions (30 minutes)	Let's begin with your overall impressions of the *To Learn* materials. • As you look(ed) over the materials, can you describe your first impressions? Now, let's take a look at the Activity Description for Activity #1. • Can you tell me what you are thinking as you (re)read this description? • Additional Prompts (e.g., Does the description make sense to

	you? Does the description make you want to explore the materials further? If so, why? If not, why not?) Let's move on to the Instructions section for Activity #1. • Can you tell me what you are thinking as you look at the pictures and review the Steps? • What are your impressions of the materials? (e.g., stamps) • Additional Prompts (e.g., Do the pictures and Steps appear to be related? How? Is it clear what you are being asked to do in each Step? Do some of these activities appeal to you more than others?) Let's move on to the Standards section for Activity #1. • Can you tell me what you are thinking as you review the standards? • Additional Prompts (e.g., Why do you think the standards were included? Do you find them helpful?) Finally, let's move on to the Family Tips section for Activity #1. • Can you tell me what you are thinking as you review the tips? • Additional Prompts (e.g., Are there any tips that interest you more than others? Why? Are there any tips that are unclear to you?) [Repeat for Activity #2]
Closing Questions **(12 minutes)**	Before we close, I have just a few more questions for you. • How interested would you be in using the *To Learn* materials with (your) child(ren)? • What aspects of the kits do you think (your) child(ren) would be most interested in/excited about? • Do you anticipate any challenges in using the *To Learn* materials with (your) child(ren)? If so, please explain. • Have the *To Learn* materials changed your thinking about how to engage (your) child(ren) in math learning? • Do you have thoughts about the *To Learn* kits or about particular activities that you haven't already shared? Thank you for your time.