MY SKY TONIGHT:

Summative Evaluation
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Introduction

My Sky Tonight: Early Childhood Pathways to Astronomy is a National Science Foundation funded Full-Scale Development project that was designed to support informal science education practitioner's ability to provide astronomy learning for young children ages 3-5 years. Based on prior research and assessment of the field, the project team identified that many informal educators lack the astronomy content, interpretive strategies, and confidence they need to effectively engage audiences of families with preschool-aged children. Three mechanisms were identified to address this need: 1) An Early Astronomy Toolkit for ISE practitioners that focused on what children observe on an everyday basis, 2) Professional Development Workshops to train practitioners to effectively use toolkit activities and materials, and 3) A Community of Practice to support capacity-building among educators in this area. Taken together, these deliverables formed a coherent approach to how early childhood astronomy can be characterized and delivered by Informal Science Educators.

The project team included: Astronomical Society of the Pacific—a recognized leader in astronomy education; experts in cognitive development; early childhood and astronomy learning professors from UC Santa Cruz, Cal Poly San Luis Obispo, and Pennsylvania State University; and four free-choice learning sites - the Lawrence Hall of Science, Children's Discovery Museum of San Jose, Discovery Space of Central PA and San Luis Obispo Children's Museum as sites for research, field- testing, and implementation. This highly experienced team formed an Action Research Group (ARG) to provide an intentional mechanism to support consistent communication across project stakeholder communities that was designed to ensure that research and practice-based knowledge equitably informed all aspects of the project. The implementation of the ARG resulted in the development of a robust research and practice partnership (RPP).

Research and evaluation activities were integrated with the design- development process of the project deliverables. For example: *Bear's Shadow* was an activity developed by ASP educators, field tested and refined at the Lawrence Hall of Science, and then utilized in research studies conducted in preschool and museum settings in Northern California and Central Pennsylvania. Findings from the research were then shared back with the core project team. Refinements were made to activity materials and implementation descriptions to maximize child engagement, opportunities to investigate

shadows, and relate this to the location of the Sun throughout the day. Iterations of design – development—research and refinement were applied to toolkit activities consistent with the spiral model (Evans et al., 2016). Once activities were completed, instructional videos were made to model engagement with science practices and strategies for educators to use with young children and their families. These resources were also used in professional development workshops in connection with presentations from researchers and ASP educators.

Over the course of the project, seven online professional development workshops were offered to ISE providers using a model adapted from the Astronomy from the Ground Up (AFGU) project (NSF award # 0451933). In each of the six-week My Sky Tonight sessions, approximately 30 participants were systematically introduced to early childhood development research, play-based learning research, science practices research, and astronomy concepts through the toolkit activities. Weekly webinars featured presentations from project researchers and were paired with mini-assignments (e.g. brief activities, observations and/or interviews with children and families) that encouraged participants to connect and apply these concepts with family visitors at their own institutions. Researchers worked closely with ASP staff to deliver webinars that emphasized how the design and recommended implementation of toolkit activities were supported by research findings. In parallel, the online discussion forum supported participants' reflections on assignments and webinar sessions and provided opportunities to ask questions of the project team members and their peers. With the exception of the weekly webinars, all activities were asynchronous to allow participants to determine when and how to best integrate this professional learning opportunity into their schedules. The overall pacing of the workshop was facilitated by ASP staff who monitored the work flow of assignments, posted questions and synthesized the responses on the discussion forum throughout the workshop. All participants were invited to remain connected during and after their individual professional development sessions through the Astronomy from the Ground Up web portal. Through this website, any educator who participated in the My Sky Tonight professional development could access webinar recordings, slides, activity descriptions and materials lists as well as post questions to the group for discussion or respond to questions and comments from others.

Through evidence-based activity development, professional development workshops, and the opportunity to engage in a community of practice, this project was designed to positively impact ISE professionals' knowledge of target astronomy concepts, awareness of how young children learn about astronomy concepts and practices through inquiry, interest in supporting young children and families engagement with astronomy learning experiences, as well as to build confidence and skill in delivering astronomy learning experiences (see full impacts table in Appendix A). This report will focus on evaluation data collected to measure project impacts and address the following questions:

1- To what degree did the Action Research Group process influence the project deliverables?

2- To what degree has My Sky Tonight produced materials and training resources that enable ISE professionals to provide high quality astronomy education experiences for young children and their families? In what ways could story narrative be used to further increase the impact of early childhood astronomy learning opportunities?

3- How do ISE providers choose to participate (or not) in an online community of practice during and after the conclusion of professional development workshops?

Methods

Q1: To what degree did the Action Research Group (ARG) process influence the project deliverables?

To address this question multiple sources of data were used to inform a mixed methods analysis. These included social Network Analysis (SNA) of virtual and in person meetings during years 1 and 2 of the project. SNA was specifically used to explore the following questions: What are the patterns of interaction in the My Sky Tonight team? What practices facilitate collaboration among team members? In addition, the team made a commitment to use an online project management tool called Central Desktop. This served as a shared virtual workspace for documents as well as a platform for online discussion. The evaluation included a review of Central Desktop interaction logs, alignment, and interview reflections on the impact of research and evaluation on design and development of toolkit activities and PD workshops.

In the final year of the project, team members who had formed this research to practice partnership (RPP) were interviewed at length, using the Discussion Guide in Appendix B. These individual team member reflection interviews were used to investigate how the *My Sky Tonight* team members were able to connect research and practice and to shape deliverables.

Q2: To what degree has My Sky Tonight produced materials and training resources that enable ISE professionals to provide high quality astronomy education experiences for young children and their families? In what ways could story narrative be used to further increase the impact of early childhood astronomy learning opportunities?

To address these questions, a mixed methods analysis was utilized. Information was collected and synthesized from sources that included: Pre/post online surveys that were distributed in connection with each professional development workshop; Observations of all professional development sessions (both in real time and through recordings of sessions); observations and guided reflections on storybook development sessions. In addition, the evaluators designed and monitored a set of tools to measure participant engagement with the online forum, workshop activities, and product implementation. A series of Case Studies was developed to further explore ISE professionals' learning and consider examples of the impact of these experiences on end users (children and families).

The Case Studies investigated:
1. What My Sky Tonight PD materials were used and whether this changed over time?
2. What changes My Sky Tonight PD experiences and materials made to participants' planning and program design?
3. In what ways have My Sky Tonight PD experiences and materials influenced early childhood astronomy within participating institutions and/or other educators?

Q3- How do ISE providers choose to participate (or not) in the online community of practice during and after the conclusion of professional development workshops?

To address this question both qualitative and quantitative analysis were applied to: Observations of interactions during the professional development sessions; participation in online activities and forums; individual and cohort engagement with webinars; post professional development surveys and case study reflections; patterns of engagement with additional professional development opportunities offered by the Astronomical Society of the Pacific and project partners.

Findings

Q1: To what degree did the action research group process influence the project deliverables?

This question considers the ways in which different stakeholder groups interacted with each other during the study period. In the first two years, the team's effort focused on two key areas:
1) conducting research related to how young children (i.e. 3- to 5-year-olds) engage with astronomical concepts and scientific practices, and 2) creating and testing toolkit activities to engage young children with astronomy. The social network data provided a snapshot of key points in time when the team came together and engaged in different aspects of the research-development cycle.

One of the most valuable aspects of studying the process of collaboration within a team is gaining an understanding of the essential elements that created an opportunity for success, and the challenges that created a barrier to that success. Social network analysis initially revealed that there were more active and detailed conversations within stakeholder groups (researchers engaging with each other) than across groups. The opportunity to recognize this early in the project timeline enabled the team to establish norms and expectations for communication that bridged these groups. This required team members to develop shared language and processes for effective collaboration. It also revealed the challenges and benefits of working in different time zones and on very different annual calendars. Most notable were the different patterns of project participation and how to best coordinate that with

other professional expectations (e.g. academic calendars; activity development calendars, museum calendars). One way these challenges were addressed was to have researches and developers connect with the museum partners one-on-one in order to serve as a conduit of information flow back to the project. This allowed the museum partners to balance their time and schedule while supporting the overall goals of the project. Additional face-to-face meetings provided critical connections and supported effective communication. This in combination with more frequent team calls allowed for better incorporation of the full range of stakeholders in the design, development, and implementation of project deliverables.

At the conclusion of the project, reflection interviews were conducted with all stakeholders. Analysis revealed that, consistent with an emerging framework for assessing RPPs, the My Sky Tonight project invested time in all five dimensions identified as central to successful partnerships: building trust, conducting and using rigorous research findings to inform action, supporting stakeholders in achieving their project specific goals, producing new knowledge that can inform educational improvement efforts, and building capacity for stakeholders to engage in authentic partnerships (Henrick et al., 2017). All stakeholders were in agreement that initial team building in years 1 and 2 was critical for the development of trust. During this phase, the group worked together to articulate how roles and responsibilities would be shaped by project goals. Shared language and priorities emerged from regular conference calls. In person meetings improved team cohesion through shared activity development and discussion of ways that research findings could explicitly shape the design and delivery of educational experiences. Museum professionals offered critical insights into the ways that context would impact patterns of activity engagement. When reflecting as a group and individually, team members commented that the social network analysis was able to "make visible" the patterns of interaction that were productive as well as identify potential problems early in the project timeline. This objective visualization allowed project members to identify where communication needed to be reinforced and to outline new strategies to address this need. The ability of the team to course correct in this way prevented the stakeholder groups from becoming isolated and encouraged more effective collaboration as opposed to the patterns of parallel research design and activity development that can sometimes be observed in large scale, complex projects of this kind. As one team member commented,

"It was very helpful to see how we were all connected and realize where more energy needed to be invested to make the best use of everyone's expertise".

Interviews also revealed that stakeholders were in agreement that research findings were instrumental in shaping the topics that activities focused on and the characteristics of the activities that were selected for inclusion in the kits. As one team member reflected, "Having the chance to interact regularly with the researchers gave me a better understanding of why we work with young children in this way". Several interviews referenced the importance of meeting and working in small teams on the design of new activities. When researchers, activity developers, museum educators, administrators, and local advisors were able to work together on activity prototypes in real time, the value of integrating multiple perspectives was recognized and embraced. As one team member commented, "It was great to have these different insights about which characteristics of activities were more likely to produce target outcomes based on the research". This meeting also furthered the development of a design matrix to help to define the selection criteria for which activities would be included in the toolkit. For example, in order to support authentic engagement with science practices, it was determined that additional activities were needed to provide children and their families with the opportunity to directly engage with science phenomena.

The professional development workshops were also directly influenced by the ongoing project research as well as activity prototyping. In the previous AFGU professional development model, child development and learning sciences research were not prominent features. However, since the design, development, and selection of activities in My Sky Tonight were all informed by research and practice insights, the professional development webinar sessions were restructured to present a balance of this information. As a result, in the final three professional development workshops, research findings, in conjunction with the activities, were highlighted by ASP staff and team researchers in 85% of the live webinar sessions. In addition, research was also explicitly highlighted in the educator guides associated with each of the activities. Project researchers collaborated closely with ASP staff to ensure that the research evidence that informed the design and development of each activity was accessible for all of the final toolkit experiences.

Analysis of the interviews suggested that research was also actively shaped by the project in two distinct ways. First, all of the research was conducted with activities that were in development by the My Sky team. In some cases, the research findings about the use and impact of an activity may have provided evidence that it was not well suited for inclusion with the other kit materials. However, it was also apparent during the reflection interviews that there may have been some activities that did not make the final cut for inclusion in the kit but had gone on to be effectively used and enjoyed in other learning settings. Second, the researchers consistently reported that their research interests and driving questions have been expanded through their experiences with this project. As one researcher commented, "*This project opened up a new and exciting line of work that was directly refined and accelerated as a result of my participation in this project*." Through lessons learned and professional relationships formed through this project, researchers have expanded their capacity to conduct studies and more effectively engage in research and practice partnerships. Finally, while less than half of the team members had participated in a research and practice partnership prior to this project, all commented that they would be interested in future work of this kind.

Q2: To what degree has My Sky Tonight produced materials and training resources that enable ISE professionals to provide high quality astronomy education experiences for young children and their families?

As one of the core components of the My Sky Tonight project, professional development workshops were designed to encourage and support informal science educators to bring the excitement of astronomy to pre-K children and their families. Each educator who participated received a free toolkit of hands-on astronomy activities designed for 3- to 5-year-old children that had been tested at multiple museums. The goal of the workshops was to provide educators with the opportunity to learn methods of engaging young children and their families in activities related to astronomy, including some of the stepping stones to understanding astronomical science, such as exploring near versus far, and observing how shadows change. Facilitated by the educators and activity developers at the ASP as well as the MST research partners, each workshop was six weeks in length and included both

synchronous and asynchronous elements that facilitated rich discussions among participants and facilitators. The workshops provided participants with the opportunity to engage with detailed descriptions of astronomy activities for preschool-aged children; receive an education toolkit with the materials needed for implementing the activities; develop content knowledge in astronomy; learn about strategies to successfully engage preschool-age children and their families; and receive membership in Astronomy from the Ground Up—an online community and support network of peers from all over the country that have participated in similar astronomy workshops for informal educators.

While there were seven total professional development workshops, the first four were conducted in conjunction with the active design and refinement of the toolkit activities. In addition, the structure and delivery of the professional development sessions was also being refined over this time to reflect the new knowledge being generated by project team researchers. The summative evaluation data included below reflects information collected from participants in the final three professional development workshops. Across these three sessions, there were 93 registered participants who represented 82 unique organizations including children's museums, nature centers, observatories, parks, planetariums, science centers, and other free choice science programs and educational outreach contexts.

Pre-Test Findings

In order to maximize the response to evaluation questions, the pre-workshop survey was associated with the registration process. The 93 respondents were asked to share information about the settings and learning opportunities through which they currently engaged with early childhood learners and their caregivers. Learning settings were coded into six categories: dedicated classrooms; early learner areas in museum settings; targeted/ stand-alone exhibits; planetarium; outreach programs conducted in schools/ community; no current engagement. Approximately 80% of ISE practitioners (*n*=74) across the three workshops engaged with early learners and their caregivers in more than one type of setting. The most common combination of settings included dedicated exhibition spaces combined with classroom programs and outreach. Unlike museum settings, the nature centers all emphasized the role of outdoor programs for this audience, often paired with classroom activities (e.g. stories and crafts).

The majority of participants (77%, *n*=72) described programs and activities that encouraged interaction between children and caregivers through mechanisms such as inviting parent participation, providing parent prompts, and requiring parents to attend programs. Respondents were much less likely to report that they offered exclusively child-only programs for the early childhood audience (4%, n=4). The same proportion of respondents reported that young children typically play on their own in exhibition or outdoor spaces while parents sit or stand to the side.

When asked what they would personally like to improve as a result of participating in the workshop (knowledge, skills, comfort level working with this audience), the majority of responses (96%, *n*=89) included the knowledge of astronomy and how to communicate it to an early childhood audience. In addition, there were nearly 50% (*n*=46) of responses that indicated that refining skills to facilitate learning with young children was a priority. For approximately 15% of respondents (*n*=14) they also specifically emphasized the importance of developing confidence in delivering activities with young children as part of their goals for this workshop.

Post Test

Following each professional development webinar, online surveys measured participants' assessment of the quality of the workshop design and delivery, explored plans for implementation, and whether they intended to participate in the online community of practice. All participants were invited and encouraged to provide feedback both at the final webinar session and through two follow-up email reminders. Online post-tests were collected from 74 participants across the three final workshops.

Workshop Delivery

Overall, participants were very positive about the workshop as a whole, as well as the individual elements of the workshop. As one participant commented, *"The activities backed up with research were really valuable. I appreciated learning how you had come to the final recommendations on how to run the activities. The videos that show the kids engaged were great as well. The webinars were the*

heart of the workshop for me - the activities are useful, but the information shared in the webinar gave me "a-ha" moments where I better understood the big picture and how it all fit together".

 On average, the majority of participants rated six of the components as excellent—selecting a 4 on a 4-point scale (Mean=4) and the remaining two components as good (Mean=3). Table 1 includes percentages for each component rating. The materials and resources provided, the overall workshop, and the overall organization and structure consistently received the highest ratings. In comparison, the workshop's webinars and forums received lower ratings. Participant's reasons for these elements being less enjoyable seemed to be related to participants' perceptions of their participation in the forums, as well as technology issues. The following comments illustrate this perspective:

> *"Everything was great for me, the webchats I marked down only because the video feed would have long delays most times and I'd end up hearing two people talking at once. Otherwise, excellent."*

> *"The workshop was a bit fast for me. There were SO many great resources I had trouble getting through all of them. The forum was a bit confusing and hard to follow."*

It is important to note the challenges with technology were reduced with each workshop as much as possible. However, the reality of technology limitations of non-profit and government supported positions was that many participants who would have liked to engage more fully with breakout peer to peer discussions were limited by connectivity issues and internet speeds/bandwidth, as well as older computers and operating systems. As one participant commented, *"It was at times difficult navigating the multiple video screens with typical government internet (which is iffy at best). Maybe there could be a voice only breakout discussion option for those of us who are dealing with bad internet and/or shared workspaces that would preclude us using video."* In addition, the workshop facilitators from ASP, as well as the researchers, increased their engagement with the forums, regularly asking follow-up questions to the online community which helped to seed additional interactions between weekly webinar sessions.

Table 1: Distribution of responses n=74 for "How would you rate the following components of the My Sky Tonight workshop?"

	Poor	Fair	Good	Excellent
Materials & resources provided	0%	0%	12%	**88%**
Workshop overall	0%	0%	23%	**77%**
Overall organization & structure	0%	0%	31%	**69%**
Overall content	0%	8%	31%	**62%**
Duration of workshop	0%	8%	31%	**62%**
Pace of workshop and activities	0%	8%	38%	**54%**
Workshop webchats	0%	8%	**54%**	38%
Workshop forums	0%	15%	**62%**	23%

Participants were also asked to reflect on the kinds of and distribution of learning opportunities available in the workshop. For this item they were asked to indicate which components they would have liked to see more of, the same amount of, or less of in the workshop. For approximately 80% (*n*=59) of the workshop components listed the largest percentage of responses indicated that they wanted "the same" amounts of the activities provided (see Table 2, for the list of activities). This pattern of participant responses suggested that the design of the workshop offered a good selection of learning opportunities for the majority of participants. As one comment summarized, "*Great balance of activities, information, research, and ability to chat with other participants.*" The activities that the majority of participants wanted to see more of were hands on activities/demos of the activities and videos of children engaged with the science activities in the kits. In addition, this item also revealed that approximately 30% (*n*=22) of participants wanted more: interactions with other participants, interactions with workshop moderators, readings about developmentally appropriate practices, discussions of science practices, and the readings about the science connected to the activities. Approximately 15% of the participants (*n*=11) indicated they would have preferred any of the workshop components reduced. These preferences seemed to be directly related to personal

experience. For example, those with more familiarity with young children felt there could be less discussion of developmentally appropriate practices. As one participant commented, *"Your activities are wonderful and will be very helpful!! I would have rather spent more time discussing each activity more and less on the psychology. I already understand pretty well how children think and experience things.* In contrast, those with less familiarity with early childhood audiences appreciated the inclusion of the research. One participant commented, *"It was so helpful to hear the findings about what children can do with these activities. Knowing that [research] gives me more confidence to work with this group".* Interestingly, there was no correlation between institution type and whether participants indicated a desire for more, less, or the same amounts of the workshop learning opportunities.

Table 2: Distribution of responses (n=74) for "Which of the following workshop components would you have liked to see more, less or the same of during the workshop?"

	Less	Same	More
Live web chats	0%	88%	12%
Moon observations	15%	81%	4%
Forum Discussions	15%	81%	4%
Interactions with other workshop participants	0%	73%	27%
Interactions with workshop moderators	0%	69%	31%
Discussion of science practices	4%	65%	31%
Reading about developmentally appropriate practices	8%	65%	27%
Discussion of developmentally appropriate practices	12%	65%	23%
Discussion of science related to the activities	8%	62%	31%
Reading about science related to the activities	0%	58%	42%
Reading about science practices	4%	58%	38%
Hands-On Activities / Demos	0%	35%	65%
Videos of children engaged with the activities	0%	27%	73%

Based on these responses, it seems that the key areas in which the workshop could be improved is in increasing the practical components of program delivery. These findings reinforce the importance of pre-assessment to best align the proportion of workshop components to the professional development needs of the participants.

How to Improve the Workshop

Through a combination of open-ended items participants provided feedback and suggestions for ways to further refine the workshop experience. Interestingly, 30% (n=22) included requests for more astronomy across the three workshops. Additional suggestions were less clustered—some were interested in less details about developmentally appropriate practices or more emphasis on science practices. These requests seemed to be related to personal prior experience—e.g. those with familiarity with astronomy were more eager for strategies for working with early childhood audiences, while those who were more comfortable with young children and families were often more interested to hear about how to expand the astronomy content and concepts.

Some suggestions were more structural:

> *"It seemed that many participants had great questions for the workshop moderators about specifics of implementing the activities. It would have been nice to have more time for Q&A either at the end of each webinar or perhaps during an additional webinar at the end of the workshop."*

> *"Maybe offer a way to schedule a recorded showing of the webcast so people who missed the live chat would have the chance to watch the recorded chat with others who missed it and be able to discuss it with them instead of watching alone if they missed it?"*

> *"As someone with very little knowledge of the moon phases, I found the daily moon observations hard and it did not help that the weather was often cloudy so I could not see it at all. I think some discussion/ information at the beginning of the program about the moon phases would have been useful."*

"I haven't really used the write-ups yet--shorter forum questions and threads might be nice as it takes a while to answer the questions and I often get interrupted both at work and at home. I think the participants needed a little more scaffolding for what is most useful to post. I like the less academic posts and more personal experiences or questions."

Other suggestions were more conceptual—either focused on topics for children or on participant knowledge:

"There was very little about the stars. I know there is only so much you can fit in the time, and where you are changes the stars you're looking at, but it's a very popular topic. The workshop is My Sky TONIGHT and half of the activities are about the sun. I loved those too, so I wouldn't want them cut, so I don't know a good solution, but I was disappointed by the lack of stars."

"I would love to have an activity right at the beginning of the program about the planets- a way of introducing children to the solar system and planets.

"More science, though it's not developmentally appropriate for us to teach it to that level to the kids, I still feel like I need to know more, in order to better present it"

When asked what they found most useful about the workshop, the majority of responses emphasized the importance of the activities and materials (52%, *n*=38).

"I found the fully-developed astronomy activities the most useful/helpful part of the workshop. I would have avoided astronomy related topics completely if you didn't provide the full-fledged program. I also really enjoyed observing the children/educators conducting the programming."

"The activities and the way to engage children in new ways. The way to guide them to make observations without just "teaching" them about information."

This was followed closely by the importance of learning about strategies for engaging with children and research behind those strategies (40%, *n*=30).

"I think Jennifer's presentation on DAP and Maureen's on working with families were great! I think I have a different (maybe more stringent) definition of what constitutes a model and so some of that content didn't work for me. I found it very useful to hear about the research on children's interests in astronomy as well, and I know I will refer back to the write-ups for both basic science content and how to do the activities."

"I found the information on developmentally appropriate practices extremely helpful. I believe the practices I learned (once practiced to where I no longer have to think about it but just do it) will be extremely helpful in interacting with children of all ages. And this will also improve the amount of information the child will take away from the programs since they are the ones forming hypothesis and conclusions instead of just being talked at."

"I had not always thought about some of these items, such as modeling, when I did programs. I may have been doing it without realizing I was doing it. The training really helped me see how I can better work with this age group."

In addition, the activity videos themselves were also specifically mentioned as being useful (20%, *n*=15).

"Seeing the activities actually presented in real life settings was the most useful. I loved it."

"Having the ability to watch the videos (lessons) gave a clearly understanding on how to form my own programming. The materials make it possible to carry out the programming. Having someone explaining the research about children's thinking makes it better able to write a program. This program also helped with my understanding as well. I feel better prepared to explain to children."

Interestingly, the activity write-ups/ lesson plans were highlighted less often in comments. It is possible that references to the activities included the write-ups implicitly. However, in another item that asked specifically about the activity write-ups, participants were overwhelmingly positive about the quality and value of the write-ups. For example:

"I shared them with staff that had not participated in the webinar. They were able to understand the activities well. I think that is a clear indication that they are well formatted and written."

"I think the formats are great I like the Set-up and Activity first and the background information last. I love the extension that adds more that you can do or pair up with this lesson."

"I really appreciate the thorough write-ups. I feel confident giving these as-is to one of our floor staff, knowing that they have what they need to run the activity successfully."

Impact of Workshop on Knowledge, Skills, and Confidence

Participants were asked to complete a set of rating scale items to indicate their perceived gains in knowledge as a result of the workshop. For each item, participants were asked to provide two ratings: their knowledge prior to the workshop and their knowledge following the workshop. They used a seven-point scale where 1= not very knowledgeable and 7= very knowledgeable. Paired *t*-test analysis

indicated that there were significant gains across all knowledge items p<.001. Table 3 includes the distribution of percentages and counts for each concept rating following the workshop.

Table 3: Distribution of responses n=74 for __knowledge__ of each concept following the workshop.

Knowledge about:	1: Not Very Knowledgeable	2	3	4	5	6	7: Very Knowledgeable
Child development for 3-5 year old children	0%	0%	0%	8%	12%	42%	38%
3-5 year old children's ability in astronomy	0%	0%	0%	23%	35%	31%	12%
3-5 year old children's interest in astronomy	0%	0%	0%	12%	35%	35%	19%
Moon phases	0%	0%	8%	4%	32%	20%	36%
Tools used by astronomers	0%	0%	7%	8%	38%	31%	15%
Position of the Sun, Moon, Stars change over the day	0%	0%	0%	19%	19%	27%	35%

Given the emphasis in the pretest on knowledge gain as a key reason for attending this workshop, this suggests that participants' expectations were being met. On average, the participants felt they had improved their knowledge of working with early childhood audiences and astronomy topics. However, depending on the balance of early childhood educators and those who were more familiar with astronomy the specific content of the webinars was adjusted accordingly. Despite these efforts, some comments in each session indicated that the distribution of child development to astronomy content was not a perfect match for all participants.

"I was not expecting the webchats to be focused on child development. I see how they connect when using Astronomy topic lessons, but the content was heavy on the child development side."

"I've improved a lot of my knowledge level about child development, but I feel I still need to practice with groups of children, and that there will be some surprises for me."

"I found a lot of the discussion in the webinars very helpful to increasing my understanding. The very first webinar discussing children's views and understanding of the earth's shape was quite beneficial."

To ensure that all educators had access to more in-depth astronomy content as well as child development information, the activity write ups included expanded sections with more detailed information than could be included in the webinars.

Participants were also asked to complete a set of rating scale items to indicate their perceived gains in their confidence with the skills presented as a result of the workshop. For each item, participants were asked to provide two ratings: their confidence with the skills prior to the workshop and their confidence following the workshop. They used a seven-point scale where 1= not very confident and 7=very confident. Paired *t*-test analysis indicated that there were significant gains across all confidence items p<.001. Table 4 includes the distribution of percentages for each topic rating following the workshop.

*Table 4: Distribution of responses (n=74) for the development of **skills** following the workshop.*

Skills in:	1: Not Very Confident	2	3	4	5	6	7: Very Confident
Developmentally appropriate strategies for engaging 3-5 year old children	0%	0%	0%	4%	19%	31%	46%
Developmentally appropriate strategies for engaging 3-5 year old children in science activities	0%	0%	0%	8%	16%	48%	28%
Facilitating astronomy conversations with 3-5 year old children and their families	0%	0%	0%	8%	32%	52%	8%
Facilitating astronomy activities with 3-5 year old children and their families	0%	0%	0%	8%	23%	50%	19%
Guiding 3-5 year old children to engage in the science practice of observation	0%	0%	0%	8%	15%	50%	27%
Guiding 3-5 year old children to engage in the science practice of using tools to gather info	0%	0%	4%	4%	23%	42%	27%

As the quotes below suggest, on average participants reported improved skills and increased confidence for working with early childhood audiences while engaging with astronomy topics and science practices.

"I appreciated how intentional all of the activities were on capturing the different goals such as using tools, making models, creating explanations and exploring. These activities have helped me think of other activities that I have developed and given me ways to make adaptations to create richer activities."

"Definitely feel more confident about working with youngest children"

"I like getting down on the level of younger kids. We've just never had the curriculum to address such a young age, but now I do!."

However, there were a few additional comments that reflected participants concerns about using these approaches with young children. Identifying mechanisms for additional practice might help to further support practitioners who have these persistent concerns.

"Knowing what the skills are [it] is different from actually using them in the moment when working with children. I still need to practice what I've learned."

"I have talked individually to only a few 3-5 year-olds at this point. I think that confidence will come with actually doing."

Participants also completed a set of ratings to indicate their perceived gains (or loses) in confidence when working with young children and their families. For each item, participants were asked to provide two ratings: their confidence prior to the workshop and their confidence following the workshop. They used a seven-point scale where 1= not very confident and 7=very confident. Paired t-test analysis indicated that there were significant gains across all confidence items p<.001. Table 5 includes the distribution of percentages and frequency counts for each topic rating following the workshop.

Table 5: Distribution of percentages for confidence level related to each topic following the workshop

Confidence with:	1: Not Very Confident	2	3	4	5	6	7: Very Confident
Answering astronomy-related questions	4%	4%	0%	23%	31%	23%	15%
Talking with 3-5 year old children about the Moon's phases and why they happen	0%	0%	8%	23%	35%	27%	8%
Talking with 3-5 year old children about space exploration	0%	0%	0%	8%	46%	27%	19%
Talking with 3-5 year old children about shadows	0%	0%	0%	4%	19%	50%	9%
Talking with 3-5 year old children about day vs. night	0%	0%	0%	4%	27%	42%	27%
Talking with 3-5 year old children about the sky	0%	0%	0%	4%	42%	31%	23%
Guiding 3-5 year old children in the use of binoculars	0%	4%	0%	12%	19%	23%	42%

On average the cohort reported increased confidence for working with early childhood audiences while engaging with astronomy topics and practices. However, there also seemed to be interest in engaging with more astronomy content during the workshop. For example:

> *I would have enjoyed more information about astronomy in general. I felt we spent a lot of time focusing on how to relay the information to the children. However, I needed to know more about the information in order to help the children learn.*

Again, once I've had a chance to run the activities and practice the skills, I'll be more

confident in these things.

Statements such as these highlight a fundamental issue in developing confidence in delivering astronomy programs for early childhood learners. These individuals need opportunities to practice engaging with these audiences, while also having the opportunity to deeply engage with the material themselves.

Implementation

Participants were enthusiastic about the majority of the activities in the kits. When asked, "How likely are you to use each of the following activities at your venue?" the four activities that were most frequently selected were: *Bear's Shadow; Hide and Seek Moon; Lunar Landscape; Creating Craters*. Consistent with this prediction, activity feedback forms indicated that *Bear's Shadow* was the most popular activity and was used across all sites that reported back on their use of the kits. Hide and Seek Moon was used by over 80% of the participants who provided activity feedback and was also considered to be highly successful at engaging young children and their families.

Participants were asked to describe the key challenges to successful implementation of the activities and skills learned from the workshop. The three most frequently mentioned challenges were: finding dedicated space for the activities, preparing additional staff to use developmentally appropriate strategies with these activities, and, more generally, engaging this age group with these concepts. Here are some examples of challenges to implementation:

"Providing enough guidance and training on DAP for our floor staff to engage this age

group in the best possible way. We currently employ mostly people with high levels of

science knowledge but not necessarily tons of experience with young children."

"Teaching this to my co-workers and having them buy into it. They may adapt and

change things around a bit to suit their teaching styles."

"Our space is pretty small and we have to work around field trips and birthday parties to get the open room."

Interestingly, many educators emphasized the importance of being able to *customize activities across settings*. For example, one educator emphasized that at her setting they were able to be "*very flexible and adapt to the size and ages of the family group*." While other educators consistently stressed the value of having the time to complete the activities. Participants commented on how helpful it was to have variations and suggested adaptations included in all of the write-ups so that individual educators could adapt the activities to both their own setting and the time available for their program. One participant commented, "*In preparation to conduct these activities all I need to do is read over the guides and watch the videos and I have all that I need to have a great interaction with our family visitors*."

Activity implementation feedback forms were requested from all workshop participants within three months of finishing the webinar. Completed forms were collected from approximately 40% of participants. Based on the forms that were returned, materials and strategies provided through workshops were consistently used to enrich existing programs or support new opportunities to engage young children in astronomy learning experiences by participants.

Case Studies

Three case studies were conducted with My Sky Tonight professional development participants to better understand the following questions:

1. To what extent have the MST PD materials/ strategies have been used and did this change over time?
2. What changes did MST PD and materials make to participants' planning and program design?
3. In what ways have MST PD and materials influenced early childhood astronomy within the institutions and/or other educators?

Case study participants represented a state park, a children's museum, and a natural history museum. Based on the diversity of the sites, educators chose to reflect on My Sky activities that best met the needs of their visitors, in their unique learning contexts. Interestingly, some of the patterns of activity implementation were consistent. Most notably, all sites used *Bear's Shadow* and at least one of the Moon Activities: *Hide and Seek Moon* or *Moon Phase Matching*. More details of the specific patterns of implementation are described below.

State Park Nature Center

At the Nature Center, they chose to regularly use the My Sky Tonight activities in connection with existing programs, where families had already signed up for outdoor explorations or guided experiences. This educator reflected mostly on her use of the Day/ Night activity, and how effective the UV beads were for talking about astronomy content while touring the park. The educator reflected that the children, in particular, were excited to talk about activities that happen during the night and the day, as well as the different animals who are awake in the day and night. Children and their families were also highly engaged with making shadows and finding the shadows of others. This educator also commented that the UV beads were an excellent tool for inquiry and discussion. Children were often surprised at how the beads reacted to the light and what materials actually offered protection from the sun.

Overall, staff at this site were very comfortable talking about astronomy but *were less confident about using developmentally appropriate strategies*. When additional training was provided to staff, the focus was on how to support science practices with the youngest family members in the family groups. The My Sky Tonight materials and activities became regularly included in programs as a way to directly engage younger children. After receiving the kit, and completing the training, this case study site created opportunities in most of their family programs to engage these young visitors. Bears' Shadow became a regular feature in the wildlife education center and became associated with different daytime animal species. At the end of the workshop series, the educator remarked that "*All of the activities have taken some work to adapt, but it has been great to see how excited young children are*

to explore the UV beads and shadows and talk about what they notice with educators and their parents and siblings."

Children's Museum

At the children's museum, they chose to primarily use the My Sky Tonight activities with drop in family programs offered 1-2 times per month. For each of the programs, the family experience would start with a story time and then transition to engagement with the activities. According to the educator, *Bear's Shadow* was one of the first activities they used, and it was highly engaging and successful for all of the families who attended. Having the book already identified made it very easy to use in a way that was familiar to the museum, staff, and family visitors. Moon Phase Matching was also very well received and sparked great conversations with families about what the shapes of the moon looked like and when they had seen moons in different phases. Another week when the educator carried out the *Hide and Seek Moon*, she found children were excited to share that they had seen the "Blood Moon" in the sky and that sparked a great conversation about different "types" of moons children had seen before like "Blue Moons" and "Harvest Moons". *Creating Craters* also was a favorite, children were highly engaged and asked many questions—some that educators did not know how to answer, particularly about craters on the actual moon.

Over time the astronomy programs became very popular and it was necessary to train more staff on how to set-up and facilitate these experiences. Overall, staff were very comfortable interacting with families and using developmentally appropriate strategies, but some staff felt less confident about explaining some of the astronomy content. Therefore, the major focus of the training, especially for part time staff, was on delivering and understanding the astronomy information. The My Sky Tonight materials and activities became regular drop in offerings at the museum. In addition, after receiving the kit and completing the training, this case study site created a summer astronomy series structured around the My Sky activities and resources in 2017. It was so successful, it was repeated in the summer of 2018 and was once again very well received. The museum educator commented, "*Without the materials and training from this project, I do not think we would have developed an astronomy*

program like this. It's been a great addition and it's clear that our visitors and members enjoy it!" This site expected to continue offering the summer series as well as the drop-in programs.

Natural History Museum

At the natural history museum, they frequently used the My Sky Tonight activities with an early childhood education program that met twice a week. Similar to a pre-school like setting, the young children and their caregivers (often parents or nanny's) come to the museum to engage in 2 hours of programing for an eight-week time period. For each of the programs, the family experience would start with free play activities, followed by a circle time and a book reading, and then an exploration of an exhibition at the museum. *Bear's Shadow* was the most popular activity for this program. The educator shared that she felt it was highly engaging and successful for all the families who attended. The book and the story cards made it easy to carry out an activity in a way that was familiar to the staff, children, and caregivers. The educator felt *Moon Phase Matching* was useful in sparking great conversations with families about what the shapes of the moon, while *Hide and Seek Moon* and *Creating Craters* were highly successful as station activities facilitated mostly by caregivers. As with the children's museum, children became deeply engaged in this activity and asked many questions—some relating to the Earth's Moon craters, that educators did not know how to answer.

All three case study sites indicated that their astronomy programs had increased in popularity after using the My Sky Tonight activities and they have added additional events and programs so more families can experience these activities beyond the initial plans they had shared through activity feedback forms like a single week of summer camp or weekend family workshops.

Q3: How do ISE providers choose to participate (or not) in the online community of practice during and after the conclusion of professional development workshops?

Patterns of participation and engagement with activities and resources were consistent across the professional development workshops—both those designated as part of the formative refinement phase and those designated to be included in the summative evaluation. Initial levels of participation in

all of the workshop activities were above 90% during the first two weeks. For example, participants posted introductions on the forum, attended the webinars, shared initial stories about their experiences with observing the sky, and posted feedback on initial workshop assignments including making moon phase observations and conducting initial interviews with children about astronomy topics like the shape of the earth. However, there was also a predictable dip between weeks 3-5, when completion of assignments, posts to the forum, and participation in the online webinars would reduce to 65% or less. Once these patterns were noted in formative assessment, ASP staff used tools to actively monitor activity completion and forum engagement. When participants showed signs of disengagement (missed posts or absences from the webinars), email follow-ups were sent. Through these efforts, participation in the online forum was maintained throughout the summative evaluation sessions at 84% -- significantly higher than formative sessions.

Participation in the forum was primarily driven by the completion of specific assignments and target questions for reflection from ASP educators. Active discussion and commentary between participants was less common and when it did occur it was often as a result of ASP facilitators making connections across posts and posing follow-up questions. This pattern of interaction is consistent with literature on communities of practice and online forums that suggest that active moderation (over 20 hours per week) is the average investment needed to maintain productive online conversations (Blakenship, 2007).

Given that there is consistent interest in professional development for early childhood astronomy, and solid engagement with workshops when they are offered, there is good potential for this group to become a community of practice. The majority of participants expressed interest in future engagement with the ASP and the community of educators that they encountered during the professional development experiences. In the final year of the project, webinars and a mini-PD course were offered to the community. Each time, there was an enthusiastic response with the average registration for these online events $n=76$ interested participants. However, actual participation rates in these events in real time are significantly lower $n=30$, though analysis of webinar views suggests that additional educators may be engaging with the materials on demand after the live sessions.

During webinars and mini-PD sessions offered in last year of the program, participants offered unprompted endorsements of the tool kit activities and the quality of the full training. This suggests that ASP is a trusted source for providing professional development that ISE educators appreciate. In addition, this finding echoes quantitative patterns observed in the post-workshop survey data. Over 90% of participants in My Sky Tonight professional development report that they are interested in additional professional development from ASP, with the majority indicating that they would like to see shorter than six week workshops and webinars offered. It is likely that with a higher frequency of shorter PD experiences, a core of participants who regularly attend might further establish a community of practice around early childhood astronomy education.

Formative Testing (Prototyping) of *Breakfast Moon* Book and Activities

The My Sky Tonight team receive supplemental funding to explore the role of storybooks in supporting children's engagement in science practices, an interest sparked by the success of the *Bear's Shadow* activity, which includes a reading of storybook. The team prototyped a children's storybook, Breakfast Moon, based on the research developed in this project. A process of prototyping served to describe the experiences and reactions of young children and their caregivers to *Breakfast Moon* in order to inform the development of the book. *Breakfast Moon* was read to diverse groups of young children at multiple preschool and museum sites. The story took an average of 15-20 minutes to read, with a related activity following the story, that was also 15 minutes in length. The process was iterative, with a series of 3 studies, each testing at 3 unique sites (for a total of 9 sites), considering the results, altering the story and the illustrations, and then repeating the prototyping process. Detailed memo reports were shared by the evaluators with the project team to inform each successive iteration. A report summarizing what was learned from each phase of testing can be found in Appendix C. The final book is the result of input from researchers, and audiences of adult readers engaging preschoolers, as well as observations of the childhood learners themselves.

Conclusions

The My Sky Tonight team successfully maintained a research and practice partnership. Initial investment in team building in years 1-2 was critical for the development of trust and shared language

across stakeholders. Research findings and activity field testing informed the creation of a design matrix that guided selection of materials and activities to include in the final kits to effectively engage young children in astronomy learning experiences. There is clear evidence that the team was able to articulate a shared problem of practice and use the available team expertise to address it through the development of high quality activities, training materials and research findings.

Analysis of professional development workshops and case studies suggest that the materials and training resources have been highly effective in empowering educators to offer more astronomy learning experiences to young children and their families. Workshops were able to meet participants where they were and generally meet their needs whether it was for additional astronomy content, strategies for working with young children, or a combination of both.

Based on the consistent interest in professional development offerings, it seems that there is the potential for a community of practice to become established around early childhood astronomy education. Analysis of the patterns of interactions among the My Sky Tonight participants suggests that despite high interest, the formation of a true community of practice is in its very early stages. With active support from ASP this community could become more robust and potentially self-sustaining, but significant efforts would be required.

Implications for the Field

1. Despite the early skepticism expressed by astronomy educators, this project demonstrated that well-trained ISE practitioners can effectively engage preschoolers in authentic science practices that serve as the foundation for astronomy and many other fields of science.
2. Professional development was very effective at increasing both conceptual knowledge of astronomy and practical knowledge of working with preschoolers.
3. Research-Practice Partnerships can be very effective tools in both professional learning and project development if a strong sense of community is built in initial stages, and sustained through regular interactions. Individual professionals learn much from each other and the project is richer as a result of these multiple perspectives.

4. To engage a professional group online requires commitment and investment. Explicit mechanisms and facilitation are required to successfully support continuous online learning and exchange. This group is well positioned to serve as a model of how to cultivate an early community of practice around a shared need in the field and with further investments could continue to be a successful professional resource in this area.

Citations

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Appendices

Appendix A: Impacts Table

Appendix B: Data Collection Instruments

Appendix C: *Breakfast Moon* Formative Evaluation Summary

Appendix A: Project Impacts Table

ISE Category	Impact Statement
ISE PRACTITIONERS will:	
Knowledge, Awareness, Understanding	Increase their knowledge of target astronomy concepts and processes. Increase their awareness of how young children can learn about astronomy through inquiry. Increase awareness of astronomy practices that are accessible to young children and families. Increase understanding of how to adapt astronomy activities for young children and families.
Interest	Increase their interest in encouraging young children and their families to explore target astronomy concepts and processes.
Attitude	Increase confidence in using inquiry based communication strategies during astronomy activities with young children and their families.
Behavior	Encourage and participate in learning opportunities that support young children and their families' use of inquiry-based communication strategies.
Skills	Develop and use strategies to engage young children and their families in astronomy learning experiences that encourage inquiry.

Appendix B: Research - Practice Partnership Team Reflection Interview Protocol

Introduction:

Thank you (<u>interviewee name)</u> for making time in your schedule to speak with me. In our conversation today the primary goal is to reflect and document your perspective on the research and practice partnership (RPP) and to consider how the RPP influenced project deliverables (the tool kit activities, professional development webinars, activity guides, project videos, and research). At the beginning of this project, we referred to the team as the action research group (ARG) however, given that we have operated as an RPP, with shared goals informed by both research and practice, it seems appropriate to assess this collaboration informed by the RPP literature.

As we move through the questions there may be some that are less relevant to your project experience. If that is the case, please feel free to let us know so we can devote more time to other questions.

Finally, we would like to record this interview. Do we have your permission to do so? Many thanks— let's begin.

1- How long have you worked on the My Sky Tonight project?

2- Please describe your role in the My Sky Tonight project?

3- What were your primary responsibilities on the project?

4- How well did you know the other members of the project team before the project started?

    a. How has the project influenced pre-existing relationships (if at all)?

    b. In what ways has the project supported new relationships (if at all)?

    c. Who did you work most closely with during the project?

5- What were your goals for participating in the project? How did those goals relate to the shared outcomes of the project?

6- What do you think were the most important team activities for building trust in this RPP?

7- In what ways do you think the RPP worked well together?

8- What were some of the challenges of working in this RPP?

9- Do you think the RPP influenced the tool kit activities?

    a. If yes—in what ways?

    b. If no—why not?

10- Do you think the RPP influenced the professional development workshops?

    a. If yes—in what ways?

    b. If no—why not?

11- Do you think the RPP influenced the research?

    a. If yes—in what ways?

    b. If no—why not?

12- How has the RPP changed over the time period that you were involved?

13- Have you participated in other RPPs?

    a. If yes, please choose one and describe how My Sky Tonight was similar or different from others that you have worked on

14- How has your experience on this project influenced the way you think about RPPs? Your own work? How you might choose to engage with a future RPP project?

15- Is there anything else that you would like to share about the experience of working on the My Sky Tonight project?

Appendix C: Formative Evaluation of *Breakfast Moon* Story Book

Prepared by Sasha Palmquist, Ph.D. and Monae Verbeke, Ph.D.

Summarized by Judith Koke, Institute for Learning Innovation

The evaluation described in this appendix served to describe the experiences and reactions of young children and their caregivers, in the first iteration of the *Breakfast Moon* storybook (prototyping) in order to inform the development of the book and its related activities. *Breakfast Moon* was read to diverse groups of early childhood learners, at multiple preschool and museum sites. The story took an average of 15-20 minutes to read, with a related activity following the story, that was also 15 minutes in length. The process was iterative, with a series of 3 testing / revising iterations, each testing at 3 unique sites (for a total of 9 sites), considering the results, altering the story and its illustrations, and then repeating the prototyping process. The following report summarizes what was learned from each phase of testing. The final book is the result of input from researchers, and audiences of adult readers engaging preschoolers, as well as observations of the childhood learners themselves.

Testing Round One

The first round of testing set out to address three general goals that relate explicitly to the story

    a. What are the conceptual connections children make with the changing shape of the moon over time, including providing opportunities to observe and discuss the moon phases?

    b. Did the story components encourage caregivers/teachers/parents to engage with children during the story.?

    c. To what degree does the story hold the attention of the children?

From the observational sessions, we determined there were several sections of the book that provided opportunities for children to observe, discuss, and connect with the material. Children enjoyed being able to identify the correct shape of the moon, as well as the ability to connect those shapes to other familiar items. When children were unable to observe the images they became distracted, and were less likely to make connections between the moon shape and phase name. Across all three sites we identified adult interactions that modified, enhanced, or interrupted children's engagement with the

story. Children's engagement and conceptual connection with the story increased when adults other than the reader modeled or brought to attention the key concepts. In one classroom, we found that when the teacher assisted the children in connecting parts of the story (days of the week and moon shape) to their personal experience the children remained attentive and interested in the story. We observed children were highly engaged in the story overall. There were three facets of the book we identified as contributing factors to children losing interest during the storytime: the length of the book, other 'interesting' things, and the size/distinction of the illustrations.

Food as a symbol in the story was very well received by the children. However, reactions to the turtle as a food item were strong in each of the story times. For most of the children this would be an non-traditional breakfast food, yet for some cultures we realize this food item may be part of their diet. Children at this age are likely to be sensitive to the positive and negative attitudes of others towards these aspects of their own identity.

Testing Round Two

The study of version two of *Breakfast Moon* was designed to address three general goals related to the refinement of the story and the associated illustrations.

      a.   What are the conceptual connections children make with the changing shape of the moon over time, including providing opportunities to observe and discuss the moon phases?

      b.   Did the story components encourage caregivers/teachers/parents to engage with children during the story.?

      c.   To what degree does the story hold the attention of the children?

Again, the book was read to diverse groups of preschool learners at multiple sites. From the observations sessions in this round we found there are several sections of the book that provide opportunities for children to observe, discuss, and connect with the material. The reinforcement of the pattern and the motion/position of the moon in this version provided some new opportunities for conceptual engagement and related comments. Also, highlighting the journal and the practice of journaling as a daily activity was fairly new for most children. Across all sites we identified adult interactions that modified and enhanced children's engagement with the story. We observed children's

engagement and conceptual connection with the story increase when adults other than the reader modeled or brought to attention the key concepts. In addition, the use of questions and the consistent invitation from readers to have children engage with familiar foods and their shape, the pattern/order of the changing days of the week, the ways that moon patterns were noted and reinforced in the book, and the opportunities to predict were very effective to sustain attention.

Testing Round Three

The study of version three of *Breakfast Moon* was designed to address three general goals related to the refinement of the story and the associated illustrations.

     a. What are the conceptual connections children make with the changing shape of the moon over time, including providing opportunities to observe and discuss the moon phases?

     b. Did the story components encourage caregivers/teachers/parents to engage with children during the story.?

     c. To what degree does the story hold the attention of the children?

The reinforcement of the pattern and the motion/position of the moon in this version provided some new opportunities for conceptual engagement and related comments. Across sessions, there were more comments related to the pattern of shape change. Also, highlighting the journal and the practice of journaling as a daily activity was fairly new for most children. The majority seemed to like the idea of keeping track in this way. During this testing session, we observed adult interactions that modified and enhanced children's engagement with the story at each of the sites. When adults modeled engagement children were more settled and responded to more of the reader's questions. Several of the children sitting on their caregiver's laps could be seen to create shapes with their hands and/or discuss parts of the book. There are the primary elements of the book that still seemed to have different levels of engagement from children: moon observation in the sky; connections to food (at table or in thought bubbles); connections with other objects (Arthur's adventures); journal pages and practice. In addition, there is now the thunderstorm and the modified shape guessing game that are new elements in this version.

Children were engaged in the story overall. Food as a symbol in the story continues to be very well-received by the children. The humor connected with not eating clothes and pets seems to be working well and there is less evidence of disapproval with any of the food/ eating comments. Finally, the journal pages and practices seemed more interesting/ engaging for children who had more experience with what this is and why you might keep a journal. When readers spent more time establishing shared understanding about journals children also seemed more engaged.