2018-04-01

The Nature of Child Engagement and Teacher-Child Interactions Within STEM-Based Instruction in Preschool Classrooms

Hayley Ann Griffin
Brigham Young University

The Nature of Child Engagement and Teacher-Child Interactions Within STEM-Based Instruction in Preschool Classrooms

Hayley Ann Griffin

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Barbara Culatta, Chair
Kendra Hall-Kenyon
Martin Fujiki

Department of Communication Disorders

Brigham Young University

ABSTRACT

The Nature of Child Engagement and Teacher-Child Interactions Within STEM-Based Instruction in Preschool Classrooms

Hayley Ann Griffin
Department of Communication Disorders, BYU
Master of Science

While educators and speech-language pathologists have been found to utilize informational texts far less than fictional texts when working with young children, informational texts can support young children's academic and language development. This study qualitatively analyzed how children engaged in informationally-based activities and how instructors interacted with children to support their engagement and learning. Fifty-three children from 4 Head Start classrooms participated in small and large group STEM-based instructional activities for 2 days each across 2 weeks. The instructional unit related to how plants grow and how they are used for food. The researchers reviewed and transcribed video recordings and coded turn exchanges as the children participated in 2 small group science-based activities in the first week of the unit, for a total of 8 analyzed sessions. Overall, children demonstrated positive verbal and nonverbal responses while participating in the science-based activities. Instructors were found to use facilitative strategies such as bridging the contextualized experiences to remote concepts, but did not utilize strategies consistently. Instructors were responsive to children's contributions and exchanges between children and instructors were typically 2-3 turns. Instructors could have further developed these exchanges by elaborating or asking thought-provoking questions to highlight targeted concepts. This study supported the idea that young children can respond positively to informational content. Educators and speech-language pathologists can purposefully utilize informational texts with young children and should attempt to help children connect immediate experiences to abstract STEM-based content and concepts.

Keywords: science, literacy, engagement, informational texts, preschool, integrated

ACKNOWLEDGMENTS

I would like to express appreciation to Dr. Barbara Culatta for patiently devoting her time and impressive expertise to this project. I am grateful to my committee and all of the department and university faculty who have contributed in different ways. I would like to thank my support system, specifically, my husband Tyson, my mom, my dad, and my sister Hattie, for making this endeavor possible. I would also like to thank my daughter, Aunie, for sharing her mom with this project and for teaching me the importance of learning.

TABLE OF CONTENTS

DESCRIPTION OF THESIS STRUCTURE

This thesis, *The Nature of Child Engagement and Teacher-Child Interactions Within STEM-Based Instruction in Preschool Classrooms*, is written in a standard thesis format with a typical thesis structure. The literature review follows the introduction. Appendix A contains lesson plans from the study's instructional unit. Appendix B contains a complete sample transcript from the study. This thesis follows APA formatting guidelines.

CHAPTER 1

Introduction

While preschool programs typically do not provide children with much instruction in STEM-based content (science, technology, engineering, and math), young children can participate in and benefit from informationally-based instruction (Caswell & Duke, 1998; Duke, 2000; Duke & Kays, 1998). One of the advantages of exposing children to informational content is that children necessarily encounter academic language as they engage in the process of discussing and exploring informational content. The teaching of subject matter facts and ideas involves giving children explanations and interacting with them around concrete, hands-on experiences that relate to the targeted nonfiction subject matter. Thus exposure to elaborated, decontextualized language can support the development of academic language skills. Science can be one of those relevant subject areas for teaching new concepts and supporting children's development of decontextualized, literate language, in part because it involves talking about abstract concepts while children manipulate and explore concrete materials (Conezio & French, 2002; van Kleeck, 2015).

Preschool programs that address informational content, such as scientific topics, tend to do so within integrated, theme-based units that target facts and content along with other curricular areas such as language, math, and literacy (Conezio & French, 2002; Culatta, Hall-Kenyon, & Black, 2012). A particular instructional program, *Systematic and Engaging Early Literacy (SEEL)*, has facilitated children's development of important informationally-based skills within units that also address language and literacy (see Culatta et al., 2012). The SEEL program has addressed targeted literacy skills in Head Start and other preschool classrooms within a unit that conveys factual content related to how people and animals live together

(Culatta, Hall-Kenyon, & Black, 2010; Hall-Kenyon & Culatta, 2013; Hall-Kenyon, Culatta, & Duke, 2015; Westby & Culatta, 2010).

This current research explored young children's engagement and participation within activities designed to transmit content knowledge and teach literacy skills. Student engagement and participation were observed in relation to the nature of the various activities, or participation structures. Teacher-child interactions were also analyzed. The study was designed to evaluate the nature of children's interest in and responsiveness to STEM- and literacy-based instructional activities.

CHAPTER 2

Review of Literature

Despite a common practice to emphasize fictional over informational texts in early childhood classrooms (Pentimonti, Zucker, Justice, & Kadaeravek, 2010; Yopp & Yopp, 2006), young children are capable of comprehending and benefitting from exposure to and instruction in informational content and texts (Caswell & Duke, 1998; Duke, Halverson, & Knight, 2012; Duke & Kays, 1998; Pappas, 1993). Thus informational text instruction should have an important presence in early childhood education programs (Duke, 2006). In addition, teachers and speech-language pathologists should be aware of the role informational texts can play in supporting language and vocabulary and of strategies they can use to facilitate this development within information-based contexts. They may also benefit from being aware of existing instructional programs that support children's learning within contexts that address informational content.

The Role Informational Texts Play in Young Children's Learning

Members of the educational team can benefit from understanding the advantages that drawing upon informational content can have in supporting children's learning. Instruction in informational texts and content can motivate children to want to explore new topics, facilitate background knowledge, support acquisition of vocabulary, and provide an environment that facilitates early academic language skills.

Motivate learning. *Informational texts*, defined as connected utterances about factual topics that can be presented in written or oral media, can cover intriguing real-world topics (Duke & Carlisle, 2011). Because even young children are often motivated by learning about such things as robots and space ships, informational content can act as a motivating force for

learning (Caswell & Duke, 1998). Scientific topics within the informational genre can draw upon children's curiosity about the natural world. Through experiences with real-world topics, they are provided with answers to questions they have about the world.

Similarly, one specific appeal for integrating informational texts into early childhood programs relates to the role they can play in reducing the boy vs. girl gender gap in regard to motivation for reading. Boys have been found to be generally less interested in reading than girls; and yet when they are attracted to books, boys tend to have a great interest in nonfictional material (Wilheim, 2002). Nonfictional texts are more applicable and more easily connected to boys' lives than fictional content (Harkrader & Moore, 1997; Merisuo-Storm, 2006; Yopp & Yopp, 2006). Since boys have been found to be interested in nonfictional content, their reluctance to engage with books can be addressed by drawing upon intriguing nonfictional topics (Scieszka, 2003). Classrooms can better utilize nonfictional texts, including scientific content, to facilitate boys', as well as girls', motivation for reading and learning (Wilheim, 2002).

Build specific background knowledge. Informational texts aim to convey facts. They are well suited to help young children develop background knowledge about the social and natural world (Maduram, 2000; Monson & Sebesta, 1991; Oyler & Barry, 1996). One of the most important things educators can do to help young children build background knowledge is to arrange compelling reasons for them to encounter informational texts (Purcell-Gates, Duke, & Martineau, 2007). This can be accomplished by bringing in informational texts as resources when children pose questions about the natural world.

Children can be given functional and engaging opportunities to apply background knowledge gained by exploring informational texts. For example, after reading a text on weather patterns, a classroom activity could be built around creating simple graphical representations

from collected data on local temperature and rainfall and making simple weather predictions (Duke et al., 2012). Thus informational texts and content lend themselves to observing and exploring aspects of the world and developing and applying background knowledge.

Support development of abstract and specialized vocabulary. Informational texts address specific concepts with specialized, complex vocabulary. The exposure to ideas about real events, and words that reflect those ideas, builds vocabulary skills that are foundational for text comprehension (Fielding & Pearson, 1994; Goldman & Rakestraw, 2000; Kamberelis, 1998; Ogle & Blachowicz, 2002). As informational texts and content expose children to specialized vocabulary, children are provided with the words they need to represent, discuss, and understand new concepts and content (Duke & Kays, 1998). While highly technical vocabulary may not be relevant to teach children, certain appropriate academic vocabulary, frequently found in informational texts, can be applicable and generalizable across learning contexts (e.g., words like observe or record; Hall-Kenyon et al., 2015). In addition, scientific experiences that are suitable for young children, often also incorporate words that are known and used by mature language users. These words, termed *Tier 2* words, are general academic words that can generalize beyond a specific domain and be applied to other contexts (Beck & McKeown, 1985; Beck, McKeown, & Kucan, 2002, 2013; van Kleeck, 2014). Words such as *sequence* and *precise* can be considered Tier 2 vocabulary since they can cut across curricular disciplines and be used to discuss learning about the world on a general level. Informational texts can provide a rich context to facilitate Tier 2 vocabulary development. They lend themselves to various meaningful modalities, such as discussions and hands-on experiences, which can be utilized to facilitate acquisition and deep learning of vocabulary (Snow, 2010).

Facilitate text processing and academic language skills. While abstract and sophisticated vocabulary is considered a part of academic language, there are other components that relate to children's processing of informational texts. In particular, academic language, including explanations of informational content, refers to the decontextualized, abstract form of language that is more complex, formal, and impersonal than casual talk (Snow, 2010). Academic language is usually concise, containing a high concentration of information-bearing words, making it more difficult to comprehend than casual talk. This decontextualized language is the medium in which informational topics are typically presented in curricular topics such as social studies and science. While academic language can appear in fictional texts, informational texts provide an effective, language-rich context to facilitate children's ability to handle decontextualized, abstract language (van Kleeck, 2014). Science, in particular, can serve as a context for supporting academic language due to its concrete nature and hands-on learning opportunities while at the same time requiring children to understand explanations that go beyond the immediate (van Kleeck, 2015).

Strategies to Facilitate Informational Text Processing and Academic Language Skills

Educators should aim to facilitate young children's development of informational content and concepts and their processing of informational texts. The acquisition and processing of informational content and academic language skills is crucial for success in school and life (Scheele et al., 2012). Educators must be key players in facilitating children's ability to comprehend and acquire informational content and handle academic language demands.

Decontextualized and abstract language, even in preschool classrooms, can be facilitated with the use of interaction strategies teachers use as they involve children in discussions, convey information, and provide explanations. Such classroom talk has been described as a crucial

educational tool for supporting the understanding and development of jointly constructed knowledge (Mercer & Hodgkinson, 2008). Teachers and speech-language pathologists can purposefully implement strategies to support language skills in discussions about informational content as they acknowledge and elaborate children's contributions, ask thought-provoking questions, make relevant comments, and provide child-friendly explanations (Culatta, Blank, & Black, 2010; van Kleeck & Schwarz, 2011). Reciprocal supportive exchanges allow the teacher to assist students in participating in academic conversations and facilitate informational text comprehension (Blank, 2002; Culatta et al., 2010).

Within facilitative instructional exchanges about informational content, educators can use concrete experiences as immediate contexts that can act as a bridge from the immediate event to more abstract, remote, and unfamiliar information. Educators can provide encounters with contextually supported yet unfamiliar information to help engage children in the content and relate the experience to other contexts (Blank, 1983; Culatta, Hall-Kenyon, & Black, 2010; Cummins, 1984). An example of using a hands-on experience to illustrate a decontextualized idea would be letting children dip strips of cotton pads in colored water to simulate how plant roots suck up and absorb water and nutrients from the soil. In addition, remote concepts and events can be illustrated with timelines, maps, globes, pictures, and charts. By discussing how immediate events relate to remote events, children can bridge the gap between the "there and then" and the "here and now" (Culatta et al., 2010).

In addition to providing experiences and presentations to illustrate decontextualized concepts, text comprehension can also be deepened by helping children make personal connections with the texts and content. For example, the content can be related to emotions and experiences, such as fear when seeing lightning for the first time (Culatta et al., 2010). Teachers

can facilitate these connections through comments and questions of both the teacher and the students (Blank, 2002; Britton, 1993; Norris & Hoffman, 1990, Scott, 1994; Silliman & Wilkinson, 1994; Westby, 1994). Teachers may, for example, ask the children if they have had experiences related to the texts, in order to help make new content more meaningful and relevant. By building these connections, children can relate to the content and more effectively retain new information (Culatta et al., 2010).

With the appropriate support of the educational team, content learning and early academic language skills can develop within experiences with informational content (Duke & Bennett-Armistead, 2003). Young children have much to gain from exposure to informational texts and preschool programs can utilize them accordingly.

Programs that Address Informational Texts and Content in Preschool

Science instruction can provide educators with a context for addressing informational texts and content and the development of academic language skills in early childhood programs. Existing supports and resources related to teaching science-based content are available to early childhood educators and include general guidelines for teaching science to young children and model programs that employ science-based content in their instruction.

NAEYC's guidelines for integrating science into preschool classrooms. The National Association for Education of Young Children (NAEYC) created guidelines for best practices for integrating science into the curricular content for preschool-aged children (Bredekamp & Copple, 1997). These guidelines encourage stimulating children's learning through themed units, projects, play, and other involved experiences. Educators are encouraged to integrate science with math, literature, and other curricular areas to help young children make connections across disciplines and better understand concepts (Bredekamp & Copple, 1997; Tu, 2006). By

implementing science-based integrated units, children's development and learning are enhanced as they cultivate skills across a range of situations (Harlan & Rivkin, 2000). Learning in a range of situations is key as it helps children to generalize skills and to learn about content beyond what is immediately present. Science can be taught in structured activities planned by the teacher, informal experiences led by an adult, or naturalistic experiences initiated by the child (Lind, 2000; Neuman, 1972). Educators are advised to take advantage of spontaneous experiences, while also selecting planned formal and informal science activities (Eliason & Jenkins, 2003). By recognizing the different approaches for addressing science, teachers and speech-language pathologists can capitalize on teachable moments.

While integrating language and literacy within preschool science curricula is currently encouraged, some researchers feel that educators have been hesitant to formally or informally teach science to young children because they underestimate the importance of including science in early education (Conezio & French, 2002; Tu, 2006). Other researchers encourage educators to integrate science with language and literacy in preschool classrooms, showing that providing authentic situations to apply language and literacy skills reinforces language and literacy learning (Goodman, 1984; Teale & Sulzby, 1986).

The NAEYC guidelines, and other research-based recommendations, support the notion that integrated science units in early childhood programs stimulate higher-level language and literacy learning. The guidelines reflect the need for increased educator awareness of the importance of presenting integrated science-based units in classrooms.

Text Organization for Preschoolers in Special Education (TOPS). A specific science-based program that is being developed is *Text Organization for Preschoolers in Special Education* (TOPS). In this project, expository book reading interventions have been developed

for preschool children with language impairment (LI), focusing on knowledge of text structures and language of expository texts (Breit-Smith, Busch, & Guo, 2015). The interventions aim to determine the impact for affecting language, expository text skills, and engagement of children with LI during expository book reading interventions centered around text structure and topic specific modules. These modules are based around such themes as "how plants grow" and purposefully relate the science themes to the text structure. In one module, the sequence of the text was highlighted through signal words, by retelling the steps of plant growth and by using a graphical organizer to map the sequence. Tier 2 words were intentionally selected and highlighted throughout the module. The TOPS interventions align with national and state standard charts including objectives for science as well as language and literacy. The features of academic language that are targeted in the TOPS intervention models are academic vocabulary and text structure. The interventions reflect how science can be a naturalistic and appropriate context to teach text structure and other academic language components.

Informational units within Systematic and Engaging Early Literacy (SEEL).

Another example of a science-based unit comes from a language-based literacy program, *Systematic and Engaging Early Literacy*, which implemented and evaluated units presented around science themes. This program allows children to develop critical informationally-based comprehension skills (e.g., text processing, concept knowledge, oral language, and content/vocabulary) as well as early literacy skills (e.g., phonological awareness, letter knowledge, print awareness; Culatta, Hall-Kenyon, & Black, 2012; Duke & Bennett-Amistead, 2003). Culatta et al. (2012) implemented this integrated, theme-based curriculum that teaches literacy and language skills that relate to compelling science-based informational content. The program introduces literacy within a set of engaging and authentic experiences that also target

phonological and phonemic awareness, phonic patterns, and alphabetic knowledge. The theme of the science-based instruction serves as content that can be drawn upon in the literacy activities. Target words that highlight phonological awareness patterns fit within the theme of the science-based instruction. Children may encounter rhyming or alliteration activities that are not designed to teach science concepts but that relate to content children are encountering. For example, they may rhyme with "seed" as they need a seed, read and heed how to take care of seed, plead not to step on seeds, weed the seeds, feed the seeds, and learn how the seed will succeed.

Throughout the SEEL curricula, meaningful reciprocal exchanges occur between educators and children, which purposefully highlight session targets. For example, the rhyming target of the *long o* sound is highlighted within an activity around plant growth. Phrases with repetitions of the *long o* sound such as "plants grow in a row" and "can plants grow in the snow?" are meaningfully and explicitly incorporated all throughout the experiences, like when pretending to grow paper flowers.

One activity within the unit builds around the theme of pond animals and compared the lives of pet frogs with pond frogs to help children understand and talk about similarities and differences (Culatta et al., 2012). The contrasting features were represented by pictures and objects placed onto a large 2-column chart. The comparisons highlight that while the frogs' needs are the same in each habitat, their needs are met in different ways. While teaching content, the unit teaches specific vocabulary and facilitates expository text comprehension skills within engaging activities with explicit instruction and visual representations.

The SEEL curriculum supports drawing upon children's interests and background knowledge in order to enhance engagement with and comprehension of expository texts (Culatta

et al., 2012). The SEEL curriculum has been implemented in Head Start classrooms, and has documented high levels of child engagement and affective involvement in the various instructional contexts used (Culatta, Hall, Kovarsky, & Theadore, 2007). The interventions have shown the importance of utilizing concrete, hands-on encounters with language and literacy targets to engage children and reinforce learning.

Purpose of the Study

While early childhood programs have been designed to facilitate decontextualized language and content learning in informationally-based contexts, additional research is necessary to illustrate what these programs look like in practice and how children engage and participate within the instructional activities. This study was designed to identify patterns in children's responsiveness and engagement based on the nature and format of science-based instructional activities and to explore the manner in which children and instructors interacted within the activities. By observing children's participation and teacher-children interactions, information was gleaned regarding the quality and effectiveness of exposing children to decontextualized language to teach science concepts.

CHAPTER 3

Method

Setting and Participants

This study was conducted in a Head Start program in central Utah. Four classrooms, consisting of 53 typically achieving 3-to 5-year-olds, participated in the unit. Each class was seen for two 45-minute periods: once during Week 1 instruction and once during Week 2 instruction. Instruction occurred in 14 total large and small group stations and transition activities centered on literacy and science targets across both weeks. This study analyzed two of the small group science-based activities occurring during Week 1. One activity was centered around grinding corn and the other around sprouting seeds. Each of the four classes participated in the two activities, in groups of 6-7 children, for a total of eight analyzed activities.

The project was conducted in a dedicated STEM classroom, separate from Head Start classrooms. The classroom contained a Smart Board and a number of iPads in a dedicated station. The four classes rotated into the classroom to participate in the instructional unit. Graduate and undergraduate students assisted university personnel in implementing the instructional activities and in supporting language and content knowledge within those activities.

The Instructional Unit

A STEM-based unit created for this study was designed to facilitate young children's content knowledge, academic language skills, and early literacy skills. While the unit included activities designed to support literacy skills, this study explored only children's participation in two of the four science-based instructional activities.

The unit focused on the theme of plants: their parts and characteristics, the process of growing them, and the valuable vegetables and grains they produce. Content within this theme

aligned with National Science Teachers Association (NSTA, 2003) standards (e.g., the nature of change and the value of natural resources) and related to the things plants need to grow, the stages of a plant's growth cycle, and the use of foods produced by vegetable plants. The program provided children with an array of motivating activities designed to teach specific scientific content and facilitate academic language. Information about the instructional activities and the language facilitation strategies follows.

Science-based activities. The scientific content related to growing and using plants was taught through meaningful hands-on experiences associated with pictured representations and graphic information presented in picture books. Children encountered targeted concepts in various formats. Some of the activities included observing real plants and their parts, uprooting a plant to explore the roots, watching YouTube videos about the life cycle of plants, grinding grains, and tasting foods made from the ground flour. The science-based activities, facilitated by instructors, encouraged active child participation. The science-based activities incorporated elaboration and repetition of key concepts as well as review activities to reinforce learning of content. See Appendix A for lesson plans, including the activities and materials used in the unit.

Literacy-based activities. The content highlighted in the literacy lessons related to the content presented in the science-based activities. While acting on interesting props in interactive contexts, instructors exposed children to examples of print or phonological targets and provided reasons to notice sound patterns and associate printed with oral language. Awareness of sound patterns was highlighted orally and then attached to print. The children engaged in rhyming and alliteration sound play activities and encountered texts that served to highlight rhyming and alliteration. The literacy activities involved hands on manipulation of materials or exposure to literacy examples via interactive digital media.

First-hand experiences. Literacy skills were introduced in extension activities that related to the informationally-based theme. For example, rhyming with the word ending -out was highlighted in activities that were related to information about ways to take care of plants. After reading *The Cows are in the Corn* (Young, 1995) and explaining how vegetable plants cannot grow when animals or people step on them, an instructor engaged the children in an activity in which the children had to get the animals out of the plants. The children were given spouts (the upper portion of a water bottle where the water comes out) and were allowed to shout out of the spout to get cows out of a patch of paper plants, which mimicked the plot of the book. They then went outside to shout out of the spout. They pretended to take turns being inside and outside of a house. The children inside could not shout because they were not out of the house, and they would pout. The children outside could shout out of the spout.

To rhyme with -op, children encountered the text *Popcorn* (Asch, 1979) and then set up popcorn shops. Within playful interactions, they were exposed to highlighted examples of -op words as they hopped to the shop, watched popcorn pop, put a top on the popcorn to prevent the popcorn from hopping out, and dropped popcorn into a popcorn popper, popped popcorn, dropped the popcorn into the containers and hopped back. In this case, the notion that seeds and vegetables come from plants provided a jumping off point for engaging in rhyming with -op. Other literacy activities that addressed alliteration and letter sound association were also incorporated into the unit.

Technology-based activities. Some activities capitalized on appropriate use of technology (e.g., Smart Board, eBooks, iPad apps) to expose children to targeted skills. The children were given a chance to interact with the app *Hideout: Early Reading*, developed by SEEL researchers, which uses game mechanics to highlight rhyming targets in a virtual context.

In this study, the children and instructor proceeded through a series of short, engaging activities in the app that supported rhyming and sound blending with predictable and repetitive uses of target words. The target -op was highlighted in a game related to popcorn. For example, an activity in *Hideout* simulated popcorn popping; the children would tap on kernels to make them pop to the top (of a box), watch the popcorn hop around, and tap on a stop sign to stop the popcorn from popping.

In addition to the iPad app, a personalized digital book software was used to create and represent the informational content and literacy activities the children experienced. The Pictello stories were co-created with the children dictating their ideas and were illustrated with pictures of the children taken during instruction. The children were then exposed to the printed product as it was produced from a computer projector. Instructors involved children in interactive and shared reading of the personal digital book that was based on their hands-on experiences in instruction. YouTube videos were also used to provide a visual representation of theme related concepts, like the processes involved in plant growth and in popcorn popping. The instructors provided explanations to go with the videos that the children watched.

Strategies to Facilitate Language and Content Knowledge

In implementation of the unit, the instructors aimed to convey informational content and provide explanations to facilitate comprehension of informational texts and acquisition of informational content. They also wanted to provide ways for the children to connect with the content and information presented. The targeted strategies came from previous researchers' descriptions of facilitative *instructional discourse*, or the teacher-student conversations that take place during reading and discussion (Culatta et al., 2010; van Kleeck, 2014). Instructors sought to integrate strategies within the hands-on science activities. Targeted strategies included

teaching the meaning of words that were not immediately familiar and pairing explanations with hands-on experiences, graphic representations, and gestures. For example, the concept of roots and their function was presented by uprooting a plant and letting children inspect its roots paired with an explanation of how roots function. They were also provided with a visual and tactile experience of absorbing colored water with a "root"-like strip of cotton and relating that experience to roots absorbing needed water and "food" from the soil.

The goal of implementing instructional discourse strategies was to have children gain information through use of language to achieve higher-level communicative functions, such as understanding explanations. Children's ability to gain or process information about remote events was reinforced as instructors aimed to use academic language with appropriate supports in place. Instructors aimed to provide child-friendly explanations, relate immediate experiences to remote ones, respond to children's contributions, and relate decontextualized content to children's own experiences.

Provide child-friendly explanations about remote events. Instructors should adjust their language to match children's entering language abilities. While using language to convey information and give explanations, instructors need to use words that children are likely to be familiar with to explain new concepts. They should elaborate beyond what is immediately perceptible with repeated explanations and by recasting. Instructors should use abstract and decontextualized language in statements that relate to remote events, in order to help children think about things not immediately relevant to their own lives. When following strategies to support early academic language, instructors should also speak in general terms about people, places, and things that they may be able to easily experience for themselves, or things that are far away.

Relate immediate events to remote and abstract ones. Instructors sought to use immediate events as examples to comment on remote or abstract events. They aimed to provide something concrete to act as a bridge to something more abstract, such as by first asking the child if they had had similar experiences that in some way related to a decontextualized experience. By following such procedures, children are better able to comprehend remote information.

Respond to children's contributions. In supporting academic language, instructors can acknowledge children's contributions, extend their utterances, and elaborate upon their comments. Instructors can use the conversational exchange to explain abstract concepts and connect children's knowledge beyond immediate events.

Relate new and decontextualized content to children's own experiences. By using children's contributions as a foundation to work from, instructors aimed to extend children's knowledge and build connections from what the children already knew. Making connections between new content and children's own lives can help to reinforce new or remote concepts.

Design and Data Collection

This qualitative study was designed to explore preschool children's participation in science-based instructional activities. The study also sought to characterize child-adult interactions within the unit activities, which were designed to support language development and acquisition of informational content.

Video collection. Video recordings of instruction were collected during Week 1 instructional interactions, those related to changes that occur during the sprouting-to-harvesting process of plants, for four Head Start classes. The recordings permitted researchers to observe the children's participation within the instructional activities and analyze the nature of their

interactions with the instructor. While the video recordings were collected during all instructional activities (large and small group with both a literacy and science focus), only small group instructional activities that related to the teaching of science content were analyzed. Recordings of instructional sessions analyzed for this study thus consisted of two activities: one centered around corn grinding and one around sprouting seeds. A total of eight sessions were analyzed as four classes participated in the two rotations.

The recordings provided video and audio of instructional activities, typically including a view of all children and instructors participating in a given activity. Due to movement of the camera and the children during activities, some children were out of view of the camera's lens intermittently. These instances were noted in the transcriptions.

Transcribing, coding, and determining reliability of the transcripts. The video recordings from Week 1 small group science-based instructional interactions were transcribed. Only students with permission to participate in the study were included in the recordings. Instead of noting children by name, children were referred to as *Child 1*, *Child 2*, etc., based on their clockwise positioning in the group with Child 1 being positioned to the right of the instructor at the start of each session.

Transcriptions of the recordings were made by the primary researcher (author of the study) and an undergraduate research assistant. The undergraduate research assistant was trained on the details of the research project as well as transcription conventions and procedures. The transcriptions included teacher and student verbalizations on a turn-by-turn basis along with descriptions of physical stance (body posture), facial expressions, gestures and actions, and vocalizations.

Positive and negative affective behaviors were coded. Positive affective behaviors were indicated by displays of smiling or laughing, positive comments (e.g., "this is fun!"), positive expressions (e.g., "wow!") and attention to task. Negative affective behaviors were indicated by frowns or pouty faces, negative statements or comments (e.g., "I don't like this!") and expressions (e.g., "yuck!").

Reliability of the transcripts was established as the primary researcher and undergraduate research assistant evaluated agreement of each other's transcripts. First, the researcher and research assistant each viewed and transcribed approximately 50% of the eight recordings. Then, half of each researcher's transcripts (two each) were exchanged and viewed by the other. Researchers aimed to determine whether at least 80% agreement was achieved before continued analysis. Each transcribed conversational turn was evaluated, in presence of the recordings, and marked as either "yes" or "no" to reflect agreement or disagreement with the initial transcriber. Conversational turns were counted each time the speaker changed, such that one turn may include more than one utterance by the same speaker. Any discrepancies or disagreements were noted in the document and discussed with the original transcriber. Such discrepancies were discussed until an agreement was reached and the applicable changes were made to the transcripts. A count of the turns that were agreed upon during the review was divided by the total number of turns in order to provide a reliability percentage. Reliability of the selected transcripts reflected 96.6% (57/59 turns), 97.4% (111/114 turns), 94.9% (111/117 turns), and 90.2% (46/51 turns) agreement between researchers for a mean of 94.8% agreement and was determined to be sufficient to establish adequate transcript reliability in order to proceed with analysis. Nonverbal behaviors were also detailed in the transcripts, and any small discrepancies were discussed and revised. See Appendix B for a complete sample transcript.

Data Analysis

Qualitative analyses were used to characterize the nature of the instructional activities, children's engagement in the activities, and interactions between the instructor and children during the course of the instruction. The analyses were adapted from similar studies designed to explore preschool children's participation in instructional activities (Kovarsky, Culatta, Franklin, & Theadore, 2001; Philips, 1972). Children's participation and engagement were analyzed in reference to the notion of *participant structure*, or the ways in which activities are organized. In addition, turn taking exchanges between the instructors and children; including teachers' use of behaviors to support children's processing of decontextualized, informational content; were analyzed using conversational discourse.

Participant structure: Children's engagement within the instructional activities. In attempting to describe children's participation within the instructional context, the research drew upon the notion of participant structure. Participant structure is a framework for characterizing the nature of instructional activities. Participant structure deals with the ways participants arrange or structure interactions in various contexts (Philips, 1972). Philips described the ways in which teachers arranged interactions with their students–the allocation of speaker turns, contributions speakers and audience members could make in a group activity, and expectations signaled in regard to how to participate. Teachers can attempt to control or allocate student turns to ensure that children actively participate. Teachers can foster positive engagement by arranging for children to access turns, initiate actions, make self-initiated contributions, and access materials.

The principal researcher characterized participant structures within the two analyzed activities centered around corn grinding and sprouting seeds. The activities were portrayed in

terms of the goal (e.g., particular informational content to be conveyed), setting (e.g., arrangement of the children and materials), and options children had to act on the materials and participate (e.g., exploration of hands on materials vs. participation in a tightly structured routine.) The videos were observed with the intent to describe the structure of the instructional activities and the nature of children's engagement as they were exposed to targeted scientific concepts within the particular activity types.

Conversational discourse: Instructor-child interactions during instructional activities. Videos were observed and transcripts analyzed in regard to conversational exchanges between the instructor and students. Conversational discourse analysis was employed to gain information relative to teachers' input and teachers' responsiveness to children's verbal and nonverbal acts. The interactions were inspected to glean information about the use of strategies to support children's processing of decontextualized, informational content.

Researchers characterized the turn-by-turn nature of the instructional exchange and identified examples of child and instructor interactions that reflected the nature of turn taking exchanges that occurred within the instructional activities. These samples of exchanges were those that were deemed to be reflective of the typical interactions that occurred within the targeted activities as well as those that reflected the range of interaction patterns. The discourse analysis also could be inspected for instructors' use of facilitation strategies to stimulate children's processing of decontextualized, academic language. Analysis of transcribed videos revealed information about instructor-child interactions during the activities.

The transcripts were analyzed for instances of the instructor modifying messages to meet the needs or behaviors of the students. The goal was to determine to what extent the instructor was accommodating to the students' verbal and nonverbal behaviors. Researchers were also

interested in knowing how the instructors modified their interactions to keep children engaged and if they interacted in a way that also served to expose the children to the targeted scientific concepts. Researchers observed to what extent children responded to the instructor's input and made relevant comments about the experience and the instructor's input.

The conversational analysis entailed describing interactions within the instructional activities from the written transcriptions of the video recordings. The conversational turn was viewed in relation to other turns in a sequence within an exchange (Atkinson & Heritage, 1984). Conversational turns consist of two utterances positioned immediately adjacent to one another. Adjacency pairs can consist of such exchanges as question-answer, greeting-greeting; comment-elaboration; and offer-acceptance/refusal. Children's responsiveness to instructor's behaviors and vice versa were gauged as researchers watched for reciprocal turn taking. Transcription of the video recordings permitted analysis of the nature of the interactions on a turn-by-turn basis.

The turn-by-turn analysis of exchanges permitted inspections of elaborations of other participants' expressions and personal connections made with the content. Researchers thus observed the children's verbalizations to gain a sense of how the children were processing the information and participating in the instruction. Likewise, researchers watched for irrelevant student responses or lack of participation. The extent to which children's and instructors' affect and utterances mirrored each other was noted as an indication of the extent to which they were responsive to each other. Analysis also noted the extent to which teachers elaborated on children's comments and used the immediate as a bridge to remote concepts to support comprehension and learning. Observations within the participant structures focused on participant engagement, extent to which children were exposed to salient examples of target concepts, and instructors' responsiveness to children's inputs.

CHAPTER 4

Results

Researchers observed children's participation and engagement in light of the structure of the two science-based activities and characterized the child and instructor interactions within the activities. Analyses provided information regarding the nature of children's participation and instructor-child interactions, including interactions designed to support children's development of science-based information and decontextualized language. This section includes the analyses of the two activities, grinding corn and sprouting seeds, and makes comparisons between the two activity types and across groups that were conducted by different instructors.

Analyses of Participation and Interactions within the Activities

A description of the options for children's participation in science-based activities are presented below along with a description of the children's engagement. In addition, analysis of conversational exchanges served to characterize the nature of the interactions that occurred between the children and the instructors. Results are presented in terms of what was discovered in regard to child engagement and child-instructor interactions within the corn grinding activity and seed sprouting activities.

Grinding corn. In this activity, children participated in grinding corn seeds into flour. Instructor 1 facilitated two of the four corn grinding rotations (days 1 and 3), while Instructor 2 facilitated the other two (days 2 and 4).

The participant structure and children's participation. The science-centered activity of grinding corn was designed to convey the concept of how plants are made into common foods and how seeds can be turned into flour to be used to make foods like bread. Children were arranged around a small table, seated in chairs; they then took turns standing in order to turn the

crank on a large hand grinder. An instructor faced the children from the center of the table. She assisted the children mostly from the center of the table, but also occasionally walked around the table and knelt down to be at eye level with the children. Materials were positioned on the table directly in front of each child, including a mortar and pestle for each child, a large hand grinder on the side of the table, and seeds placed by the instructor into the mortars and hand grinder. For the duration of the activity, children were given options to freely act on the materials by grinding seeds using the mortar and pestle or using the larger hand grinder. Children participated in a simultaneous, hands-on fashion as they each experienced grinding seeds in the two formats (mortar/pestle and hand grinder) while the instructor demonstrated the grinding of two types of seeds and made sure that the children had sufficient seeds to grind. The instructor commented on what they were doing and why as they participated.

The hands-on nature of the activity allowed for active participation from each child simultaneously. Across all analyzed recordings, not one child refused to participate in the seed grinding, with each child at least attempting to use the mortar and pestle. Children verbally and nonverbally conveyed interest in the materials as they approached the table, reaching for and inspecting the materials and asking, "what's this?" They continued to observe the instructor as well as the children around them as they ground seeds and mimicked the actions of others. Children were not required to bid for turns by raising their hands but could contribute comments spontaneously and freely act on the materials that were placed in front of them. They did, however, have to take turns using the hand grinder but had free access to the mortar and pestle when they were not using the hand grinder.

Children's gestures and body postures typically displayed positive responses to the task. Smiling was noted especially when children's seeds turned to flour, when instructors stated that

the flour could be used to make different foods, and when instructors gave verbal praise. Other notable facial expressions reflected exerted effort while using the hand grinder and curiosity while looking into the grinder. The students displayed attention to the task by participating appropriately and mostly facing the instructor or materials–only occasionally facing away from the table to glance toward the noises of the other group's activity in the classroom. One child (Child 1, Day 2) left his seat out of turn but was redirected back to the group. Attention to the task reduced slightly for some children toward the end of the activity; such as seen in Day 4 as Child 2 asked when the rotation would be finished, though most children remained engaged such as seen in Day 4 as Child 1 were requested additional turns at the activity's end.

Instructor-child interactions. Throughout the corn grinding activities on each day, children were exposed to the concrete hands-on experience of grinding seeds to teach the target concept of using plants as food. Instructors were found to have supported the activity with facilitative strategies. Child-friendly explanations were given for relevant vocabulary (i.e., Instructor 1: "We're going to grind it into flour. Grinding means to smash it all up."). Instructors utilized repetition to reinforce targets. They specifically used repetition when bridging the concrete activity (grinding corn) to the remote target concept (using plants to make foods). For example, Instructor 1 repeated the phrase "We're making flour," or a close variation of the phrase (i.e.,"You're making flour!"), nine times across a 5-minute sample. She also repeatedly stated that flour can be used to make cakes, bread, etc. Instructors were found to use some questions to relate the task to the target concept or to familiar experiences, such as in the following exchange:

Child 3: "It (ground corn kernels) smells good."

Instructor 2: "It does kind of smell good. What does it smell like?"

Child 3: “It smells like popcorn.”

Instructor 2: “It does kind of smell like popcorn. What does yours smell like?” (turning to Child 2).

Here, the instructor could have followed up further by conveying, “Yes, this flour is made from corn seeds and popcorn comes from corn seeds too,” to relate how both products come from corn plants and to make the connection between what the child was experiencing (ground corn seeds), and what they had recognized from their own life (popcorn).

Instructors were typically found to be responsive to children’s verbal and nonverbal contributions throughout the task, though not every turn was elaborated. For instance, in one 5-minute session, there were only two instances of bids to the adult that were not expanded or acknowledged. One of these bids was off-topic, and both took place as the instructor directed her attention either toward the group as a whole or toward another student. Instructors responded to students as they made requests about how they wanted to participate. For example,

Child 1 (Grinding Corn Day 3): “I want to try that one!” (referencing the hand grinder).

Instructor 1: “Okay come on. Turn it this way. We’re making flour!” (demonstrating how to turn the handle of the hand grinder).

Instructors encouraged students to participate and reinforced their involvement, as noted in the exchange below from Day 2. The child nonverbally responded to the instructor’s contributions in a positive way and demonstrated pride in his accomplishment.

Instructor 2: “Can you get those big kernels?” (speaking to Child 2 as he uses a mortar and pestle to grind corn seeds).

(Child 2 looks up to instructor then back down at materials as he grinds).

Instructor 2: “(Try it-), Try a little harder.”

(Instructor leans over and watches Child 2 smash a larger seed with the pestle.)

Instructor 2: "Oh, you got it!"

(Child 2 looks up at the instructor and smiles wide.)

Instructor 2: "You got it!"

(Instructor 2 signals a thumbs up and smiles.)

(Child 2 smiles at the instructor then at the camera.)

The nature of the exchanges within this activity was such that the instructors were the main speakers, with fewer verbal contributions from the students. It was typical for students to nod in response to the instructor and for the instructor to acknowledge their affirmation.

Sprouting seeds. In the sprouting seeds activity, children were exposed to several tasks related to how seeds grow into plants. Instructor 1 facilitated two of the four seed sprouting rotations (days 1 and 3), while Instructor 2 facilitated the remainder (days 2 and 4).

Children's engagement in light of the participant structure. The goal of the spouting seeds rotation was to highlight the science concepts of how plants grow and characteristics of plants, while reviewing the literacy target of rhyming -out words. Children were seated around a small U-shaped table with the instructor seated in the center of the table in order to face each child. Materials were placed both in the center of the table and directly in front of each child. When new materials were presented, they were shown to the group or held directly in front of each child in sequence. The activity facilitated frequent opportunities for the children to actively manipulate materials. The activity had several components, each with opportunities to act on materials. Children took turns and were each able to view seeds and sprouts through a magnifying glass, plant a seed in dirt, plant a seed in a paper towel, look at a real plant and its

roots, and use cotton to absorb colored liquid to represent how roots absorb or suck up water and nutrients that the plant needs to survive.

The structure of this activity allowed for active participation from each child for the majority of the rotation, with a range of materials and tasks. All children were found to have engaged and participated in at least attempting each component of the rotation. Children typically faced the instructor, made eye contact frequently, nodded/raised their hands/smiled/said "yes" in response to questions, and remained seated. They occasionally looked toward the noises from the other group in the classroom, only noted twice during one 15-minute period. Only one child (Child 7 on Day 2) got up from his seat and had to be directed to return to his seat three times during a 15-minute period. While the children were typically found to attend to the task, they occasionally made irrelevant remarks or did not respond to instructor communicative requests. When children did not respond, they were often attending or making eye contact, and may have not understood the instruction or question, as noted below.

Instructor 2 (Day 2): "They (plants) use their roots like we use a straw. What do you do when you use a straw? (Name), what do you- what do you use a straw for?" (looks to Child 3 for a response).

(Child 3 looks toward instructor but does not give a response.)

Instructor 2: "To drink? Do you think?"

Child 3: "Mm-hm" (nods head).

Instructor 2: "Do you know what? This is going to be like a pretend root. Let's watch it drink up the water." (dips cotton in colored water) "That's kind of how roots are, aren't they? Do you see that? It's drinking it up!"

In this instance, the instructor did not explicitly use words like "sucking" or "absorbing" and could have further discussed how roots absorb water and nutrients through their roots.

Verbal and nonverbal behaviors typically reflected enjoyment (i.e., smiling), curiosity ("what's it [seed] going to grow into?"), astonishment ("wow!") and excitement ("yeah!"). Some children excitedly showed the instructor what she or he accomplished after following an instruction (i.e., Child 3, Day 1: "Look it!" [holding seed in paper towel]). Children also displayed excitement verbally and through facial expressions when they were told that they would be permitted to take their seeds home to let them grow and that they could teach their families about how seeds grow. As instructors presented activities, children often appeared eager to participate (i.e., when Instructor 2 asked Child 7 if she would like to dip cotton in colored water, the child smiled, grabbed the cotton and placed it in the water). In several instances, children responded in unison (by exclaiming "yeah!" or raising their hands) when asked if they would like to see a new material or carry out the next activity. After learning about how plants grow from seeds, children made some simple connections to familiar experiences, as noted in the exchange below from Day 4.

Child 5: "I already have flowers grow."

Instructor 2: "You have flowers! Does anybody else have flowers in their house?"

(two students raise their hands).

The sprouting seeds activity took place after a large group activity wherein children viewed a real plant and watched a video about plant parts and how plants grow. Instructors asked students to recall what they had previously experienced by asking them if they recalled the plant and its roots. On Day 3, Instructor 1 started the small group activity by holding up a plant and asking, "Remember? This is our plant?" On Day 1, part way through the small group

activity, she stated, “Now, we get to look at the root. Do you remember that this is the root? And this is the part that goes in the ground.” It was noted that both instructors used simple questions to recall previous activities in at least one instance.

Instructor-child interactions. As children participated in the rotation, instructors used language to direct the task and manage the group, but also to support acquisition of abstract or remote concepts. They were found to use child-friendly explanations along with repetition to teach new concepts (i.e., Instructor 1: “Do you want to see some other kinds of seeds that are sprouting? These are sprouting. They’re coming out. They’re coming out. These seeds are sprouting. And the plant is coming out.”) As instructors presented new materials, such as seeds or roots, they were often found to place the material directly in front of each child in succession while repeating a simple phrase explaining what they were viewing (i.e., “This is the root!”). When using a tangible material to represent a remote concept, Instructor 1 repeatedly discussed the remote concept and how it was connected, while Instructor 2 used fewer connections. For example, the following exchange took place while using cotton and water to represent root function.

> Instructor 1: “This is like a root. It’s going to suck up this water, and it’s going to suck up the food that’s in the water, watch! It works like a root. It works like a root!”
>
> Child 2: “Yeah?”
>
> Instructor 1: “Yeah! It’s sucking up—this is the way your root works. The root sucks up the water and the water’s got food in it!”

Instructors were seen to respond to student conversational turns in most instances, and to occasionally bring in children’s prior knowledge. The resulting reciprocal, topically-related turn exchanges typically consisted of only one or two turns. Instructors acknowledged contributions

with nods, vocalizations, and verbally such as by restating children's statements either in direct repetition or through alternate wording and by elaborating on the child's utterance, as noted in the following exchange.

Child 3: "A seed! Look it a seed!"

Instructor 1: "Oh yeah, uh huh. You got a seed? These seeds turn into wheat, and these seeds turn into beans. You have different kinds of seeds."

Instructors used some simple questions throughout the task to introduce and review targets and to direct the task (i.e., "Do you want to see the corn sprouts?" and "Did you get a sprout?"). As children answered questions, instructors responded with affirmation, as noted on Day 2.

Instructor 2: "What else do you think our plant needs with our spouts?"

Children in unison: "Water."

Instructor 2: "I think it needs water too. I think you're right."

When the group was asked questions related to target concepts, at least one child typically responded with an accurate or near accurate response, when given the appropriate level of support. The following exchange from Day 4 demonstrates two questions given, with a correct response along with the supports given in response to an incorrect answer, which was likely due to misinterpretation of the question.

Instructor 2 (holding up seeds): "Do you think they have sprouted yet?"

Child 6: "No."

Instructor 2: "No? How can you tell?"

Child 6: "Because they don't have water."

Instructor 2: “They don’t have water- what else- what else looks different about these from sprout(ed) seeds? What do these seeds not have? …”

Child 5: “They need (the)”

Instructor 2: “These seeds right here? They look the same ones as those, but they have sprouts! Do you want to look at the difference (between those)?”

In this exchange, the instructor allotted pauses after questions and gave multiple opportunities to respond. She could have given a visual cue of showing the sprouted seed before giving the answer, though she was able to show the children the sprout, which she was seeking to reference. The initial question invited the children to think critically and look for differences between seeds and sprouted seeds. The child was potentially not able to process the question, and instead gave an answer for what a seed needs in order to sprout and grow. Overall, instructors asked simple questions related to the immediate experience, occasionally referencing the remote and occasionally asking thought-provoking questions. Children were found to ask questions throughout the task, and instructors responded to questions with simple answers appropriately.

Child 3: “What does this seed do?”

Instructor 1: “That turns into a bean. A bean plant.”

Instructors positively reinforced verbal and nonverbal participation with verbal praise, often using the children’s names (i.e., “Very good! Good job [name]!”).

Comparison of Children’s Responses Across Instructors and Activities

During observations of the videos and analysis of the transcripts, child participation and engagement were observed across the two activities and in response to the two instructors. Child participation and engagement were noted to be similar with minor variations across the activities and instructors.

Different instructors. Variation was found between the two instructors in how they used facilitative strategies, which seemed to play a role in how well the children engaged, though overall, engagement was noted with each instructor. While conducting the seed sprouting activity on Day 2, Instructor 2 focused on the immediate aspect of the activities, while directing the activity and managing the group, with fewer remarks related to the remote concepts than the other instructor. Here, children were engaged, though occasionally demonstrating reduced focus on the task noted by off-topic remarks. When Instructor 1 repeatedly tied in the remote concept and asked children to recall previous learned information, children demonstrated engagement in the task by turning toward the instructor, asking relevant questions, and making positive exclamations ("wow!"). These signs of engagement were also seen as instructors displayed enthusiasm toward the tasks, spoke to children individually, and as they responded to children's remarks.

Different participant structures. The participant structure in the two analyzed activities reflected similar structures as children acted on immediate materials in small groups. There was some difference in the activities due to the number of options for hands-on manipulation. Children engaged well with the materials in both activities.

Within the activities, when materials were placed directly in front of the children, each child engaged by manipulating the materials as directed. Children also displayed enjoyment through body gestures and smiling while participating. They were seen to look toward the instructor, especially to mimic how she used the manipulatives. When materials were displayed for viewing to the group or individually, children looked at the materials and asked some appropriate questions (i.e., "What's that?"). When children took turns using a shared item, the hand grinder, some children lost attention while waiting to use it, though children appeared to

enjoy using the grinder as noted by such things as smiling and requesting additional turns. In this case, some children were anxious to try the less available manipulative, and others lost interest. Children were engaged when the materials were well prepared by the instructor beforehand and immediately available in close proximity to each child, though they also attended well as instructors communicated with one another to facilitate the materials. For example, as Instructor 2 asked for assistance from an adult during Day 2 for three communication turns, children continued to look toward the instructor or the materials.

Children were found to attend for longer periods of time when the activity had multiple components. This was observed during the seed sprouting activity, which consisted of several parts (i.e., viewing a real plant, absorbing colored liquid with cotton to learn about roots, looking at sprouts and seeds with a magnifying glass, and planting a seed in dirt and in a bag with a wet paper towel) within the 15-minute session with typically no more than 5 minutes spent on one single task. Children appeared eager to see what was next and participated in each task. In the grinding corn activity, children engaged well for most of the 5-7 minutes but became slightly less engaged toward the end of the time period. However, children responded well to the instructor when they were encouraged to continue to participate.

CHAPTER 5

Discussion

Summary of Findings

Children's engagement and teacher-child interactions during STEM-based instructional activities were the focus of the study. While engagement and interactions are most likely to be interrelated, we analyzed the discourse separately for child engagement and teacher behaviors that could have served to support the turn taking and children's acquisition of the science-based concepts and information.

Child engagement. In each of the analyzed activities, children participated in small groups, with an instructor interacting individually with each child. Children engaged with each task typically for the entire duration of the activity, even in the presence of background noise from other students in the classroom, and only occasionally looking toward the other small group in the classroom. Children requested materials and turns and gave relevant verbal and nonverbal responses to instructor questions and comments, especially when given appropriate supports, such as visual cues or extra time to respond. Their positive behaviors demonstrated enjoyment in the activities.

In terms of making connections to the content, most children were seen asking simple questions related to the immediate context, and some spontaneously commented on how the materials related to the more remote and abstract content being addressed. They also made some connections between their own lives and the activities.

Instructor-child interactions. Instructors were found to use facilitative strategies to teach decontextualized concepts, though they missed opportunities to tie what was happening in the immediate context to the remote concept being addressed. Questions posed to the children

were often basic ones related to the immediate context, and questions related to the decontextualized content were used less frequently. The instructors seemed to miss opportunities to involve the children in conversations or ask questions that would activate connections to the targeted content or concept. However, when children made connections to their own lives, as seen when Child 1 (Day 4) stated, "I already have flowers grow," instructors acknowledged the contribution. The instructor followed up by asking if anyone else had flowers, but could have discussed how the flowers in your home need to get water and food from their roots into their stalks and leaves, just like the plant that was in front of them. Instructors occasionally referred back to experiences provided within the unit.

While instructors were typically found to be responsive to students' bids, they mainly facilitated short exchanges rather than elaborating further or asking thought-provoking questions to create more reciprocal turn taking. It can be challenging to expand every turn in an exchange and some opportunities to elaborate children's comments were missed.

Certain factors may have made the instruction conducive to brief turn exchanges. First, the content did not always require in-depth elaboration. Instructors tended to restate children's references to concrete and familiar experiences and their comments about materials that were immediately present. Second, children mainly participated nonverbally, giving the adult few opportunities to elaborate on what the children said and resulting in a limited number of back-and-forth, topically-related exchanges. Third, children may have had limited prior exposure to the content. Providing experiences that would support background knowledge would help children connect to what they encounter in a particular instructional activity. Fourth, small group dynamics may have influenced the conversational exchange since individual children often "answered for the group", contributed more than other children, or required attention from the

instructor to remain on task. While instructors were seen to direct questions to each child by name, they could have further encouraged verbal contributions from the children by planning to ask additional thought-provoking questions and those that would require the children to relate immediate experiences to concepts or information they had encountered in the past. Although the back and forth turn exchanges were short, children received a lot of instructor input in regard to the ideas and concepts being taught.

As instructors engaged with the students and used facilitative strategies to support the informational content, children responded positively. Children also responded well to moderately structured activities with frequent opportunities for active participation.

Clinical Application

This study indicated that children engaged and actively participated in the integrated science-based instruction supported by facilitative instructional discourse strategies. Children answered and asked simple questions related to target concepts, though they mainly made comments about the immediate activity. Children demonstrated positive verbal and nonverbal responses to these science-centered activities. In light of the extent to which preschool-aged children engaged with the science-based content, this study and previous works support that instructors should find opportunities to expose children to informational texts and content. They should continue to pay attention to how the structure of an activity serves to actively involve children in manipulating and talking about the content. As instructors plan to teach informational content, they can seek out appropriate materials and arrange them to be readily available to allow for active participation. Instructors can be mindful to use facilitative strategies, like effectively bridging remote concepts to the immediate, in order to help children achieve the goal of learning concepts. Instructors may choose to allow for a level of structure

that helps students participate in an organized way with an instructor conducting, while encouraging child input throughout the tasks and hands-on manipulation and exploration of the materials.

Limitations and Suggestions for Future Research

While this was a qualitative study, seeking to analyze child engagement and instructor-child interactions within informational instruction, quantitative data could be utilized to also analyze children's comprehension of the informational content. By attempting to identify a causal connection between children's exposure to the informational content and their understanding or acquisition of targeted concepts, researchers could evaluate what the children had processed of the language and content they were exposed to. In the case of this unit, pre and posttests could have been administered before and after each experience, giving such questions as "What does absorb mean?"; "How do plants get food and water into their stems and leaves?"; "What do a plant's roots do?"; "Why does a plant need a root?"; etc. These questions could also be posed during instruction to probe comprehension.

While this study observed instructors' use of facilitative strategies, further research is needed to determine which strategies are most facilitative of children's decontextualized language and acquisition of abstract concepts. A better understanding of how well specific strategies facilitate comprehension can direct the instruction of informational content.

References

Asch, F. (1979). *Popcorn: A Frank Asch bear story*. New York, NY: Parent's Magazine Press.

Atkinson, J. M. & Heritage, J. (1984). *Structures of social action: Studies in conversation analysis.* Cambridge: Cambridge University Press.

Beck, I. L. & McKeown, M. G. (1985). Teaching vocabulary: Making the instruction fit the goal. *Educational Perspectives*, *23*, 11–15.

Beck, I. L., McKeown, M. G., & Kucan, L. (2002). *Bringing words to life: Robust vocabulary instruction*. New York, NY: Guilford Press.

Beck, I., McKeown, M. G., & Kucan, L. (2013). *Bringing words to life: Robust vocabulary instruction* (2nd ed.). New York, NY: Guilford Press.

Black, S., Hall-Kenyon, K., & Culatta, B. (2013). Learning about the world: Exploring and comprehending expository texts. In B. Culatta, K. Hall-Kenyon, & S. Black (Eds.) *Systematic and engaging early literacy* (pp. 443-464.) San Diego, CA: Plural Publishing.

Blank, M. (1983). *Teaching learning in the preschool: A dialogue approach.* Cambridge, MA: Brookline Books.

Blank, M. (2002). Classroom discourse: A key to literacy. In K.G. Bulter & E.R. Silliman (Eds.), *Speaking, reading, and writing in children with language learning disabilities: New paradigms in research and practice.* 151-173.

Bredekamp, S. & Copple, C. (1997). *Developmentally appropriate practice in early childhood programs*. Washington, D.C.: National Association for the Education of Young Children.

Breit-Smith, A., Busch, J., & Guo, Y. (2015). Sharing expository texts with preschool children in special education. *Perspectives on Language Learning and Education, 22*, 93–102.

Britton, J. (1993). *Language and learning* (2nd ed.). Portsmouth, NH: Boynton/Cook Publishers.

Caswell, L. J. & Duke, N. K. (1998). Non-narrative as a catalyst for literacy development. *Language Arts*, *75*, 108-117.

Conezio, K., & French, L. (2002). Science in the preschool classroom: Capitalizing on children's fascination with the everyday world to foster language and literacy development. *Young Children, 57*, 12-18.

Culatta, B., Blank, M., & Black, S. (2010). Talking things through: Roles of instructional discourse in children's processing of expository texts. *Topics in Language Disorders*, *30*, 308-322.

Culatta, B., Hall-Kenyon, K., & Black, S. (2010). Teaching expository comprehension skills in early childhood classrooms. *Topics in Language Disorders*, *30*, 323-338.

Culatta, B., Hall-Kenyon, K., & Black, S. (2012). *Systematic and engaging early literacy: Instruction and intervention* (1st ed.). San Diego, CA: Plural Publishing, Inc.

Culatta, B., Hall, K. M., Kovarsky, D, & Theadore, G. (2007). Contextualized approach to language and literacy instruction (Project CALL): Capitalizing on varied activities and contexts to teach early literacy skills. *Communication Disorders Quarterly*, *28*, 216-235.

Cummins, J. (1984). *Bilingualism and special education: Issues in assessment and pedagogy.* San Francisco, CA: College-Hill Press.

Duke, N. K. (2000). 3.6 minutes per day: The scarcity of informational texts in the first grade. *Reading Research Quarterly, 35*, 202-224.

Duke, N. K. (2006). Foreword. In T. Stead (Ed.), *Reality checks: Teaching reading comprehension with non- fiction.* Portland, ME: Stenhouse.

Duke, N. K. & Bennett-Armistead, V. S. (2003). *Reading and writing informational text in the primary grades: Research-based practices*. New York, NY: Scholastic.

Duke, N. K. & Carlisle, J. F. (2011). The development of comprehension. In M. L. Kamil, P. D. Pearson, E. B. Moje, and P. Afflerbach (Eds.), *Handbook of Reading Research*. London: Routledge.

Duke, N. K., Halverson, A., & Knight, J. A. (2012). Building knowledge through informational text. In A. M. Pinkham, T. Kaefer, & S. B. Neuman, *Knowledge development in early childhood: Sources of learning and classroom implications*. New York, NY: The Guilford Press.

Duke, N. K. & Kays, J. (1998). "Can I say 'once upon a time'?": Kindergarten children developing knowledge of information book language. *Early Childhood Research Quarterly, 13*, 295.

Eliason, C. & Jenkins, L. (2003). *A practical guide to early childhood curriculum.* Upper Saddle River, NJ: Merrill Prentice Hall.

Fielding, L. G. & Pearson, P. D. (1994). Reading comprehension: What works. *Educational Leadership*, *51*, 62–68.

Goldman, S. R. & Rakestraw, J. A., Jr. (2000). Structural aspects of constructing meaning from text. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research, 3*, 311–335. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Goodman, Y. (1984). The development of initial literacy. In H. Goelman, A.A. Oberg, & F. Smith (Eds.), *Awakening to Literacy.* London: Heineman Education.

Hall-Kenyon, K. & Culatta, B. (2013). Applying systematic and engaging practices: Planning units and lesson activities. In B. Culatta, K. Hall-Kenyon, and S. Black (Eds.) *Systematic and engaging early literacy*, 443-464. San Diego, CA: Plural Publishing.

Hall-Kenyon, K., Culatta, B., & Duke, N. (2015). Building emergent comprehension through the use of informational texts. In A. DeBruin, S. B. Gear, & A. van Kleeck (Eds.), *Pre-reader comprehension: One of the essential building blocks to becoming a successful reader*. Baltimore, MD: Paul H. Brookes.

Harkrader, M. A. & Moore, R. (1997). Literature preferences of fourth-graders. *Reading Research and Instruction*, *36*, 325-339.

Harlan, J. & Rivkin, M. (2000). *Science Experiences for the Early Childhood Years: An Integrated Approach* (7th ed.). Columbus, OH: Merrill.

Hideout: Early Reading. Version 1.4. [Computer Software]. Vers. 1.4. Third Rail Games LLC, 5 May 2015, Web.

Kamberelis, G. (1998). Relations between children's literacy diets and genre development: You write what you read. *Literacy Teaching and Learning, 3*, 7–53.

Kovarsky, D., Culatta, B., Franklin, A., & Theadore, G. (2001). "Communicative participation" as a way of facilitating and ascertaining communicative outcomes. *Topics in Language Disorders*, *21*, 1-20.

Lind, K. (2000). Exploring science in early childhood: A developmental approach. Independence, KY: Delmar.

Maduram, I. (2000). "Playing possum": A young child's responses to information books. *Language Arts, 77*, 391-297.

Mercer, N. & Hodgkinson, S. (2008). *Exploring Talk in School: Inspired by the works of Douglas Barnes.* London: SAGE.

Merisuo-Storm, T. (2006). Girls and boys like to read and write different texts. *Scandinavian Journal of Educational Research*, *50*, 111–125. doi:10.1080/00313830600576039.

Monson, D. L. & Sebesta, S. (1991). Reading preferences. In J. Flood, J. Jensen, D. Lapp, & J. Squire (Eds.), *Handbook of research on teaching the English language*. New York, NY: Macmillan.

National Science Teachers Association (NSTA; 2003). *Standards for Science Teacher Preparation.* Arlington, VA: NSTA Press.

Norris, J. A. & Hoffman, P. R. (1990). Language intervention within naturalistic environments. *Language, Speech, and Hearing Services in Schools, 21,* 72-84.

Neuman, D. (1972). Sciencing for young children. In K. R. Baker (Ed.), *Ideas that work with young children.* Washington, D.C.: National Association for the Education of Young Children.

Ogle, D. & Blachowicz, C. (2002). Beyond literature circles: Helping students comprehend informational text. In C. C. Block & M. Pressley (Eds.) *Comprehension instruction: Research-based best practices*, (pp. 259–274). New York, NY: Guilford.

Oyler, C. & Barry, A. (1996). Urban first graders intertextual connections in the collaborative talk around information books during teacher-led read-alouds. *Language Arts, 73*, 324-239.

Pappas, C. C. (1993). Is narrative "primary"? Some interesting insights from kindergarteners' pretend readings of stories and information books. *Journal of Reading Behavior, 25*, 97-129.

Pentimonti, J. M., Zucker, T. A., Justice, L. M., & Kaderavek, J. N. (2010). Informational text in preschool classroom read – alouds. *Reading Teacher*, *63*, 656-665.

Philips, S. U. (1972). Participant structures and communicative competence: Warm Springs children in community and classroom, in C. B. Cazden, V. P. John, & D. Hymes (Eds.) *Functions of language in the classroom* (pp. 370-394). New York, NY: Teachers College Press.

Purcell-Gates, V., Duke, N., & Martineau, J.A. (2007). Learning to read and write genre-specific texts: Roles of authentic experience and explicit teaching. *Reading Research Quarterly*, *42*, 8-45.

Scheele, A. F., Leseman, P. P. M., Mayo, A. Y., & Elbers, E. (2012). The relation of home language and literacy to three-year-old children's emergent academic language in narrative and instruction genre. *The Elementary School Journal 112*: 419-444.

Scieszka, J. (2003). Guys and reading. *Teacher Librarian, 30*: 17–18.

Scott, C. M. (1994). A discourse continuum for school-aged students. In G. P. Wallach, & K. G. Buler (Eds.), *Language learning disabilities in school-age children and adolescents: Some principles and applications.* New York, NY: Merrill.

Silliman, E. R. & Wilkinson, L. C. (1994). Discourse scaffolds for classroom intervention. In G. P. Wallach & K. G. Butler (Eds.), *Language learning disabilities in school-age children and adolescents.* New York, NY: Merrill.

Smith, M. & Wilheim, J. (2002). Reading don't fix no Chevys: Literacy in the lives of young men. Portsmouth, N.H.: Boynton/Cook.

Snow, C. E. (2010). Academic language and the challenge of reading for learning about science. *Science, 328*, 450-452. doi:10.1126/science.1182597

Teale, W. H. & Sulzby, E. (1986). *Emergent literacy: Writing and reading.* Norwood, NJ: Ablex.

Tu, T. (2006). Preschool science environment: What is available in a preschool classroom? *Early Childhood Education Journal, 33*, 245-251.

van Kleeck, A. (2014). Distinguishing between casual talk and academic talk beginning in the preschool years: An important consideration for speech-language pathologists. *American Journal of Speech-Language Pathology, 23*, 724-741.

van Kleeck, A. (2015). The academic talk register: A critical preschool oral language foundation for later reading comprehension. In A. DeBruin, A. van Kleeck, & S. B. Gear (Eds.), *Developing early comprehension: Laying the foundation for reading success* (pp. 52-76). Baltimore, MD: Paul H. Brookes.

van Kleeck, A. & Schwarz, A. L. (2011). Making "academic talk" explicit: Research directions for fostering classroom discourse skills in children from nonmainstream cultures. *Revue Suisse des Sciences de L'education, 33*, 100-200.

Westby, C. (1994). Communication refinements in school age and adolescence. In W. O. Haynes & B. B. Shulman (Eds.), *Communication development: Foundations, processes, and clinical applications*. Englewood Cliffs, NJ: Prentice-Hall.

Westby, C. & Culatta, B. (Eds). (2010). Comprehending and producing informational texts: Bridge to academic success. *Topics in Language Disorders. 30*.

Wilheim, Jeffrey D. (2002). Getting boys to read. *Instructor 112*, 16–18.

Yopp, R. H. & Yopp, H. K. (2006). Informational text as read-alouds at school and home. *Journal of Literacy Research*, *38*, 37-51. doi: 10.1207/s15548430jlr3801_2

Young, J. (1995). *The Cows are in the Corn*. New York, NY: Scholastic.

APPENDIX A

Lesson Plans

Week 1- Plants and their Parts

Time Frame	Activity	Materials Needed
Large Group Opening 15 minutes	1. Play the song *Happy* as students are entering. Say, "When I'm happy, I want to SHOUT. Today I want to shout because we will study ab**out** plants. We will use words ending in -*out* as we sprout sprouts and shout out of spouts." 2. Show live plant. Show plant parts using *From Seed to Plant* by Gail Gibbons (informational text). 3. Explain that this plant started as a seed. "First we plant the seed in soil. Then we see the sprouts above the ground. But something that we can't see above the ground has happened under the soil. It has grown roots." Pull part of the plant out of some dirt to show the roots. Show Youtube video of time-lapse seed growth. First explaining the "fast motion" technology used in time-lapse photography. 4. Play the video again or use *Sunflowers & Bunnies* this time allowing students to 'be' seeds sprouting and growing. 5. Explain that Farmers want seeds to sprout, and often need to keep animals OUT of the garden so they don't trample the sprouts. Sometimes they have to shout, "GET OUT"! They might even use a spout (that looks like a pig's snout) to make the shout sound louder. 6. "Now we will go to two centers to explore things that end in –*out:* • We will go outside with our own spouts to use for shouting. We will pretend to be farmers who shout out the spout to remind the animals to stay out of the garden of plants beginning to sprout. • We will plant seeds and examine	1. Song *Happy* by Pharell Williams 2. Pig snout 3. *Sunflowers & Bunnies* Kindermusik (Growing music)

	sprouts from seeds already sprouted."	
Small Group Centers – First Rotation: Station 1- 15 minutes	Sprouting Sprouts: 1. Point out the parts of a live plant. 2. Explain that the roots help keep the plant alive by feeding the plant the food and water from the soil or dirt. 3. Show root absorption with dye. 4. Use magnifying glasses to view the plant and it's parts, as well as newly sprouted seeds. 5. While some are using the magnifying glasses, others could be directed to plant their seeds. Explain that they will sprout in a napkin if they are kept wet. 6. Plant some of the sprouts in a spout with dirt and water. Explain that the sprouts will sprout out of the dirt only if they are kept a little moist and if they have sunlight and air.	1. Large plant with well developed root structure. Box for catching dirt as it is pulled apart to reveal root system. 2. Sprouted Seeds for examining with magnifying glasses. 3. Seeds to sprout in napkins and send home with a note to parents to help keep it wet and watch for changes. 4. Spouts for planting in dirt, water droppers, water, dye, napkins, baggies, tops of plastic bottles with yarn tied to make necklaces
Small Group Centers – First Rotation: Station 2- 15 minutes	Shout OUT the Spout: 1. Tell the story *The Cows are in the Corn* (-*out* target emphasis) about animals in the garden. 2. Introduce spouts (top part of bottle where water comes out) – pointing out that they look a bit like pig snouts or noses. Show how the spouts can be used. 3. Explain it is best to go outside to shout. Go out of the room and practice shouting target words out of the spout. Pretend to be farmers and shout out the spout to tell animals to stay out of the garden. 4. Have the children come in and look at books or be read to while waiting for the other group to finish.	1. Book: *The Cows are in the Corn* by James Young 2. Permanent markers to write names.
Large Group #2: 5 minutes	Seeds as Food: 1. Once the 'sprouts group' is ready from the last rotation, have everyone come meet you at the grinding table. Set up the grinders/seeds for exploration. 2. Introduce the song *Grinding Corn* by	1. Prepare beforehand: Set out hand grinder, mortar & pestle and seeds. 2. Corn & wheat seeds for grinding.

	singing it two or three times and allowing the children to join as desired. 3. Introduce the concept of seeds as food. Explain that seeds can be used for planting and growing food or seeds can be eaten as food." One way to prepare seeds for eating is to grind them into flour for baking. We will grind corn to make corn flour for corn bread.	3. Song: Grinding Corn (iPod connected to speakers).
Small Group – iPad table 10 minutes	Grinding Seeds: allow each child to take a turn grinding (both with mortar and pestle and grinder)	(See above)
Small Group – Carpet area 10 minutes	Sing *Grinding Corn* and taste cornbread	1. Song: Grinding Corn (iPod connected to speakers). 2. Cornbread/napkins
Closure 10 minutes	1. Have the kids join at the rug. Review what was learned today (Parts of plants. Ask if they can think of something that rhymes with shout. Tell them that as they leave today you will ask them again to tell you.). 2. Lead into the song "Shout" by saying "If I were a sprout, and I got to sprout out of the ground…I would want to shout! Show them how they can use their spout to say shout along with the music. Practice chanting/saying it "a little bit softer now" and "a little bit louder now". 3. Turn on the music at 2 min. 45 sec. into the song. Slowly crouch down during the "softer now" chanting and slowly stand during the "louder now" chanting. Let them dance during the last part. 4. Excuse them to go to the door in a line. Ask them to think of a word that rhymes with 'pout'. (Say, how about *shout* if they don't generate an –out word. Ask the children if *shout* and *out* rhyme. Then, "Do snout and shout rhyme? "	1. Book to show plant parts 2. *Shout* song downloaded and connected to speaker system.

Week 2 – Food from Seeds and Plants

Time Frame	Activity	Materials Needed
Large Group Opening 15 minutes	1. Pop some popcorn for tasting later in the day so the room smells like popcorn. 2. *Popcorn Time* – (or any song listed in the materials list.) Have the music playing when kids come in. 3. Review last week – Use Pictello story to remind the kids of last week's concepts/targets explored: sprouts sprouting, shout out the spout, parts of a plant, the growth cycle of a seed. • Review chart – *Corn Seed to Corn Cob* • Remind the kids that seeds can either be planted to grow food, or eaten for food. 4. Introduce Small Group Centers: • Popcorn chant and the popcorn story • Introduce Hop to the Popcorn Shop Lesson	1. Seeds 2. Chart – Corn Seed to Corn Cob 3. Pictello Sprouts Story 4. Song Options: a. Move It; CJ - *Popcorn Time* b. Madagascar 5 – *Popcorn* – EP *c.* Silly Willie Moves; Brenda Colgate – *Popcorn Party*
Station 1- Tiled Area 15 minutes	1. Hop to the Popcorn Shop Lesson 2. Be sure to use the transition time away from this lesson to have the kids tell you something that rhymes with stop, or	1. Hop to the Popcorn Shop lesson materials 2. Popcorn popper 3. Popcorn cones (paper stapled into a cone) for each child 4. Popcorn Shop sign 5. Large bowl or bag for popcorn 6. Kernels – a few for each student

	shop. (Ask: "Do top and bop rhyme? Can you tell me a word that rhymes with cop?")	
Station 2- Carpet Area 15 minutes	• Popcorn chant & Popcorn Story 1. Tell and dramatize Frank Ashe *Popcorn Story -- dramatize with props* 2. Popcorn chant: *1st Verse* Popcorn Pops! Popcorn Hops! It pop-pop-pops Until it stops! (They crouch down.) *2nd Verse* Popcorn stops! Popcorn stops! Wait and wait Until it **POPS!** (Shout 'POPS' while jumping up. Repeat from *1st verse* as desired	1. Popcorn Story 2. Popcorn Chant
Large Group 5 minutes	1. Concrete representation of what happens when popcorn pops - simulation to show the explosion taking place inside the seed shell when the tiny droplets of water inside heat up and cause the inside to pop out: wrap a piece of brown paper (representing the seed coat) around a very small crumpled pies of white paper. Allow kids to shake it as you pretend the droplets of water inside are heating up – preparing for the	1. You Tube Videos http://www.youtube.com/watch?v=0xcxumccf8Q popcorn popping in slow motion 2. Paper seed to concretely demonstrate what happens when the air inside is heated and "pops it open". 3. Hot Air popper, popcorn kernels

	EXPLOSION when the inside of the seed pops out. Connect the demo to popping corn. 2. Show the video of the popcorn popping in slow motion. 3. Introduce the popcorn popper. Put a few seeds inside and say, "Let's see if the hot air on this popcorn will make the seeds hop and pop. Will popcorn get to the top and stop?" Emphasize that pop, hop, top and stop are words that rhyme or end with the same sound. 4. Do the chant while the popcorn is popping. 5. Introduce centers and excuse kids to stations. • Hideout Popcorn Game • Hop to the Pop Shop	
Small Group – Carpet Area 10 minutes	1. *Hideout* – Pop Popcorn game	1. iPads with *Hideout* Downloaded 2. Smart Board or White Board and dry erase markers to practice writing 'pop' and 'top'.
Small Group – Tiled Area 10 minutes	1. Hop to the Pop Shop (use club soda) • "Remember when we saw the air make bubbles in water? We are going to make an explosion again when we hop with pop. We will get to see an explosion again."	1. Pop Shop - Club Soda in a can

Closure 10 minutes	1. Call kids to the group and do the Popcorn Chant (learned earlier). 2. Review science concepts explored today: (We can eat seeds as food; hot air can heat the inside of a corn seed to make an explosion where the inside pops outside! That's how we get popcorn; pop and hop rhyme). 3. Review Literacy Target (–op) As kids leave have them hop and tell you a word that rhymes with drop. If they don't have a word say, "How about pop?' Have them tell you if pop and top rhyme. Give them a few pieces of popped corn as they answer and exit.	1. Popcorn Time or Instrumental Popcorn Activity

APPENDIX B

Sample Transcript

Sprouting Seeds Day 2

7 children, clockwise from instructor
Child 1: Red shirt

Child 2: Yellow shirt

Child 3: Pink stripes

Child 4: Pink dress

Child 5: Yellow/grey

Child 6: Light green shirt

Child 7: Blue jacket

Instructor: Undergraduate student, noted in analysis as Instructor 2

Instructor 2: Green shirt

Instructor 3: Operating camera, blue/green shirt

((each child holds a magnifying glass and looks at a small pile of seeds and sprouts in front of each of them))
Child 3
(XXX they're big.) ((sprouts))
Instructor
Yeah, they're bigger, aren't they? ((referring to sprouts as compared to seeds)) And do you notice- what do- what do they have coming off of them? (.) What is that? What's the difference? ((instructor holds sprout in front of Child 7 to show him the sprout's root))
Child 7
((Child 7 looks at the sprout)) (XXX)
Instructor
Do you see that? What is this? ((holds sprout in front of Child 6))
((Child 6 makes eye contact with instructor))
Child 5
Hey it changed! ((pointing at 2 bowls, one with water and one with colored water, that were sitting on the table.))
Instructor
Yeah it did change. ((referring to bowl of colored water.)) These are the sprouts! ((holds up a

single sprout)) They kind of look like they have tails, don't they? (Is that kind of) silly? But that's the roots. The roots are gonna (grow) and become a plant.
I: Oo, I just got blue food coloring all in my hair. That is so great. ((laughs)) Oh, it's fine. Um, okay friends, so, these little- oh, we have other kinds too. This one. ((Instructor starts picking out bean sprouts from a tray and handing them out to the children)) I'll give everybody one of these. This is- oh (this one-) some of these haven't sprouted yet. ((Instructor sorts through bean sprouts and hands out sprouts with visible roots)) These are beans, and they have sprouts. Can you see the bean sprout? (.) ((Instructor places a sprout in front of child 4 and 5 and they both look down at it)) Can you see the bean sprout? (.) ((Instructor places sprout in front of child 6 and she looks down at it)) Can you see that one? (.) ((Instructor places sprout in front of child 7)) (XXX) Oops. ((Instructor dropped a bean sprout)) These are what they looked like before they sprouted. ((Instructor displays bag of beans)) There's no tails, and they're smaller. No sprouts versus sprouts. Okay.
Child 3
(What [it's big)]
Instructor
[So,] why do you think they need those little roots? (.) We kind of talked about it, do you remember? (.) Do you remember why they need the roots?
Child 1
(XXX)
Instructor
Why?
Child 1
(XXX)
Instructor
Yeah, they need it to eat and drink. And you know what? They kind of use- oh, (name) could you come back and sit down please?
Child 7
(XXX) ((Child 7 walks around table with instructor 2 following and prompting))
Instructor
(Have seat.) They use their roots- (Name), come have a seat please.
((Child 7 returns to seat with prompting))
Instructor
They use their roots like we use a straw. What do you do when you use a straw? (.) (Name), what do you- what do you use a straw for? ((looks to child 3 for a response))
Instructor
To drink? Do you think?
Child 3
Mm-hm ((nods head))
Instructor
Do you know what? This is gonna be like a pretend root. Let's watch it drink up the water. Are you ready? ((Dips cotton strip into colored water and pulls it out)) ((gasps)) What's it doing? ((gasps)) Is it drinking it up? Yeah. That's kind of how the roots are, aren't they? Do you see that? It's drinking it up?

((Child 1, 2, 3, 4, and 5 briefly turn toward sound from other side of classroom))
Child 5
(my magnifying glasses!)
(Instructor 2)
[Wow!] ((acknowledging Child 5))
Instructor
[You know what?] I'm gonna let everybody have a turn doing this. Kay, (name), you're first. ((places cotton and water in front of child 1)) So what you're gonna do is you're gonna stick one in to the water and watch it drink up.
Instructor 2
Watch. ((points toward child 1 to direct child 7's attention))
Instructor
Drink drink drink drink drink. Drink drink drink drink drink. (XXX) right here.
Instructor
Okay. ((places cotton and water in front of child 2)) Do you see it? It drank it all up! Oo, yours drank a lot. Ok, (name), and what's your name, sweetheart? ((Instructor places cotton and water in front of child 3 and 4.))
Child 4
(XXX)
Instructor
What is it? ((looks at name tag)). Ok, (name), both of you, at the same time. You can stick it in there too, (name). Do you wanna put it in there too? It's- you can both drink it. Okay. Good job, guys. Okay.
Instructor
((speaking to instructor 3)) I know you're recording, but (XXX)
Instructor 3
Yeah (XXX). ((kneels down to help with demonstrations))
Instructor
Okay. ((places cotton and water in front of child 7)) (Name), your turn. Do you wanna drink it up like a straw?
((Child 7 smiles and grabs cotton, dips it in water))
Instructor 3
(XXX)
Instructor
(XXX)
Instructor
(Name), your turn. ((places cotton and water in front of child 6)) And then, just (name)'s turn.
((Child 4 holds up used cotton strip))
Instructor
Oh, okay, you guys can put them right here. ((holding out tray to place used cotton strips on)) Ok, (name) (you put it right there?) Good job, okay, last one.
((Child 7 walks away from table))
Instructor
Oh- (name)? (Name). (Name), nope, that's not- it's not time yet.

((Instructor 3 helps redirect child 7 to table))
Instructor
Good job, sweetheart. ((to child 5 as she dips cotton in water)) Good job! Okay. Now, we're gonna talk about- what is this? ((Holds up container of soil))
Instructor 3
Hey, (name), come here buddy, come sit.
Instructor
(name), do you know what this is? (.) Do you know what this is? (.) Is this dirt?
(Children)
Uh huh! ((Children nod))
Instructor
It is dirt. And you know what? I'm gonna grab a (XXX). So what we're gonna do is we're gonna plant a sprout in a spout! But first, our sprout needs some dirt. (Name)! (Name).
((Child 7 walks away from table))
Instructor 2
I'll get him.
Instructor
Thank you.
Instructor 2
You need to go back. You're missing out.
Instructor
Okay, (XXX), you guys are being so patient. Ok so we have water. What else do you think our plant needs with our spouts?
Children
Water.
Instructor
I think it needs water too. I think you're right. (Let's) put a little bit of water in there. What else do we- I think we need some seeds. Do you think we need seeds?
Child 3
Yeah.
Instructor
Yeah? So who wants to help me put the seed in the plant.
((Child 1, 2,3, and 5 raise their hands. Child 6 and 7 are out of camera's view.))
Child 3
Me.
Instructor
Okay, we're gonna have several seeds. Actually you know what we're gonna use some of these. We're gonna plant some wheat. Ok, everybody take one seed. (XXX) dirt (XXX). Plant a sprout, in the spout! Oh and you can push it under. Push push push!
((Child 1 plants seed into spout filled with dirt))
Instructor
Ready, (name)? ((Child 2 plants seed)) Push push push! Ah, so good, so good. ((Child 3 plants seed)) We're planting spou- sprouts, in a spout! And then they're gonna sprout out. ((Child 4 plants seed)) You guys are waiting so patiently, I really appreciate that, so much.

((to other instructors)) (So amazing.) That's not how yesterday went.
(Instructor 2)
Really?
Instructor
((laughs and shakes head))
Instructor
You guys are doing so good planting those sprouts!
((Child 5 plants seed))
(Instructor 2)
They are awesome kids.
Instructor
Oh my gosh, (name), your turn- (name)! I need your help. Can you help me? Oh you wanna pla- you can plant that one. Go for it, you gotta push it under the dirt. Can you help it be, under the dirt? Help it. ((Child 7 plants seed but is out of camera's view))
(Instructor 2)
Push it in.
Instructor
You gotta push it. Can you help me? Push it under.
Child 3
(XXX)
Instructor
Okay, there we go, okay, look at all of our sprouts. Oh, you guys are so great. You know what, we're gonna give it a little more water. ((Pours water into dirt)) And then, hopefully, in a couple of days, they're gonna grow. We're gonna get a little more dirt on there. A little more dirt so that they're covered and happy.
Child 2
(XXX), look. ((holds up a bean))
Instructor
Oh, you found the bean, didn't you? ((gasps)) Do you guys want to plant your own sprouts?
((Child 4 smiles, child 5 nods and raises hand. Child 2, 3, 4, and 5 are in camera's view))
Instructor
Who wants to do that?
((Child 2, 4, and 5 raise their hand. Child 2, 3, 4, and 5 are in camera's view))
Child 5
Me!
Instructor
Oh I'm so excited because we're gonna do that right now. Ok, everybody is gonna get a piece, of paper towel.
Child 3
[Me.]
Instructor
[And] you know what? ((hands out paper towel to each child)) Guess what. You guys get to take these home. You're gonna take these home, and then, you can plant them in the ground, and you can have your own plant. Do you think you can take it home and show your mom and

dad? And maybe they can help you plant it in the ground or in a pot?
((Child 4 nods))
Instructor
Yeah?
(Instructor 2)
That sounds awesome.
Instructor
That sounds so great. So what do we need? So we have-
Child 2
Sun.
Instructor
We need s- oh we do need sun, but first we need what? ((holding up bag of beans))
(Child)
Seeds.
Instructor
Oh, first we need seeds, you guys are awesome. So I'm gonna give you each-
(Child 7)
((squeals))
Instructor
Oh, careful (name). Oh can you put it flat on the ground so I can put your seeds on here? Ok, so you're gonna get one of these and a few of these. So hold it still on the ground and I'll tell you what's next. One of these, a few of these, thank you sweetie. One of these. ((hands out beans and wheat seeds to each child on their napkin))
Child 1
I (XXX).
Instructor
Kay, everybody's going to get one of these. These are your bean seeds. And then, everybody else gets some wheat seeds.
(Child)
(This is) a bean?
Instructor
It is, it's gon- it's gonna grow into a bean plant. Ok, now everybody keep it- keep it on the ground. Ok, now what I need you to do, is you are going to- I'll show you. So if you have your bean, in your paper towel, let's see who can follow directions. So here's my bean, you know what I wanna do? I wanna keep it on the table but fold it- fold it in half. Can you do that? Fold it in half, and hide the seeds.
((Each child is participating at the same time with their own paper towel and seeds in front of them))
(Child 7)
(XXX)
Instructor
Fold it in half and hide the seeds.
((knock on door))

Instructor
Oops
Instructor 3
I got it, I got it.
Instructor
(Our friends.) Fold it in half. Ok where are our paper- where's our plastic bags with names?
Instructor 3
Do they each need one?
Instructor
Perfect, yeah. Ok guys, now let's all fold it in half
((Other group walks back in. Some communication between instructors))
Instructor
Let's just get, we'll just- (XXX) there. (XXX) Ok, now (I want you to) open the seeds. Open your bag and put your seeds in. Ok now hold it open, (XXX). Hold it open (XXX)
((Instructors help each child put paper towel in their bag))
Instructor
Okay, and you know what else we need? Can everybody hold their bag open? Hold your bag open for me and I (can put) water in it. Hold your bags open. (XXX)
Child 5
(XXX) bag's open.
Instructor
(XXX) water.
((Instructor pours water in each bag))
Instructor
Okay, (name), let me see it.
(Instructor 2)
Here she comes, get it ready.
Instructor
Here you go, okay, open it up for some water, you know what, we're gonna seal them tight.
Child 2
(I put these-) these in here? ((holding seed above dirt))
Instructor
Yeah you can put it in there. Zip it tight, and then, when you go home, you can show your mommies and daddies what you did. And we have directions on there too. (XXX). Kay, (zip) them tight. Okay friends, if your ziplock bags are zipped tight, leave them on the table and stand up. Stand up and push your chairs in.