EARLY MATH – WASHINGTON'S PROFESSIONAL DEVELOPMENT STRATEGY OPTIONS, SPRING 2019

Washington State Department of CHILDREN, YOUTH & FAMILIES

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Eligibility and Provider Supports Division | Approved for Distribution by Michelle Roberts, Program Manager

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Acknowledgements

The Washington State Department of Children, Youth, and Families (DCYF) appreciates the many partners and stakeholders that shared their thoughts with us during the research into the current strengths, attitudes, and needs of early learning educators and coaches/trainers in Washington. Their insights about how to help children become confident and successful mathematicians form the foundation of these strategy options.

We would particularly like to thank the following early learning educators for sharing their insights during the research phase:

- Child Care Aware Early Achievers coaching supervisors
- Child Care Aware professional development coordinators
- Early learning fellows
- Educational Service District coordinators
- ECEAP early numeracy training participants
- University of Washington Cultivate Learning
- University of Washington Inspire
- Washington Early Childhood Teacher Preparation Council
- The Early Math Coalition partners and Steering Committee
- The trainers and coaches who were interviewed
- The many providers who participated in focus groups

We would also like to thank the members of the Washington Early Math Coalition who reviewed early drafts of these strategy options and offered insights.

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When educators have the time and opportunity to see their children as individuals, sense makers, and mathematicians, they realize that they underestimated what they can do. It is a generative moment. It increases curiosity and exploration. The teacher becomes a facilitator of experiences rather than an imparter of wisdom.

– Trainer

Executive Summary

Goal and Purpose

DCYF is committed to children being ready for kindergarten – preparing them for later success in life. WaKIDS data indicates that only 66% of children statewide have math skills expected at kindergarten entry. Importantly:

- Only 33.0% of migrant children arrive with expected skills.
- 50.2% of children living in poverty arrive with expected skills.
- 47.0% of Hispanic/Latin children arrive with expected skills (compared with 72.7% of white children and 80.9% of Asian-American children).

Because of this, DCYF and statewide partnering agencies prioritized a focus on early mathematics. DCYF, with these partners, explored the landscape and opportunities in our state related to early mathematics to make recommendations on strategies to strengthen the professional development system to build our capacity for children's success in math.

Options

During the research, many ideas were shared about effective ways to support educators. It is affirming that many of the ideas shared are reflected in the Washington Early Math Coalition's strategies, goals, and activities.

To teach STEM effectively, early childhood teachers need to understand: (a) the content they are teaching, (b) the nature of children's STEM thinking/ knowledge and how it develops, and (c) best practices for ensuring that STEM instruction meshes with children's developmental needs and level.

Intersecting Family and Professional Supports – DCYF's research recognized a valuable opportunity to connect supports for families and professionals through promotion of mathematics learning, messages, and activities that both families and professionals can engage in.

Expand Access, Opportunities, and Resources – This includes strengthening foundational competencies in developmentally appropriate practice and executive function as well as building educator's confidence in math. In addition, our state can expand and strengthen access to professional learning, tools, and resources. Educators are more likely to engage in math learning opportunities if they relate to materials and activities they can access and use with children. DCYF also learned that math pedagogy opportunities are limited and need further development. This report also expands on the benefit of peer support and learning and a need to explore this type of professional learning. Related to this is also job-embedded learning and coaching/mentors. As with many statewide efforts, the necessity was evident for expanding supports for diverse and remote educators who historically may not have access to needed opportunities. This includes removing barriers such as cost, time away from programs or family in evenings and weekends, and dates and times when options are available.

Strengthen Cross-System – DCYF recognized that our statewide system of partners have an opportunity to strengthen the foundational support through cross-agency coordination, shared learning, and aligned decision-making. The efforts of the Early Math Coalition seek to be a strategy to further this work. DCYF and the coalition recognized the need for:

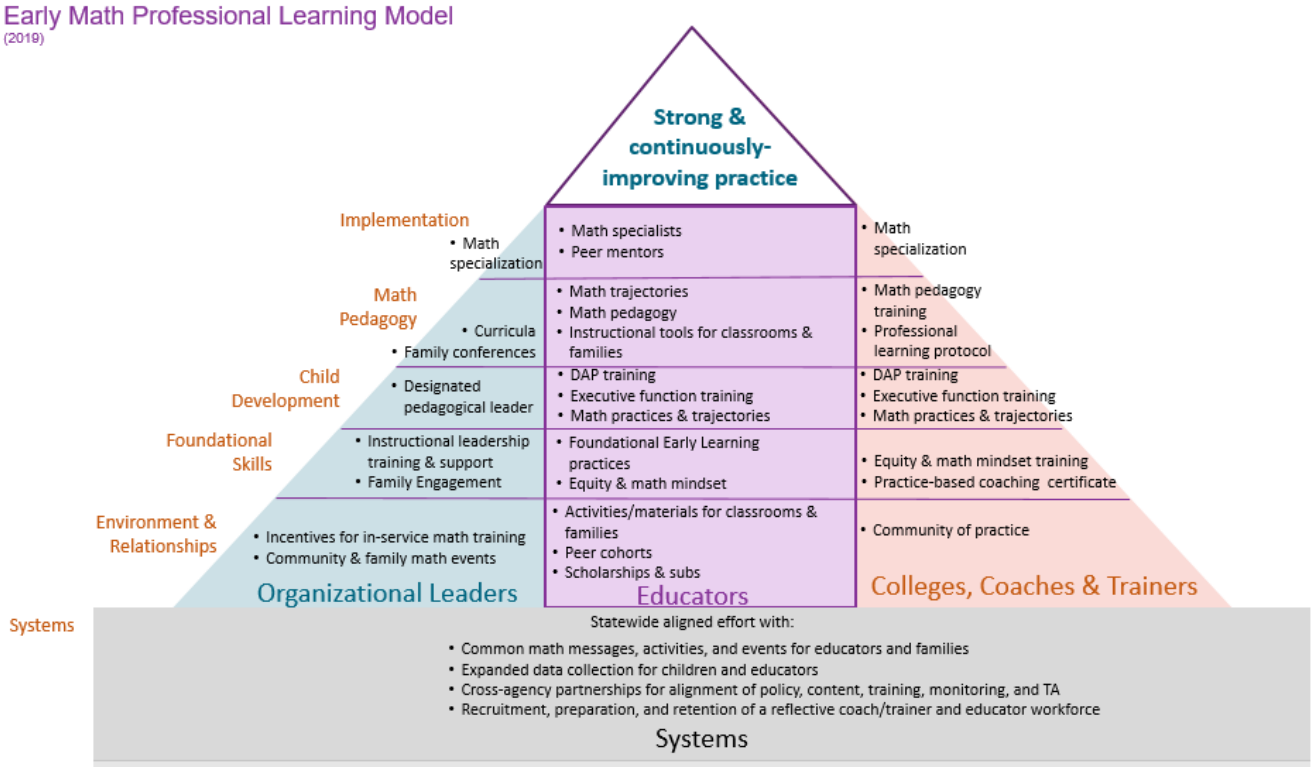
- Improve data collection and analysis.
- Align birth-8 goals.
- Expand partnerships to align our system for educator's ease in navigation of requirements.

Similar to learning opportunities, the need for diversity and cultural and linguistic competence within our system level leaders is necessary to support all educators and children.

Professional Development Model

The model developed by DCYF incorporates a focus not only on early math pedagogy, but – based on the research – on a comprehensive professional development system that can support educators in establishing a strong foundation on which they can build for math pedagogy and curriculum. The following model considers:

- Our system – consideration for how cross-agency system coordination can improve opportunities for educators.
- Educators – the supports, learning, and opportunities educators need to provide quality experiences for children.
- Early learning organization administrators – program leaders have a unique position that requires support so that they are equipped to provide the support and access to opportunities their educators need.
- Coaches, trainers, and colleges – those who equip educators need the resources, tools, and knowledge to provide high-quality professional learning opportunities.



We considered the foundation needed as well as the progression – and interconnection – of professional learning for each:

Supportive Relationships and Environments – Humans grow and change in the context of relationships. Educators need a supportive environment with peer cohorts and access to opportunities, and they need to be able to provide this for children.

Basic Skills – This includes basic mathematical thinking as well as technology skills and foundational practices for educators.

Child Development – Educators need a strong understanding of how children grow and learn in general as well as an understanding of where children are developmentally to encourage learning and growth and provide individualized supports and care. In addition, educators need an understanding of executive function skills and how they develop and relate to children's success – including mathematical thinking.

Math Pedagogy and Curriculum – Opportunities for mathematical teaching and practices with additional tools and resources is needed to increase time spent on math in early learning programs.

Implementation and Specialization – As educators and others related to the system begin implementing mathematical interventions, this creates an opportunity for specialization and targeted focus on math in early learning settings.

When it comes to math, DCYF is interested in considering the many points at which educators could benefit from additional encouragement and support to be confident educators who help children in turn be confident and successful mathematicians. In this model, the educator remains the central role in supporting families in their children's success, while relying on other key supports as a comprehensive professional development system. This model can address other priorities – reflecting on all components that impact a child's success and readiness.

The recommendations and professional development model can be used to guide decisions for how to best focus efforts in Washington's early learning professional development system related to mathematics for children birth to age 8. The Washington Early Math Coalition can use this report to inform priorities and strategies for a work plan.

Overview

Bold Goals

For the past several years, DCYF and its early learning partners have focused efforts toward ensuring that every child is ready for kindergarten and that race and income are no longer predictors of readiness or success.

In 2018, 47.4% of children entered kindergarten ready in all six domains of development, with children in lower income families – and many children of color – ready at lower rates than those from higher income families. Yet, research shows that "although virtually all young children have the capability to learn and become competent in mathematics, for most the potential to learn mathematics in the early years of school is not currently realized…This is particularly the case for economically disadvantaged children..." This points out that Washington is missing an important time to prevent the opportunity gap that contributes to inequities in achievement.

> *Developing STEM skills is an integral part of weaving strong skills ropes. As we learn new skills, our brain weaves skill strands into ropes that we can use to solve problems, meet challenges and, in turn, acquire new skills. STEM skills are vital in many different kinds of skills ropes. When kids have opportunities to collect evidence and solve scientific problems, they build strong ropes that can be used in many ways later in life.*
>
> – STEM Starts Early: Grounding science, technology, engineering, and math education in early childhood (New America 2017)

Furthermore, Washington can better prepare students with 21st Century skills required for future jobs. Current efforts are also not attracting and preparing enough students for the number of jobs in science, technology, engineering, and math (STEM) Washington is creating (9.2% of jobs in Washington in May 2014).[1]

Driven by this, DCYF, other state agencies, and non-profit partners are taking action to support children's early confidence and success in math.

Yet, only 66% of children statewide have math skills expected at kindergarten entry. Importantly:

- Only 33.0% of migrant children arrive with expected skills.
- 50.2% of children living in poverty arrive with expected skills.
- 47.0% of Hispanic/Latin children arrive with expected skills (compared with 72.7% of white children and 80.9% of Asian-American children).

Research Purpose

To address this, DCYF intends to strengthen the professional development system to build our capacity for children to be successful in math. Drawing on what we know about the early childhood educator, coach, and trainer workforce (in MERIT data and the *Thrive Washington Early Math System and Resource Analysis*), DCYF conducted targeted research and analysis to focus improvements to early math professional development and practice. The research effort was intended to:

- Build on existing data to analyze the professional development landscape.
- Identify options to strengthen high-quality math content and professional development.

Findings from the research are found in the *Washington Early Math Success – Landscape Analysis*. The strategy options that follow are intended to respond to what was learned. A professional development model is described later in this report, detailing how DCYF and partner supports can bolster the actions of early learning organizational leaders and college professors, coaches, and trainers can support early learning educators in math pedagogy.

Methodology

To create these strategy options, DCYF:

- Reviewed national research regarding math and professional learning.
- Reviewed internal analyses based on MERIT, STEM training, and other data.
- Reviewed Thrive asset mapping and WaKIDS analyses.
- Conducted interviews with nine professional development system leaders.
- Held focus groups with 63 educators, coaches/trainers, and professional development leaders.
- Reviewed strategy ideas with Washington Early Math Coalition members.

Design Principles

The Washington Early Math Coalition (EMC) developed the following design principles to guide strategies that support effective professional learning in math. The options presented in this report are also founded on these principles.

- Draw on the deep wisdom and insights of educators and communities from diverse backgrounds/roles – this facilitates cultural competence and builds on different ways math is taught.
- Support individual and cultural educator needs and opportunities.
- Facilitate and strengthen educator and instructional leadership.

[1] Technology Alliance. (June 2015). *Benchmarking Washington's Innovation Economy.*

- Help educators to access and choose high-quality content, expand skills, and implement well.
- Facilitate self-directed action of professionals and professional learning in and across community.

The professional development model described later in this report was designed with these principles in mind.

Using the Professional Learning Options in Practice

This document outlines many options for professional learning for early educators in early math. It is intended to be used by communities, organizations, state agencies, and systems to guide decisions and actions related to early math and professional learning. Based on community voice and the landscape analysis, DCYF produced these options as recommendations for implementing strategies and solutions that can improve early math outcomes for young children.

This can be a map for Washington State to further research, make funding decisions, or make plans for action. Most of these options will require additional funding. In consideration for how to invest, it is not only to develop new strategies for early learning professionals, but to expand on what we know is working – in communities as well as with ECEAP – to be inclusive of all providers.

In addition, funding and strategies should be considered for comprehensive implementation. One strategy alone may not produce the desired results – but the wraparound and holistic approaches described can have lasting impacts on children and teachers for children to come. It is also important to consider realistic expectations of gains for children that will have long-lasting effects. While intense intervention of math content may produce immediate results, often, these won't carry in to later grades as the content gap deepens if foundational concepts were not invested in.

It is the hope that this document serves as a starting point to align and strengthen efforts as well as guide decisions for implementation of new strategies.

Identified Options to Support Math

During the research, many ideas were shared about effective ways to support educators. It is affirming that many of the ideas shared are reflected in the Washington Early Math Coalition's Theory of Change, work plan, and current activities. However, research participants generated many useful ideas focused specifically on supporting early learning educators.

Prioritized Options

These first options below were prioritized based on the anticipated high level of impact and relative ease in implementation. They are followed by the rest of the options identified during the research. Notably, many of these options mirror the nine recommendations made by the National Research Council in 2009.[2]

1. Highlight Foundational Guidance

A. Increase visibility and use of existing guidance tools that incorporate math outcomes and strategies (e.g., in the Washington Early Learning and Development Guidelines and The Washington State Core Competencies for Early Care and Education Professionals).
B. Add supplemental guidance documents to these tools to include promotion of math instructional practices and complements OSPI's Learning Pathways in Numeracy document.

[2] National Research Council. (2009). *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity.* Washington, DC: The National Academies Press.

2. Strengthen Foundational Competencies

A. Increase and incentivize foundational training (DAP, executive functioning, computer skills, mathematical thinking) that allows educators and coaches to have a firm foundation for math pedagogy.
B. Promote and increase use of the practice-based coaching certificate program offered by the University of Washington and ensure that coaching instruction includes scaffolding of math learning trajectories. Explore opportunities to incentivize completion of the certificate as well as use of Coaching Companion.

3. Provide Support for Math Confidence and Math Mindset

Researchers suggest that educators need to move past their own negative past experiences to help children to be confident and successful in math. Suggested strategies include:

A. Use simple, accessible inquiries, games, riddles, and activities that help educators see that they are already doing math successfully all the time.
B. Incorporate mindfulness and mindset techniques in math training.
C. Expand availability of simple tools and materials that support educators and families in supporting children's confidence and success in math (Learning Pathways in Numeracy, STEAM Trunks, etc.)

4. Strengthen Access to Math Professional Learning

A. Provide access to and guidance for selecting high-quality, guidance, curricula, and content. Many educators say they have difficulty accessing math content. Even when so, the concepts of whole-child development, developmentally appropriate practice, and child-led learning may not be fully understood. Others look to Pinterest for activity ideas, but those sources do not have any quality control.
B. Work with training partners – in particular, those who provide math content – to add more math training and conference sessions focused on individual levels (1-5) of math pedagogy.
C. Expand supports and incentives such as Early Achievers grants and the substitute pool that already provide many of these financial supports and wraparound services, adding release time to ensure access. Add intentional support and incentives for math proficiency. Incentivize programs to access more off-site training and create incentives for organizations to offer in-service math training that allows opportunities for job-embedded learning.

5. Leverage Peer Relationships and Expertise

A. Strengthen relevance to culture, language, and teaching setting through paid peer mentors that can supplement and deepen classroom discussion.
B. Use local or online peer cohorts to foster deeper discussion for isolated educators.
C. Supplement the I-BEST approach in 17 community colleges that provide English language instruction in tandem with early childhood content.

Build Intersecting Family and Professional Supports to Expand Access to Math Guidance, Activities, and Materials

1. Promote Fun Mathematizing Activities Across the Community

The Thrive Washington *Early Math System and Resource Analysis* catalogued 269 community math activities and events happening across Washington. These activities provide a way for families, educators, and community members to use common language about math and model that math is everywhere, and math is fun. This creates opportunities to interact with math in ways that build confidence. Suggested strategies include:

A. Begin training and parenting programs with a brief mathematizing activity.
B. Plan mathematizing activities (like Math Anywhere!) at existing local community and cultural festivals.
C. Sponsor common statewide events like BLOCK Fest® or family math night.

Spotlight: Math Anywhere!

Focus for Supports: Families, educators, and children

Core Features: Established in 2017 with initial grant funding through the Washington STEM network, Math Anywhere! is a community-based project that builds positive math experiences outside of school. Media kits are available to help organizations promote Math Anywhere!

Outcomes: Activities help people see that:

- Math can be playful
- Interesting math-y ideas are all around us
- Anytime is a good time to chat about math
- Everyone can share important math thinking

Current Reach in Washington: Vancouver

Spotlight: BLOCK Fest®

Focus for Supports: Children, families, and educators

Core Features: **Adult & Child Activities**: BLOCK Fest® is a research-based traveling "exhibit" with hands-on and interactive block play experiences that strengthen emotional bonds and learning among adults and children ages 8 months to 8 years. Adults learn about the importance of early math and science and how their guided play and conversation helps children learn early math and science. **Host Training**: BLOCK Fest® Host Training is a 3-hour training that helps families and educators to facilitate an event and understand the research behind block play. The training is conducted in an online classroom with a combination of videos, interactive segments, and live presentation.

Outcomes: Increased adult knowledge of early development in the areas of math and science education while providing opportunities to increase social skills and literacy opportunities for young children.
Increased community understanding about the short- and long-term importance of early math and science.

Current Reach in Washington: Clallam, Jefferson, King, Kitsap, Kittitas, Lewis, Mason, Pierce, Thurston, and Yakima counties. http://www.blockfest.org/

2. Create a Statewide Campaign Promoting Common Math Messages and Activities

National research, state research, and educator experience all indicate that negative attitudes adults have about math frame what children see as possible. A statewide campaign that shows how math is everywhere and math is fun can change attitudes and norms. Suggested strategies include:

A. Launch a campaign like past literacy or Getting School Ready! efforts.
B. Align with national Family Math Collaborative efforts. DCYF can stay engaged with this work early on to frame and align state and national efforts together.

3. Provide Materials or Games at All Math Training Sessions

Educators say they are more likely to participate in math classes if they can receive free materials. Trainers agree that this works. Suggested strategies include:

A. Provide tools (like STEAM trunks, Tiny Polka Dot cards, or Zeno Math toolboxes) and/or games, puzzles, and musical instruments to all training participants.

Expand Professional Learning Opportunities

1. Strengthen the Continuum of Foundational and Math Pedagogy Training Offerings

Educators and trainers/coaches said most educators and trainers/coaches need a stronger foundation before they can effectively learn to teach math and progress in their pedagogy. Most also said that a single training makes little difference. Suggested strategies include:

> *To teach STEM effectively, early childhood teachers need to understand: (a) the content they are teaching, (b) the nature of children's STEM thinking/ knowledge and how it develops, and (c) best practices for ensuring that STEM instruction meshes with children's developmental needs and level.*

A. Increase math-oriented coursework regarding cognitively-guided instruction and learning trajectories in certificate and degree programs.
B. Expand on development of updated math modules and increase offerings for ongoing in-service training in math pedagogy for each of the five levels.
C. Ask the trainers who are now providing much of the math courses to lead development of expanded content.
D. Increase courses and supports for coaches and trainers to build their foundational understanding and ability to train educators in math.
E. Combine professional learning that includes training, coaching, and peer reflective cohorts to maximize learning and application. One example may be University of Washington's Teacher Education by Design (TEDD) that uses coaching and video reflection. While it currently is primarily being used in K-12, it can be targeted for early learning.

Spotlight: Professional Learning Network (PLN)

Focus for Supports: Coaches, facilitators, early learning center directors, and others who support teacher learning about early math

Core Features: PLN is a space for teacher educators to collaborate and develop skill in supporting teachers to improve early mathematics experiences and removing barriers that disadvantage particular children. A series of five meetings over the year are shaped based on participant interests covering topics such as:

- How mathematical practices can promote equity
- Attending to children's identities
- Connecting home and community knowledge and the classroom
- Creating supportive math communities for all students

Outcomes:

- Increased knowledge and skills in implementing anti-racist practices
- Improved knowledge of math trajectories and how to scaffold them

Current Reach in Washington: Southeast King County

Spotlight: Pierce College Math Courses

Focus for Supports: Educators

Core Features: This "contextualize math" course ensures educators have the content knowledge needed to teach children math through age 5 (in ECED 109) or through Grade 3 (in MATH 111). ECED 109 meets Pierce College's computational requirements for a professional technical degree, and MATH 111 meets the quantitative math requirement for degree completion and transfer into a bachelor's program. Educators also have access to an embedded academic support instructor and other IBEST supports. The academic support instructor teaches an additional one-credit course where educators can get extra help. The textbook for the course is available online.

Outcomes:

- ECED 109: Increased knowledge of patterns, sequencing, number systems and computation, geometry, measurement, and basic concepts from statistics and probability guided by national mathematics education standards.
- MATH 111: Increased knowledge of patterns, sequencing, number systems and computation, models for operations, problem-solving strategies, functions, geometry, measurement, and basic concepts of statistics and probability guided by national and state mathematics education standards.

Current Reach in Washington: Courses are offered twice/year (one daytime, one evening) at Fort Steilacoom and Lakewood

2. Strengthen Peer Roles in Helping All Educators to Succeed

Many educators indicated they do not have regular time with coaches and trainers or that language and culture of coaches and trainers are not representative of them. Others note that courses are sometimes not relevant. Suggested strategies include:

A. Use peer learning cohorts across organizations to support learning. Develop peer facilitators and mentors who can lead cohorts with specific guidance, protocol, and competencies. Match this effort with high-quality content either online or in a toolkit that is provided in smaller 'chunks,' mirroring a flipped classroom model used successfully in K-12 and other efforts across the country.
B. Recruit, prepare, and compensate peer mentors to foster deeper discussion in classes taught in languages other than home language. Use lessons learned from existing mentor programs (like Imagine Institute's Imagine U) to create a paid peer mentoring model that can facilitate application of training content.

3. Provide Additional Supports and Incentives for Participating in Math Training

Educators named many logistical and financial barriers to participating in math learning. Others say that due to turnover they seldom get to participate in training. Suggested strategies include:

A. Waive/subsidize course fees and provide substitute and travel reimbursement.
B. Pay educators for their time during training, comparable to K-12 educators.
C. Hold courses at convenient times (Saturdays from 8 a.m. to Noon). Consider other schedules for those serving migrant workers.
D. Create grants or other funding incentives for organizations to hold organization-wide in-service training (like math and literacy labs in K-12 schools) around math.
E. Make math an "area of specialization" that organizations can choose in the Early Achievers framework.

Spotlight: Early Learning Fellows

Focus for Supports: Children, families, and educators

Core Features: Across the state, Educational Service District math coordinators and early learning coordinators (where they are funded) support a network of early learning fellows in building relationships, making connections, and taking action across early learning and k-3rd grade to effectively implement state learning standards and *Early Learning Guidelines*, with a particular focus in mathematics, English language arts, and science.

Outcomes: Fellows say their participation has helped them implement inclusive practices. 95% say this is so for children of color and English language learners, and 89% say this for children with disabilities.

Current Reach in Washington: 203 early learning fellows are located at 88 school districts, Child Care Aware, and other early learning organizations

Expand Targeted Resources

1. Strengthen Planning and Support for Early Math Pedagogy at the Organizational Level

ECEAP and Head Start typically have pedagogical/instructional leaders – and even in this setting, development and guidance is needed. Further, this can be challenging to duplicate – even in large child care centers who may have more resources. Educators said they often did not know what was coming next in practice improvement at their organizations, or training was reserved for others. Still, others said they are not allowed to buy math materials since the curriculum selected by the organization does not include activity centers. Suggested strategies include:

A. Encourage/incentivize identification of instructional leaders at each site.
B. Expand focused supports for instructional leaders in all early learning settings, including ECEAP – who needs development, too.
C. Consider specialized training for administrators and directors that broadens support for activity centers, early childhood curriculum, and integrated math, connected to literacy and socio-emotional learning.

Spotlight: Lead Learn Excel™ Pilot

Focus for Supports: System leaders, supervisors, coaches

Core Features: Lead Learn Excel™ builds on leaders' experience while supporting adoption of new approaches. Participants work on:

- Data Dialogues
- Team Lesson Planning
- Peer Learning Communities

Outcomes: The program is designed to increase instructional leader skills to embed professional learning opportunities and continuous improvement into day-to-day work of early childhood educators.

Current Reach in Washington: 2-6 person ECEAP contractor teams are eligible. Five teams currently participating. https://www.theounce.org/lead-learn-excel/

2. Help Educators to Address Emergent Needs and Expand Math Learning

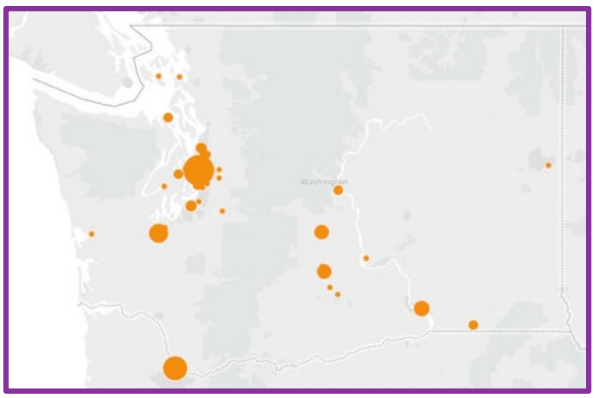
Educators and trainers/coaches commented that child socio-emotional needs take precedence in the learning environment. Many say they are a long way from feeling confident and successful in their math pedagogy, so could use help now. Suggested strategies include:

A. Create and increase training specific to social-emotional learning that focuses on executive function skills. The connection between mathematical thinking and executive function to support social-emotional learning can provide a natural progression to "math pedagogy specific" professional learning. This creates stronger alignment of school readiness with trauma-informed practices and school readiness.
B. Integrate more math pedagogy through executive functioning skills into Early Achievers coaching sessions.
C. Provide visiting math specialists to help educators see the math they are already doing and spur interest in learning more.
D. Expand availability of visiting behavioral specialists to address child socio-emotional needs, freeing teacher time for math.

3. Strengthen Rural and Remote Community Access

Most math-related training since 2016 is focused in a few places (Central Puget Sound, Vancouver, and Southcentral Washington). Distances between educators and training sessions can be long and online access can be limited. Suggested strategies include:

A. Partner with Washington Communities for Children to hold community math events.
B. Strengthen partnerships with local libraries focused on math activities and dispensing of math tools, games, musical instruments.
C. Equip "math vans" with travelling professionals and materials.
D. Prioritize high-speed internet access where early learning educators live to ease online access.
E. Start in these communities with peer cohort expansion.



Concentration of math trainings 1/1/16-9/11/18

Strengthen Cross-System Supports

1. Strengthen Data Collection About Educators, Trainers, Courses, Outcomes

Since MERIT and other data systems continue to develop and mechanisms to obtain data from educators and trainers are developing, many decisions are currently made based on partial or fragmented data. Suggested strategies include:

A. In addition to core competencies and learning objectives, add key topic areas to MERIT for all educators, coaches, trainers, and pedagogical instructional leaders to help target training (and marketing of training).
B. Develop a clear math pedagogy learning trajectory for educators that provides additional guidance to determine training levels with examples of existing content. For example – use of the Early Learning and Development Guidelines would be level 1 content, whereas OSPI math modules would be level 3.
C. Further define levels of content (1-5) and have trainers delineate training level more clearly. Rather than selecting a range of level, trainers select a specific level based on competencies and additional guidance.

D. Integrate shared specific math terminology for trainers to identify the specific math training focus and desired outcomes.
E. Find data share opportunities to combine data sets and have the full data picture for analysis. For example, MERIT tracks in-service training for licensed early learning educators but does not include all opportunities provided by Educational Service Districts or school districts that may be related to, and attended by, early learning educators.

2. Align Birth Through 8 Goals and Learning Trajectories

Professional development leaders in the early learning and K-12 system have been working together to create tools such as the math modules, so that all efforts are focused toward common goals. There is more that can be done to build on this. Suggested strategies include:

A. Aligned Messages – K-12 and early learning can work toward stronger consistent language and messaging for educators to increase communication and improve transition success for children and families. Our state can build on OSPI's Pathways in Numeracy and DCYF's Early Learning and Development Guidelines to develop companion guides aligning the two resources and offering supplemental guidance of their use together.
B. Shared Resources – Early learning partners can identify key resources for early math to promote. This includes key documents as well as tools and resources for professional learning and curriculum. Professionals will have a compilation of high-quality material that aligns with our state goals and standards.
C. Shared Approach to Professional Learning – While each community has unique needs and opportunities, there is a benefit to establish shared standards or expectations for early math professional learning. Research indicates the key components for success, some of which is outlined in the proposed model later in this report. Our state can align with the research to guide professional learning. This would involve time and capacity to investigate more thoroughly with multiple partners to identify standards. Additionally, our state can promote high-quality approaches such as Teacher Education by Design (TEDD) from University of Washington or the Early Math Collaborative at the Erikson Institute. Exploration of research would also include identifying these promising approaches.

3. Expand Partnerships with Agencies

Educators comment on how many changes to their work come at once from DCYF (WAC revisions, Early Achievers revisions, attendance training, etc.) and that adding more things can be overwhelming. Others say that they get conflicting guidance. Suggested strategies include:

A. Stage/sequence changing requirements and create flexible supports for educators.
B. Continue convening of the Early Math Coalition to align actions with state frameworks.

4. Reflective Workforce – Promote Cultural Competence, Linguistic Access

The early learning educator workforce is not reflective of the children in early learning settings and the trainer, coach, and instructor workforce is not currently reflective of the educator workforce they serve. This means that Washington is missing opportunities for cultural relevance of math activities that educators from similar cultural backgrounds might provide for children. It also reduces the availability of instruction in languages other than English. Suggested strategies include:

A. Develop math professional learning with a racial equity lens that includes opportunities to challenge biases and how we historically view math skill and success.
B. Use an asset-based approach based on cultural and linguistic knowledge in communities, ensuring content is developed in collaboration with community stakeholders to develop culturally responsive

math pedagogy. Ensure an emphasis on what children are capable of, addressing biases that impact teaching and learning, particularly those who are culturally and linguistically diverse.[3]

Professional Development Model

The Model

DCYF has developed its programs and support systems to promote individualized teaching and learning. The Early Achievers House is a reminder that a system of support for educators is a frame for the comprehensive supports they provide children and families. Extending this framework of a system of support, the following is a model for early math. This model incorporates the design principles noted in this report that focus not only on early math pedagogy, but – based on the research – on a comprehensive professional development system that can support educators in establishing a strong foundation on which they can build for math pedagogy and curriculum. The following model considers:

- Our system
- Educators
- Early learning organization administrators
- Coaches, trainers, and colleges

We considered the foundation needed and progression of professional learning for each:

- Supportive relationships and environments
- Foundational skills
- Child development
- Math pedagogy and curriculum
- Implementation and Specialization

When it comes to math, an early learning system should consider the many points at which educators could benefit from additional encouragement and support to be confident educators who in turn help children be confident and successful mathematical thinkers. This professional development research showed that some educators have the confidence and skills they need to succeed in teaching math, but many are missing practice in math pedagogy and foundational practices.

The model builds from a broad foundation focused on the cultural and individual attitudes necessary to succeed, and the systems that must be in place to all three groups of professionals. The individual paths of these three key workforce groups build from experiencing the environment and relationships, as educators move from basic skills through child development to math pedagogy. Ongoing implementation is also held by supports and resources that allow strong and continuously-improving practice.

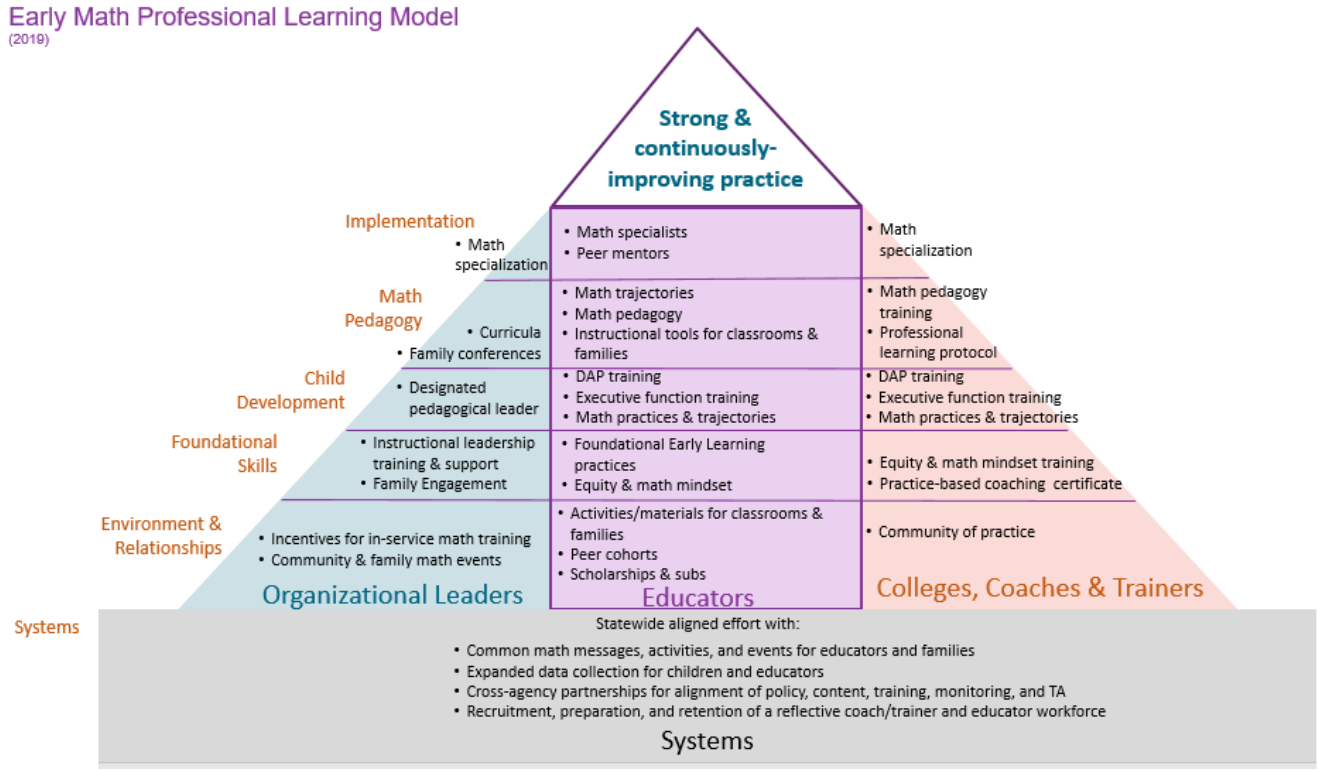
The model is designed to convey a central role of the educator in helping children to succeed, while acknowledging the key role that early learning organizational leaders and college instructors, coaches, and trainers play in supporting them. While truly center to a child's success is first and foremost the family, this

[3] Celedón-Pattichis, Sylvia & Peters, Susan & Lunney Borden, Lisa & R. Males, Joshua & Pape, Stephen & Chapman, Olive & Clements, Douglas & Leonard, Jacqueline. (2018). *Asset-Based Approaches to Equitable Mathematics Education Research and Practice.* Journal for Research in Mathematics Education. 49. 373. 10.5951/jresematheduc.49.4.0373.

model focuses on the professional development system of the workforce. It is important to note that family engagement is also key throughout this model.

The following model states opportunities where DCYF and partners can influence the systems that support educators. It also describes how a comprehensive professional development system with aligned content and professional learning supports provided for educators, early learning organization leaders, and coaches and trainers can build the foundation for optimal early math opportunities for children. This same model can address other priorities for the early learning workforce, such as dual language learning, early learning business practices, or trauma-informed care practices.

Supports that DCYF can provide for each educator group are noted at each level.



High-Quality Professional Learning

1. Integrated and Comprehensive

Research (Dunst, 2015) indicates[4] that combining training, coaching or mentoring/peer learning (relationship-based professional development), and time to practice and apply learning (job-embedded learning) has lasting results. These components should be combined (and aligned) to strengthen learning and impact of efforts. Often in our system these three components are offered parallel to one another, requiring intentional connection in content and focus to maximize outcomes.

2. Professional Learning Cycle[5]

Adult learners require an opportunity to:

A. learn new information and skills

[4] Dunst, C. J. (2015). Improving the Design and Implementation of In-Service Professional Development in Early Childhood Intervention. *Infants & Young Children, V28 – Issue 3, 210-219*

[5] Dunst, C. J.; Trivette, C. M. (2009). Let's Be PALS: An Evidence-Based Approach to Professional Development. Infants & Young Children, Volume 22 - Issue 3, p 164–176

B. have time to practice applying
C. reflect and make meaning of how it relates to their practice and
D. set their own professional learning goals.

This cycle of learning is a valuable feature in an approach to all professional learning.

3. Learning Trajectories[6]

We know that young children develop in a natural progression. Learning trajectories combine the importance of knowing the developmental path with:

A. naming a specific learning goal or expectation and
B. understanding how children develop on the trajectory;
C. a set of activities matched to the goal to support children's learning.

Ideally, our approach should be:

- *Provide information and support for pedagogical leaders*
- *Describe concepts, activities, and tools to educators so they have time to think about it*
- *Provide time for the concepts, activities, and tools to be modeled and then discussed in a group*
- *Provide time for educators to plan how they will integrate this into their day*
- *Facilitate regular peer learning conversations to build understanding and skill*
- *Provide ongoing coaching support*

– Trainer

This meaningful approach holds these three together to improve teacher practice. Educators understand how children develop and become effective at furthering development through questions and activities.

4. Whole-Teacher Framework[7]

Most professional learning has a strong emphasis on knowledge and skills for educators that occurs in a single one-time event. Historically, this does not provide significant lasting improvements to practice. The whole-teacher framework promotes all aspects of teacher development – addressing the dynamic relationship between:

A. attitudes and beliefs,
B. development of math knowledge and skills, and
C. improving classroom practice.

These three components influence one another and have the greatest impact when addressed simultaneously.

5. Equity and Mathematical Mindset

Many educators, coaches/trainers, and professional development system leaders emphasized the concept that historical use of math skill as a college gatekeeping mechanism and other societal attitudes about math have caused many educators to have negative experiences about and barriers to math success. As a result, misconceptions about what it means to be good at math – and consequently who can be good at math – unintentionally frame many adults' approach for introducing math to children. Intentional efforts to accurately label all the math that is happening, and to impact educator attitudes and confidence will need to be incorporated into all professional learning content. A statewide initiative that uses common messages about how math is everywhere and for everyone (much like we have done with literacy) will also form a stronger context for educators. This aligns with the Erikson whole-teacher framework to be sensitive to and address attitudes and beliefs. Additionally, research indicates that an asset-based approach 'leads to equitable practices grounded in the belief that students', families', and communities' ways of knowing, including their language and culture, serve as intellectual resources and contribute greatly to the teaching and learning of

[6] Clements, Douglas. (2016). Fostering STEM trajectories: Background & tools for action.

[7] Chen, J-Q., McCray, J. (2012). *A conceptual framework for teacher professional development: The whole teacher approach.* NHSA Dialog: A Research-to-Practice Journal for the Early Childhood Field, 15(1), 8-23. doi: 10.1080/15240754.2011.636491

high-quality mathematics.' Examples of asset-based approaches can provide guidance for equitable math learning. Educators focus on children's thinking and learning based on what they are capable of rather than a deficit, which also allows them to avoid biases.[8]

Educators

This professional research confirmed that there are many elements to educators being confident and successful as they help children to in turn be confident and successful in math. Importantly, they named a continuum of supports that DCYF and partners could provide to build a strong foundation and move continuously forward in math pedagogy.

1. Strengthened Computer and Technology Access and Skills

Online learning is an effective strategy for providing high-quality content and training for educators without training resources in their organization or their community. However, many educators have limited skills or access for computers and technology. These limited skills become a barrier (and additional stressor) to accessing online resources, tools, and content and using online training platforms. Addressing this need can increase the state's ability to support learning opportunities for professionals.

2. Strengthened Mathematical Thinking Skills

Many educators and trainers/coaches said that they had not done well in math and felt that higher math "passed them by." They also said that available math courses are at levels may not match their skills. Increasing offerings for using mathematical thinking in everyday settings in college courses and training offerings can help fill this gap. This might start with an understanding of mathematical concepts and processes and how they relate to whole child cognitive development and executive function. This can also help educators to more readily "see" math in the many places it happens naturally and go beyond numbers, counting, and shapes.

3. Strengthened Learning About Developmentally-Appropriate Practice

Most educators, trainers/coaches, and professional development system leaders said that many educators and coaches/trainers need a stronger foundation in child development before they can be effective in math learning pedagogy. Access to the Early Learning and Development Guidelines as well as creating supplemental guidance specific to early math learning can be a starting point as a state key resource. In addition, in-service training in developmentally-appropriate practice could be incentivized, Early Achievers coaching could prioritize DAP, and trainer/coach education could prioritize demonstrated competency in this area.

4. Strengthened Learning and Resources for Executive Function Skills

Because of the way that math development is tied to other areas of child development and the fact that educators say many children are experiencing socio-emotional challenges in the learning environment, foundational skill in meeting the social emotional needs of children is necessary. Socio-emotional development has a unique and powerful connection to early math development. The development of executive functioning skills – regulation, problem solving, and inhibitory control – sets a strong foundation for both social emotional and math development. In addition to increased professional learning opportunities, educators can benefit from individualized coaching about classroom organization strategies that respond to children's needs. These efforts can be coordinated with specific coach tools related to in-service content matched up for wrap-around support for educators.

[8] Celedón-Pattichis, Sylvia & Peters, Susan & Lunney Borden, Lisa & R. Males, Joshua & Pape, Stephen & Chapman, Olive & Clements, Douglas & Leonard, Jacqueline. (2018). *Asset-Based Approaches to Equitable Mathematics Education Research and Practice*. Journal for Research in Mathematics Education. 49. 373. 10.5951/jresematheduc.49.4.0373.

5. Strengthened Understanding of Math Development, Trajectories, and Pedagogy Scaffolding
Many educators noted that they do not know "what to do next" to help individual children keep learning in math, reverting to counting. Making content such as Doug Clements Learning Trajectories approach more readily available and pairing it with courses and training sessions in the pedagogy of scaffolding math development (including dispositions such as persistence, approaching a problem without fear, creative solutions, asking questions) can build the important platform for educators to work with what is happening in their learning environment.

6. Coaching, Peer Learning, and Support
Content that supports opportunities to implement math in everyday moments can build math learning and instruction within a child's day. This is not a stand-alone point of support. Rather, curriculum and instruction are built on the foundational knowledge of child development and mathematical concepts. Educator practice is more effective when it is built on a foundation of child development and in a supportive setting for educators to have time to practice. This often means connecting coaching and training so there is an opportunity to be reflective and intentional with planning. Similarly, job-embedded learning and peer learning communities provide opportunities for shared learning, collaborating on success and needs, reflecting on practice, and setting goals and action steps to apply learning. Peer learning can also help educators to draw on cultural norms and ideas as they apply to supporting children's math development.

7. Access to Materials, Tools, and Resources
Educators and those who work with them all expressed a need for materials, tools, and resources. This could be specific math education materials purchased for programs with guidance for implementation through training and coaching. Tools can also be activity ideas, conversation prompts, or props and resources to use with materials (such as a 5-frame). Resources might include videos of exemplary practice or demonstrating a learning goal and trajectory. Many of these are available, yet educators do not know of them. Some educators would benefit from guidance about how to use them or need supports and time for planning.

8. Access to Scholarships and the Substitute Pool
Educators have a lot of requirements and expectations relating to running their businesses, teaching and caring for children, engaging with families, and continuously improving quality. Most have little time to seek training and plan for implementation in their learning environment. Training and transportation costs, the need for a substitute while training, and the potential lost wages or lack of compensation for time attending training create additional barriers. Making training no-cost, providing scholarships/reimbursements, and increasing access to the substitute pool as well as compensation for time at training events can help to increase participation in training regarding ongoing math pedagogy.

9. Increased Access to Math Specialists
Educators noted that professional learning is heightened when paired with coaching. Coaches need specialized skills in early math learning to be better equipped to support educators in their targeted math-related needs.

Early Learning Organization Leaders

This professional development research confirmed that teachers benefit from professional learning more when they have strong and supportive leadership in their programs. Often, administrators may unintentionally create barriers for their staff. This may be for many reasons:

- Not able to prioritize resources.
- Needing their own professional supports in instructional leadership.

- Being focused on immediate business operation needs (adequate qualified staff, meeting licensing requirements and quality improvement goals, and other system expectations and standards).
- Need for understanding of trauma informed practices.

Successful supports for early math learning must address these issues. Given the many system resources invested in Early Achievers, efforts to promote early math will be most successful if they integrate with existing requirements, rather than creating an overlay. To build on what is in place, the professional development system should include the following elements:

1. Designated Pedagogical Leader

Instructional and pedagogical practice are best supported when a designated professional is charged with reflecting on the practice of educators in the organization and ensuring cycles of inquiry and action that enable continuous improvement. DCYF is beginning this practice in Early Achievers and ECEAP, but this research with Washington educators and coaches/trainers indicates that the whole system would benefit from an expansion into all early learning settings.

2. Specialized Training for Administrators

As noted above, administrators may inadvertently create barriers to educator math pedagogy. Because of their critical role in the success of a program and development of teachers, administrators and directors would benefit from specialized training highlighting the value of instructional/pedagogical leadership and improved math pedagogy to business operations. They also can benefit from connecting with peers who have similar needs. The Washington ECE Workforce Council is exploring recommendations to specialized qualifications and preparation pathways for program administrators and ECEAP has piloted Lead Learn Excel in some regions. Further implementation is needed.

3. Incentives for In-Service Training in Math

Because of the lack of training and planning time many educators experience and because learning happens best when embedded in the actual classroom context, many educators would benefit if more organizations could offer half/full-day in-service training in math development. Some of the additional foundational learning noted in this report could also be included in this in-service training, allowing more educators to quickly build a strong foundation. Creating financial incentives (such as a small grant program) or non-financial incentives (like making math an area of specialty) to provide more math-focused in-service training can accelerate action.

4. Funding Purchase Of High-Quality Curricula

When DCYF and private funders purchased high-quality curricula for all ECEAP programs over the course of a few years, it allowed DCYF to receive a bulk rate and align implementation training. Creating a process to start purchasing Creative Curriculum® for early adopters (like those who are seeking an area of specialty in math) and aligning training for different care settings can form a platform that can grow over time.

5. Engagement In Community And Family Math Events

One of the findings from the Thrive Washington Early Math System and Resource Analysis was that many communities hold events that promote math activity among families, educators, children, and community members. If DCYF plans community events with common messages and activities (like past Nurturing Children's Creativity and Born Learning events) or efforts like family reading night, DCYF could create some additional incentives/encouragement (e.g., free materials, games, etc.) for individual organizations to participate.

Coaches and Trainers

This professional development research confirmed that some coaches and trainers feel their lack of confidence in basic math skills gets in the way of their coaching at times. Others say they are knowledgeable about developmentally-appropriate practice, but greater skill in scaffolding to address children's math trajectories would make them more successful.

To build on what is in place, the professional development system should include the following elements:

1. Strengthened Basic Adult Learning Delivery for Coaches and Trainers

Parallel to educators and administrators, coaches and trainers need a strong foundation of adult professional learning on which to build math-specific content. The Coach Certificate is a way to further develop these skills. Our state can explore use and success of this pathway to determine how to promote and expand for coaches.

2. Strengthened Math Pedagogy Training for Coaches and Trainers

Trainers and coaches indicated that they would benefit from additional instruction in how to teach educators to do so. Including methods for calming or moving past educator math anxiety are also seen as important tools for coaches and trainers.

3. Math Specialization

Knowing that educators would benefit from specialized coaching on early math pedagogy, coaches need a specialization pathway that includes a targeted coaching protocol focused on math pedagogy. Professional learning to gain the knowledge and skills can be strengthened by tools and resources coaches can use specific to coaching math pedagogy.

4. Community of Practice

Just as we know educators benefit from peer cohorts, coaches need time and opportunities to learn from and with other coaches. Specific protocol and guidance related to math pedagogy can deepen practice and understanding for coaches in specialized math coaching delivery.

Systems

DCYF has many agency partners providing professional development services and supports and a math focus can be strengthened with them. Many of these organizations can play additional or strengthened roles providing the comprehensive and wrap-around support (training, coaching, community of practice, job-embedded learning) described in this evolving professional development model. This will be a successful endeavor with:

1. Equity

Math is approached with a willingness to challenge our historical assumptions about how to do math well and who is good at math, removing barriers, seeking the community and family cultural, and linguistic knowledge.

2. Alignment

Agencies are aligned and agree on the identified supports for educators and have a shared approach and expectations for delivery of high-quality professional learning.

3. Shared Framework

Agencies have a shared framework of roles, standards, and competencies that names the knowledge, skills, and abilities required for each role.

4. Adequate Funding
Agencies are adequately funded to provide these services in a consistent and coordinated delivery model.

5. Consistent Tracking
The system has a consistent and agreed upon method for tracking and recording accomplishments and communicating professional learning opportunities.

6. Shared Data
Data are available to explore for targeting improvements and focusing resources.

7. Shared Resources
Partners need to identify key resources for early math to promote and make easily accessible.

Conclusion

This research makes clear that there are many promising practices in place on which continuously improving pedagogy can be built. To realize the state's vision of all children ready for school and race and income no longer being predictors of readiness or success in math, there are many systems and structures to be strengthened. The highlighted strategy options noted in this report are a great starting place for Washington State to strengthen what is currently in place. The many and varied strategy options noted are also useful places for any partner to consider how their role in the professional development system might be adjusted to greater impact early math. It is, in effect, a bank of ideas for strategy and action.

As Washington continues to simultaneously build the early learning system and strengthen the educators who do the impressive work of supporting children's learning, the proposed professional learning model provides a useful view first of the philosophical underpinnings of our professional learning system, followed by the graphic which describes "what needs to be in place" at each level for success. The supportive roles of organizational administrators and coaches and trainers offer strong supports as the system elements support the foundation for all three of these important groups of our early learning workforce.

On the whole, this professional learning model (the what) and the conceptual framework (the how) can inform how we build a continuously improving cycle in math – and beyond. This model and framework can be applied to other areas of priority – trauma-informed care, multilingual learners, and more.

DCYF looks forward to using this report to continue to guide decisions about where to focus effort in the Washington early learning professional development system. The Washington Early Math Coalition can also use this report to inform priorities in its work plan.