



EARLY MATH: A COMMUNITY DRIVEN APPROACH

FINAL REPORT TO BOEING

Boeing Early Math: A Community Driven Approach Final Report Prepared by:
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Thrive Washington, September 26, 2018



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THRIVE WASHINGTON IN PARTNERSHIP WITH CHILD CARE RESOURCES,
KALEIDOSCOPE PLAY & LEARN GROUPS, AND ZENO

EXECUTIVE SUMMARY

With funding from the Boeing Corporation, Thrive Washington undertook a pilot project in November 2016 to better understand how to encourage parents/caregivers to engage their children in interactions that support early math learning. To that end, Thrive contracted with Kaleidoscope Play and Learn groups (KP&L), Zeno, and ORS Impact. KP&L is an interactive drop-in program for caregivers and their young children (birth to five) where they learn activities that support children’s learning and gain knowledge about child development, skills children need to be ready for kindergarten. Supported by Child Care Resources, community-based organizations run KP&L groups, and trained community members facilitate the groups. Zeno builds young children’s early math skills by equipping families with fun and engaging tools to create the math foundation for a future of limitless opportunity. ORS Impact, an evaluation and research organization was contracted to conduct an evaluation of the pilot project.

EARLY MATH, WHY NOW?

The Early Math Pilot Project (EMPP) was designed to address the need to increase kindergarten math readiness in Washington state. Increasingly, research tells us about the importance of early math and early numeracy skills to long-term understanding, and that children need to be capable and confident in math when entering kindergarten. Indeed, children who are not math-ready when entering kindergarten may struggle to reach the same level as their math-ready peers and may face challenges throughout their elementary school and high-school educational experience. Starting behind often leads to remaining or falling further behind math-ready peers and creates lifelong barriers to STEM careers and other opportunities in the 21st century workforce.

In 2012, Washington state implemented the Washington Kindergarten Inventory of Developing Skills (WaKIDS)—the first step to gathering data in the first few months of the school year— to get a snapshot of where kindergarteners are in their development. WaKIDS inventories a child’s developing skills in six areas: social-emotional, physical, cognitive, language, literacy and mathematics. Results of the more than 79,000 students who took part in the fall 2017 WaKIDS assessment indicated that overall, children are least prepared in math, with only 66% math-ready, while children of color and children from low-income families demonstrate characteristics of entering Kindergarten at significantly lower levels.

While there are theories about the cause of this disparity, the origins may be found in the lack of knowledge about the importance of early math and the lack of opportunity for a segment of children to get the experiences they need to develop these skills. In fact, upwards of 60% of students in Washington state do not participate in a licensed pre-school where many early math skills are often developed. That means that existing structures that support formal early learning environments are not serving the majority of children in need. However, given the opportunity, most children are capable of learning early math at a much earlier age than has been previously recognized. This study also indicated that children



who received high-quality math instruction in preschool scored higher on third-grade test scores in math *and* in reading (Duncan, et.al, 2007.)

To help children prepare for Kindergarten, we also need to raise the awareness of guiding adults (parents, caregivers and other informal early learning providers) about the importance of early math for success in school. Just as early literacy awareness programs have increased parents awareness of the need to read to their children during the early years to develop early literacy skills, guiding adults need to be made aware that children are capable of learning math concepts at a young age, and that these adults can increase their confidence and comfort level in providing experiences and support for math. Finally, we need to create models to increase capacity for guiding adults to incorporate early math into children's lives.

In response to these needs, Thrive proposed a pilot, ***Early Math: A Community Driven Approach***, to increase children's kindergarten math-readiness through the support of guiding adults (i.e. parents, caregivers and early learning providers.) Our initial strategy was to contract with three to five of Washington's 10 Early Learning Regional Coalitions (ELRC) to develop or implement early math interventions with children and guiding adults in informal settings. However, when we conducted interviews with ELRC leads in August 2016, we learned that only a few coalitions were in the early stages of identifying their early math implementation strategies which were more focused on providing professional development and training for providers in formal, licensed care providers. This data along with changes in Thrive's leadership and staffing structure, prompted several shifts in strategy from contracting with coalitions directly, to identifying an existing early math resource designed to be implemented with families.

EARLY MATH PILOT PROJECT OVERVIEW

With support from the Boeing Corporation, Thrive selected Child Care Resources' (CCR) Kaleidoscope Play & Learn groups, which subcontracted with Zeno, a creative nonprofit creator of math games and tools designed for family engagement in developing early math skills. Zeno was engaged to develop and pilot an early math intervention. Child Care Resources was already partnering with Zeno to develop early math activities for KP&L groups in King County, and this pilot project offered an opportunity to expand and evaluate the intervention to understand if this type of community program can change parent/caregiver attitudes and behavior regarding the importance of early math.

To determine the impact of the project, Thrive also contracted with ORS Impact to complete an assessment and evaluation report. This effort aimed to understand the effectiveness of early math activities on KP&L facilitators and caregivers, while gaining additional insight into broader learnings such as attitudes and beliefs regarding early math, and behaviors, such as use of the math games within and outside of the groups, as well as program implementation challenges and opportunities. The six King County sites were included in this evaluation though not funded through this project.

With support from the Boeing Corporation, Thrive partnered with the Child Care Resources' KP&L groups to identify 13 KP&L facilitators in 12 communities who would receive lesson guides and specialized training in four early math lessons. Thrive and CCR identified and invited KP&L sites in



three counties to participate in the pilot. Of the 12 participating groups, three were in Whatcom County, three in Yakima County, and six in King County. Six KP&L sites were selected: three in Bellingham, one in Yakima County, and two in Wenatchee. Within the pilot sites, the communities also included KP&L groups with facilitators and members speaking diverse languages including five conducted in Spanish, five in English, one in Vietnamese, and one in Chinese.

Based on attendance records provided to CCR, a total of 756 people—318 caregivers and 438 children—attended a KPL group participating in the early math project. Four new Kaleidoscope Play & Learn lesson guides on early math were created and include activities that utilize the accompanying Zeno early math games, in addition to the many activity suggestions that families can do with everyday household items.

Two separate two-hour training webinars were developed and facilitated for the 13 participating KP&L facilitators to become acquainted with the four new lesson guides and accompanying math games. These webinars divided the training in half (two lesson guides for each) and were offered both online and in-person. Additionally, the webinars were recorded for future use by KP&L facilitators interested in learning more about these early math concepts. The participating facilitators attended the trainings and received follow-up support, both through phone calls/emails and site visits. All 13 participating facilitators used the lesson guide(s) in their weekly groups, and kept “journals” about this process. They all also had the accompanying Zeno game available at a “station,” for families to interact with; then all participating families were given a set of the games to take home and play.

Facilitators implemented the lessons in four or five consecutive KPL group sessions and made the Zeno games available both during the sessions and for take-home use during the period the lesson was covered. The pilot began at the end of January 2018 and most groups finished their final lesson in June 2018. The KP&L staff worked with Zeno to create facilitation guides and specialized training for the four modules.

PROJECT DELIVERABLES

Child Care Resources was asked to complete the following deliverables:

- Develop a database to track information about Kaleidoscope Play & Learn groups. The database would be used to capture demographic, program data (e.g. technical assistance and training for facilitators) for quality assurance and evaluation purposes.
- Expand the piloting of early math modules to include Kaleidoscope Play & Learn groups in Whatcom County and Yakima area at 6 sites mutually agreed upon by Thrive and CCR.
- Ensure math modules in Kaleidoscope Play & Learn groups created in partnership with Zeno were delivered at a dosage determined by Thrive's evaluator. Each of the four modules was to be delivered one time and math modules had to be delivered in 4 consecutive weeks in each of the 12 locations by the end of the contract period.
- Subcontract with Zeno for services to include training to CCR staff on facilitating games



and math practice including how to engage families around using Zeno's games and manipulatives. Zeno was also to provide logistical coordination of Zeno game materials to sites/families for the delivery of 1,200 games to 300 families (4 games/family) and facilitators in the 6 identified

- Kaleidoscope Play & Learn groups plus 6 additional groups participating in a similar pilot in King County. CCR was to partner with Zeno on evaluation related efforts for this project.
- Zeno games were to be used at the 6 identified Kaleidoscope Play & Learn groups plus 6 King County pilot groups to observe child/caregiver use at the Kaleidoscope Play & Learn sites and distributed to participating families to take home
- Ensure that the math modules utilized for this Early Math project were made available to Thrive and the evaluator for evaluation purposes.
- Coordinate and participate with Thrive's evaluation efforts associated with this Early Math project.

The project goals and deliverables were all met, and the four early math lessons were titled ***All About Shapes, Sort It Out, Let's Learn to Measure, and 1,2, 3: Learning Numbers***. Each one included a lesson guide with the following elements:

- Learning objectives that described what caregivers and children were supposed to gain from the lesson
- Key messages including definitions of the early math concepts of focus and examples of ways for caregivers to engage with their children (e.g., parallel talk)
- Suggestions of potential activities to do in a group or to set up for child-directed play, including suggestions of books to read during story time
- Suggestions for encouraging caregiver/child engagement in math-related activities at home
- Resources and handouts for caregivers who are interested in learning more about supporting their child's early math learning

In addition to the training on these early math lessons, CCR staff provided ongoing technical assistance throughout the course of this project. Again, Zeno contributed early math games that complemented each of the four lessons by helping children learn about shapes, sorting, measuring, and counting. KPL groups received 25 sets of each game for facilitators to use within group sessions and to distribute to participants. As noted previously, this project expanded the piloting of the new early math lessons, including groups in Whatcom County and Yakima County. Child Care Resources also participated in the evaluation component of this project, coordinating efforts with ORS and connecting them to Thrive at the onset.

The other large component of this project involved the development of a new database to support systemic collection and tracking of all the Kaleidoscope Play & Learn activities across the state (i.e. demographic information, technical assistance, affiliate agreements, training offered,



etc.). CCR worked with a technology team to build out this database, meeting weekly to review progress, test the new features, and input current data. The portal was completed in May, 2018.

WHAT WE LEARNED: EVALUATION RESULTS **

To determine the impact of the KP&L/Zeno early math lessons, Thrive Washington contracted with ORS Impact, to understand the impact and implementation of the new early math lessons that incorporated the Zeno games within the KPL context. The information that follows comprises a summary of the ORS evaluation, which is included with this report.

*** Please see individual evaluation reports from ORS Impact (Executive Summary and Kaleidoscope Play & Learn Early Math Pilot Evaluation Summary) included.*

Evaluation Questions:

- What components or content of the training, facilitation guide, or lesson guides best support successful implementation by KPL facilitators?
- What is the nature of caregiver and child engagement during the early math-focused KPL sessions (including having fun)? What supports or inhibits such engagement?
- To what extent is lesson implementation associated with changes in caregiver attitudes and beliefs about math for early learners and caregiver confidence to engage with children in early math activities?
- To what extent is lesson implementation associated with changes in caregiver math behaviors in other settings? What supports or inhibits such behavior?
- What elements of lesson implementation best support caregiver outcomes?
- To what extent is the facilitator training and lesson implementation associated with changes in facilitator attitudes and beliefs about math for early learners? Are such attitudes and beliefs associated with caregiver attitudes?
- Does dosage (session attendance) affect caregiver outcomes?

Data Collection Methods:

The pilot evaluation employed a variety of qualitative and quantitative methods to collect data, representing multiple perspectives:

- Facilitator pre-pilot surveys assessed facilitators' beliefs about math and teaching early math prior to the first facilitator training (n=12)
- Site-visits to each of the participating KP&L groups (one per group) by an ORS Impact consultant who recorded information on group structure and composition, as well as examples of caregiver and child engagement (n=12)



- Intercept interviews with four to six caregivers conducted by ORS Impact at each site visit during the course of the group that focused on caregivers' experience of the early math lessons and Zeno games and lasted about three minutes each (n=53)
- Facilitator journals completed throughout the pilot to help capture reflections on aspects of implementation that worked well, potential areas of improvement, and engagement among group participants (n=13)
- Caregiver surveys completed at a group session near the end of the pilot to assess changes in beliefs, confidence, and behavior supporting early math learning and to gather feedback on the Zeno games and lessons (n=118, 46% of the 255 caregiver participants during the final month of the pilot)
- Facilitator interviews conducted at the end of the pilot by ORS Impact consultants to better understand facilitators' experiences with the early math lessons and Zeno games, gather perceptions of caregivers' experiences with the same, and assess intended outcomes for facilitators (using items identical to those asked on the pre-pilot survey; n=13)
- CCR records on unduplicated monthly caregiver and child attendance, provided to CCR by each host organization

Outcomes:

Overall, the ORS Evaluation data suggests that both “KP&L facilitators and caregivers experienced positive changes in attitudes, beliefs, understanding, and behavior that support early math learning through their participation in the pilot. Evidence also suggests caregivers experienced stronger outcomes if they attended more KPL group sessions during the pilot and if they attended groups with facilitators who reported better attitudes toward and more confidence in teaching early math” (ORS, 2018.)

Facilitators reported more favorable attitudes toward math and early math

The biggest shift in facilitator attitudes toward early math learning was in math being their “least favorite subject to teach” (see Figure 4 and Appendix A for all item-level frequencies corresponding to facilitator and caregiver outcomes). Prior to the pilot, three facilitators agreed with the statement; after the pilot, those three facilitators had shifted to disagree.

There was also a relatively big shift in facilitators feeling they have “the support they need to teach math well.” Again, three facilitators shifted from disagree to agree or strongly agree over the course of the pilot, and four shifted from agree to strongly agree.

For facilitators, there was an increase in favorable attitudes toward math and early math as well as increased confidence to support early math learning after participating in the pilot. Indeed, during the course of the pilot, “facilitators increased from an average closer to “somewhat confident” to “very



confident” (2.3 vs 2.8, $p < .01$) in their abilities to support early math learning. Interestingly, while confidence increased overall, the facilitators’ comfort in teaching particular math concepts did not increase in a statistically significant way. Moreover, facilitators experienced changes over the course of the pilot including:

- Increased appreciation of younger children’s ability to learn math and how fast they can learn it
- Increased appreciation that children can learn math anywhere
- A shift to a more inclusive conceptualization of “early literacy” that includes early math

Facilitators also reported increased appreciation of the breadth of math—where they used to think of early math as just numbers, they now include concepts such as shapes, measuring, and sorting. As one facilitator said, “My biggest shift is just to think of math as more than just numbers and counting, to think of shapes as geometry and to think of measurements as math.”

Facilitators also reported improvements in their facilitation related to teaching early math

In reflecting upon how they have changed as a result of participating in the pilot, facilitators reported increased:

- Explicitness in how they talk about math concepts
- Recognition and identification of “math aspects” of everyday activities
- Automaticity in their incorporation of math concepts into what they say and do during their groups
- Creativity in adapting typical KPL activities to teach math concepts and weave math into their lessons
- Deeper thinking about how to best support early math learning and caregiver engagement with math outside of the KPL setting
- Facilitators also shared ways in which participation in the early math pilot influenced their thinking and behavior related to KPL facilitation more generally, including:
 - Increased understanding of how children learn through play
 - Increased appreciation of the benefits of repeating lessons and activities for multiple weeks
 - Increased usage of parallel talk
 - More focus on child learning
 - Intentions to use KPL lesson guides more frequently

Caregivers reported increased engagement in early math with children outside of KPL sessions

Caregiver outcomes were measured through a survey completed at a group session near the end of the pilot. Overall, “caregivers reported more frequent math talk and activities at home, more favorable attitudes toward math, and greater comfort in teaching math since participating in the pilot. On average caregivers reported between “a little” more and “a lot” more time spent talking about and doing early math activities with the children in their care outside of the KPL sessions compared to before the pilot. At least nine of 10 caregivers reported talking about math-related ideas at home more



often (93%) and doing more math-related activities (91%; 38% and 34% of caregivers reported doing these “a lot” more).

Additionally, most caregivers reported doing “new” math activities and talking about topics respectively at least “a little” more compared to before the pilot (91% and 89%, respectively). Among caregivers that received Zeno games to take home, 90% reported playing it at home with their child at least “a little” during the pilot, with most caregivers (93%) reporting an intention to continue to play the games at home in the future.

The drop-in nature of KPL supports group attendance, but also makes it common for caregivers to miss parts of sessions that may include an orientation to an activity. Caregivers who attended more regularly throughout the pilot period, reported significantly greater increases in comfort teaching their children early math, compared to those who attended less regularly. Increases in attitudes toward math and doing early math at home were also larger among more regularly attending caregivers, but not to a statistically significant degree.

Many facilitators noted the importance of caregiver education, both in terms of making sure caregivers understand the math concept, as well as the best ways for them to support their child’s learning.

Facilitators noted that math concepts differ in terms of developmental appropriateness more drastically than most KPL topics, and they found it challenging to make some activities suggested in the lesson guides broadly accessible. Facilitators also noted that modeling ways to support a child’s early math learning fostered increased engagement among caregivers and gave caregivers an example to follow in terms of best practices for teaching their children early math.

Child outcomes were determined through caregiver/child engagement observations that took many forms:

For example, ORS staff observed enjoyment of an early math activity, including observations of children or caregivers having fun, laughing, running to an activity when they could have walked, or asking to do a certain activity again.

- **Interactivity:** observations of children and caregivers using materials or a game as intended and in different ways, or using different materials like they did within a math activity. This also includes doing an activity as a family (including with siblings of different ages), high levels of interaction across families (caregivers playing with or attending to other caregivers’ children), children actively leading a caregiver in an activity, and caregivers following through on a part of an activity that a child could not complete.
- **Attentiveness to activity:** observations of children or caregivers being “into it” including references to sustained attentiveness, children exerting effort to “do it right,” caregivers appearing interested in teaching a concept, children and caregivers electing to repeat a



group math activity during play time, or children checking with caregivers about their understanding of a math concept.

- **Proactivity:** observations of caregivers and children expressing eagerness about what the next math lesson would be, caregivers bringing ideas of early math activities to do at home to the group (peer sharing), caregivers and children expressing eagerness to take home a Zeno game, or making sure to be in attendance when the games are sent home.
- **Comfort with an activity and/or use of skills taught:** observations of caregivers using skills taught in KPL such as parallel talk or asking questions of a child as they are playing with a math activity and “really taking it upon themselves” to promote learning with their children.
- **Sharing with facilitators their enjoyment of activities or doing them at home:** observations or reports from caregivers that their children love playing the game at home, bringing in pictures of children playing the games at home, or sharing how they like being a part of the pilot and how it emphasizes doing early math at home.

CONCLUSION

Thrive undertook this project in November 2016 with the assertion that children, if given the opportunity, would increase their math readiness through the support of guiding adults. While the original scope and structures of the activities changed over the course of the pilot project, the “evaluation evidence suggests that participating in the pilot changed the ways facilitators and caregivers think about and teach early math, which supported increased engagement in early math activities among the caregivers and the young children in their care” (ORS Evaluation Report, 2018) Although this pilot focused on one specific intervention in 12 communities across the state, it is likely that a Kaleidoscope Play & Learn group/Zeno model would be successful if scaled up throughout the KP&L network across the state. Moreover, other opportunities may exist to adapt the model to other informal learning venues such as libraries, museums, community centers and other trusted places where families of young children congregate for story times and other activities.

ADDITIONAL RESOURCES

Kaleidoscope Play & Learn | Zeno | Thrive Washington Early Math Pilot Evaluation Report, August 2018
Kaleidoscope Play & Learn Early Math Pilot Evaluation Summary, ORS Impact, September 2018