Developmentally Appropriate Strategies for Interacting with Young Children

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The *My Sky Tonight* project builds on evidence regarding the best ways to support preschool-aged children's learning. One useful set of guidelines for what is "developmentally appropriate" for this age was developed by the National Association for the Education of Young Children (NAEYC). Our team draws on these guidelines and on empirical research in developmental psychology and education (Jipson et al., 2014). In this handout, we focus first on three key aspects of young children's learning: learning through play; learning in social interaction; variation in learning. Next we introduce several developmentally appropriate teaching strategies, their basis in research, and their application to young children's astronomy engagement.

Key Aspects of Young Children's Learning

Learning through Play, Imagination, and Exploration. Young children's thinking can be simultaneously very logical and impressively creative (Gopnik, 2009). Young children's learning often happens in the midst of play, imagination, and story-telling, rather than in lessons (Hirsh-Pasek, Golinkoff, Berk, & Singer, 2008). Teaching 3- to 5-year-old children through long-winded verbal instruction or rote memorization is not very effective. (In fact, evidence suggests that these approaches are not ideal even for older learners.) Young children around the world are intrigued by stories, whether in books or oral story-telling, and they process their understanding of the world in pretend play. Even within play contexts, children are often testing hypotheses and evaluating evidence (van Schijndel, Visser, van Bers, & Raijmakers, 2015). It is important for adults to recognize that preschoolers sometimes combine scientific facts with make believe, and that this is a sign that they are engaging with ideas and figuring things out.

Learning in meaningful social interactions. Central to a developmentally appropriate approach is recognition that young children learn best when they are engaged with other people in meaningful activities, or even just observing those activities (Rogoff, 2003). In fact, children's play often involves imitating the everyday activities of the adults around them. Young children also show keen interest in helping in the "real" activities of their household and community. In some cultural communities, this early "pitching in" is welcomed and children learn well when their contributions are valued (Rogoff, 2003).

Variations in learning. Research reveals surprising developmental changes between ages 3 and 5 (Gopnik, 2009), as well as

vast individual differences in children's beliefs and interests. In their advice for developmentally appropriate practice, Copple and Bredekamp (2009) emphasize "meeting children where they are," both in terms of their individual skills and interests, and in terms of their experiences within a particular family and community. Responding to children as individuals is the first step in developmentally appropriate teaching. Copple and Bredekamp also focus on supporting each child's engagement with challenging ideas that make sense for them given their everyday practices and their individual interests. Based on these ideas, NAEYC proposes ten effective teaching strategies (http://www.naeyc.org/dap/10-effective-dap-teaching-strategies). We describe a few of these below, discussing research support for some of the strategies, and providing examples of how these strategies connect with the domain of astronomy.

Young Children Learning Astronomy in Developmentally Appropriate Ways

Acknowledge what children do or say. Letting children know that what they say or do is heard and valued is an important way to support their learning. Adults sometimes think that we need to motivate children to learn or "spark" their curiosity. But research on young children tells us that they are already very curious and eager to learn! In one study, a group of 3 and 4 year olds asked an average of 76 information-seeking questions per hour (Chouinard, 2007). Listening to and acknowledging their questions and ideas tell us what interests a child and helps us to meet them where they are. Sometimes you can also demonstrate your interest in what a child is doing by simply sitting nearby and observing. Recognizing that different children have different interests, it is developmentally appropriate to present activities in an open-ended way so that children can find different ways to interpret or engage in the activity. (Examples of acknowledgement: *"I like hearing about your ideas!" "You added a lot of detail to that space helmet."*)

Encourage persistence and effort rather than just praising and evaluating what the child has done. Carol Dweck's (2006) research has shown that praising children for their intelligence ("you're so smart!") or finished products ("what a beautiful drawing!") can have the unintended consequences of leading them to develop a view that they have a fixed set of abilities, and a tendency to avoid difficult tasks for fear of failing. In contrast, brain research tells us that our ability to learn is constantly growing. When children think of their ability as growing, they learn more and have less fear of mistakes. Dweck finds that adults' encouragement of ongoing effort and process helps them develop a growth mindset. (Examples of encouragement: *"You're thinking of lots of things you can see in the sky. Let's keep going!" "You looked hard to find the special parts you wanted for your space rover!"*)

Model attitudes, ways of approaching problems, and behavior toward others, showing children rather than just telling them. Young children are fascinated by the actions of the adults around them and learn very well by observing and imitating (Rogoff, 2003). As when learning language, children understand more

than they produce, and they learn by listening to adults around them and trying to join in when they are ready. In the realm of science, we can show children that adults don't know everything, that learning and figuring things out is something adults (including scientists) do, and that it continues to be fun and interesting. Authentically figuring out something together with a child is likely to be more motivating to them than giving them the message that you know the answer and they have to figure it out. (Examples of modeling: *"Hmm, that didn't make the shadow go away and I need to think about why." "I'm sorry, Ben, I missed part of what you said. Please tell me again."*)

Give assistance (such as a cue or hint) to help children work on the edge of their current competence. Research has shown us that children's learning can be well supported by **subtle** guidance by adults around them. "Scaffolding" is a process where by giving small bits of guidance we can support children in figuring out things for themselves, rather than telling them answers in a more directive way. Preschool aged children are often open to this type of subtle guidance, whereas more direct guidance sometimes reduces their exploration (Bonawitz et al., 2011). (Example of assistance: *"Rovers move around on Mars. How do you think they do that? How do we get around here on Earth?"*)

Ask questions that provoke children's thinking. Questions are one way that adults can scaffold children's thinking. Research suggests that it is better to use more open-ended questions that encourage children to think more deeply about the topic, rather than closed-ended questions that request just a yes or no answer (Haden et al., 2014). (Examples of engaging questions about astronomy: *"Why might astronauts need a helmet on the Moon? What else might they need to wear?"* or *"What do you think it would be like to live on a planet where there are no trees?")*

Create or add challenge so that a task goes a bit beyond what the children can already do. For example, one open-ended activity asks children to use recycled materials to build a space rover. To add challenge, you could suggest to children that their rover might take a "mission" to Mars to discover what makes Martian rocks red. This involves discussing some of the properties of the environment. Children then are free to incorporate the information into their creative construction, perhaps adding "scoopers" or "cans" for collecting rocks.

A Word about Cultural Diversity

Some of the ways that we can be most sensitive to cultural variation in development are reflected in Copple and Bredekamp's (2009) advice and NAEYC's strategies. Leave room for variability, listen to children's (and to their parents') ideas and interests, and be sure not to make assumptions based on children's ethnicity, race, or cultural community. Parents know their children best; when parents engage with their children in an activity they bring all of their expertise regarding their child's interests and styles (Callanan et al., 2012). For example, some families, and some children, may focus

more on activity and less on verbalizing in their understanding of the world around them (Gaskins, 2009). Many of the open-ended strategies mentioned above make room for families to engage with the activities in ways that are comfortable for them. For example, rather than giving families school-like activities, it can be more appropriate to encourage parents and children to observe the sky together in an open-ended way and see what they notice, or to suggest that parents talk about their own memories of looking at the sky when they were children. Planning for the rich variety of families' styles of interacting can be one of the most effective strategies for engaging young children with astronomy and other science topics.

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