CONCEPT MAPPING AND EARLY LITERACY: A PROMISING CROSSROADS

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Abstract. Through a qualitative analysis of conversation in teacher-guided concept mapping activities in a single kindergarten classroom over eight weeks, the present study explores the ways in which concept mapping promotes three important dimensions of emergent literacy. Specifically, teacher-child conversations facilitated the following three understandings important for literacy development: 1) Expository language genres can be used to obtain or provide decontextualized information; 2) A relationship exists between the elements of printed or symbolic representation and words in a spoken proposition; 3) Creating text is an inherently social process, with the purposes of communicating and sharing one's thinking with others. Findings illustrate, through excerpts of conversations, the various ways that these aspects of literacy were co-constructed between classroom participants, highlighting the important role of the teacher in scaffolding children's understanding of the meaning and functions of the concept map and its elements.

1   Introduction

In recent years, literacy has been understood as a process, beginning at birth, in which learners interact with text or other symbolic representational forms for the purpose of constructing meaning (Schreiber, 2005). Researchers interested in developmental aspects of meaningful text interactions have identified several aspects of *emergent literacy*, defined as strategies, attitudes, skills, and behaviors practiced by young children that contribute to "conventional" reading and writing proficiency, including: knowledge of alphabet system and letter-sound relationships, awareness of print in the environment, understanding print directionality, and understanding that print carries meaning (Goodman, 1986). As these constructs are intimately integrated to one another and to the context in which meaning-making takes place, learning environments for literacy development should support a broad range of knowledge and skills through demonstrations, social interactions, and models (NAEYC & IRA, 1998).

The present study explores the extent to which concept mapping may be used as an instructional tool in the early childhood classroom in order to facilitate several components of emergent literacy. Thus far, concept mapping has had limited use in early childhood classrooms, primarily centered on teaching conceptual structures (e.g., Figuerido, Lopez, Firmino & de Sousa, 2004; Gallenstein, 2003) or facilitating metacognitive control processes such as planning, monitoring and evaluation (e.g., Cassata & French, 2006). The potential for concept maps to facilitate a wider range of literacy activities in young children is far-reaching. The visual, hands-on, and representational qualities of concept maps provide a unique opportunity for children who are not yet readers to create, manipulate, share, and interact with text in a highly personal, meaningful fashion. In addition, the inherent structure of concept maps as logical propositions allows children to become familiar with expository, information-bearing language structures important for later school success.

1.1   Understanding Decontextualized/Expository Text Genres

Starting in the early elementary years, children are expected to become adept at "reading to learn" through providing and obtaining information using expository text, a distinct language genre associated with the use of specialized grammar and sentence structure while talking about a single, focused topic (Schleppegrell, 2004). In contrast to language often used in personal narrative, expository text is typically "decontextualized," with the primary purpose of conveying novel information to audiences with limited background knowledge (Whitehurst & Lonigan, 1998). As school and workplace success depends on the ability to comprehend informational texts, children need sufficient access to and opportunities to use expository language.

The nature and structure of concept maps provide ideal starting points for children to become familiar with the expository genre. Concept maps are representations of knowledge created when two or more concepts are connected by a linking word that designates their relationship, forming a *proposition* (Novak & Gowin, 1984). In contrast to narrative language often found in fictional stories, the structure of a proposition represented in a concept map (noun-linking verb-noun) follows a grammar based on formal, logical, and decontextualized meanings of objects and events. Concept maps commonly employ classification statements, and use generic, "timeless" nouns about *kinds* of things rather than particular instances or episodes (e.g., dogs, chairs, living things, trees). Linking words are in the present verb tense (e.g., dogs have four legs, trees are living things), and specify "relational" and "existential" relationships (e.g., is, has). Finally, as in expository texts, concept maps

organize information in a "logical" structure, such as arranging information according to part-whole relationships, classification taxonomies, and causal relationships.

1.2 Linking Spoken Language to Symbolic Referents

In addition to their usefulness as conduits of decontextualized information, concept maps, in their basic propositional form, are also ideal for demonstrating relationships between spoken and symbolic language. The ability to divide a stream to speech into its component word units is difficult for most children entering school. An important developmental pre-literacy skill, "concept of word in text," involves an awareness of word boundaries important for developing literacy skills such as spelling and phonemic awareness (Flanigan, 2006).

Concept maps provide a concrete referent of a spoken proposition by graphically parsing the phrase into its component parts (concept-linking word-concept). In particular, concept maps draw attention to the existence of the "linking word" as a distinct entity carrying meaning. Modifications for young children, such as the use of picture-word cards to represent concepts, make propositional elements manipulable, increasing salience of word boundaries. Flanigan (2006) proposes that adults may facilitate "concept of word" by deliberately matching spoken word to printed word thorough reading, speaking and pointing to each word in a sentence. A more complex instructional strategy involves "mixing up" words in a sentence and asking children to place the words back together, a task requiring the child to check their work carefully upon completion. Concept mapping enables these recommended instructional strategies to be carried out within a single activity.

1.3 Understanding the Communicative Purposes of Text

A third important component of literacy involves the growing awareness that text is a product of communication, serving authentic purposes for sharing one's thinking with others as well as learning what others are thinking. Creating any literary product with this awareness becomes a challenging task involving regulation of the text's content, structure, and comprehensibility for the reader (Cox, 1994). Managing these elements of composition involves the strategic deployment of cognitive resources through planning, monitoring, checking, evaluating, and revising activities (Cox, 1994). It is important, then, for children to have opportunities to engage in tasks that foster children's planful and strategic control of textual meaning.

The completed concept map may be considered a literary product in which spoken text is represented in using written, pictorial, and physical referents. The salient visual and tactile qualities of each concept map element provide a means for children who are not yet proficient readers and writers to represent, preserve, and examine their own communicative activities. From planning of the map content, to monitoring of the finished product (through reading the final product, error detection, and checking for sense-making), to sharing their products with others, children develop an expectation that concept maps carry meaning and intent to communicate. In planning and monitoring concept maps for sense-making, young children also engage in perspective-taking both in making their own thoughts explicit for an audience, and in understanding that concept maps can represent what others are thinking.

2 Concept Mapping as Socially-Mediated Experience

A great amount of adult guidance is necessary in order for very young children to effectively engage in a concept mapping activity. Teachers must explicitly address with children the representational meaning of the concept map by explicitly stating the goals of the activity, such as explaining that concept maps "show what you know about something." In selecting concepts to add to the map, the adult must make explicit the intention to "make sense" of one or more concepts (McAleese, 1998), rather than viewing the map as simply "looking at the pictures" (Figuerido et al., 2004). As children learn specific meaning and purposes associated with concept maps through interacting with others who provide language, guided experience, and assistance to instill these tools with meaning, the concept mapping task is socially constructed. In the present study, qualitative methodology was employed to describe ways that, during an eight-week concept mapping intervention in a kindergarten classroom, adult-child communication during concept mapping instruction structured children's ability to understand and use the concept map for literacy-related purposes.

3   Methodology

3.1   Participants

Participating children (N=14, 7 males and 7 females) attended kindergarten in an urban city in the Northeastern United States. Children were of mixed ethnicity (5 African-American, 5 Puerto Rican, 3 Biracial, 1 White) and low socioeconomic status. The classroom teacher, Lynn, was a 26-year-old white female with 3 years of teaching experience (all names used are pseudonyms). Prior to beginning the study, the researcher met with Lynn for a three-hour training session to introduce concept mapping theory, materials, and classroom applications. The researcher provided additional support through planned meetings during the study.

3.2   Materials

Concepts were represented using photo-word cards with magnetic backing, and directionality was provided by magnetic arrows. Linking words were represented using voice recorders with magnetic backing, into which children were able to write their ideas on blank space provided on the front of each recorder. The use of voice recorders has been proposed as a technique to help pre-readers preserve the meaning of linking words and communicate the conceptual relationships to one another (Gomez, 2006). Concept maps were constructed and displayed on magnetic boards. Conceptual content knowledge corresponded to vocabulary and concepts from three life-science units from the ScienceStart! Curriulum, a hands-on, science content-based early childhood curriculum designed to foster language and literacy (French, 2004). The classroom teacher was previously trained to use the curriculum and had been implementing it for 2 years. The units corresponding to concept mapping lessons included 1) Types and characteristics of living things, and what things they need in order to grow; 2) Types and characteristics of healthy foods, the four food groups, and the food pyramid; and 3) Parts of a plant, and things plants need to grow.

3.3   Procedure

Children were introduced to concept mapping in three phases of increasing complexity over the course of eight weeks, learning to make maps using 2, 3, and 5 concepts (see Figure 1). At each level of complexity, children were provided multiple opportunities to practice concept mapping with varying levels of adult support (whole class large group, small groups of teacher and 3-4 children, and 1-on-1 teacher-child interactions). Each of the three adult-supported conditions were videotaped three times over eight weeks. Field notes provided narrative records of each observation session. Observational data were supplemented by child and teacher interviews throughout the eight-week period to check for children's task understanding as well as teacher impressions and informal observations.

Qualitative analysis explored how children's understanding of the structure and purposes associated with concept mapping developed in instructional interactions. Videotaped teacher-guided lessons (transcribed verbatim) were coded into categories according to the constant comparative method (Glaser & Strauss, 1967), using NVivo7 software, revealing ways that the genre, structure, and communicative purposes of concept maps were co-constructed in classroom interactions.

4   Results

4.1   Concept Mapping Scaffolds Expository Language

In all three instructional arrangements, children had multiple opportunities to generate and create concept maps in the expository genre. Beginning in the large group setting on the first day of the study, Lynn began to model spoken propositions in the "noun-linking verb-noun" format during group discussions, as well as ask questions prompting children to generate their own propositions: "Who can tell me something that is living?" "What did we say yesterday all living things need?" As children volunteered their ideas, Lynn revoiced children's comments (underlined): "spiders are living; people are living; all living things need water; all living things need food." Children began to contribute their own propositions in similar format. Lynn followed the general discussion by modeling propositions children had generated into concept maps. Finally, individual children had the opportunity to come to the front of the class to create a concept map to represent their spoken sentences, and read one another's concept maps.
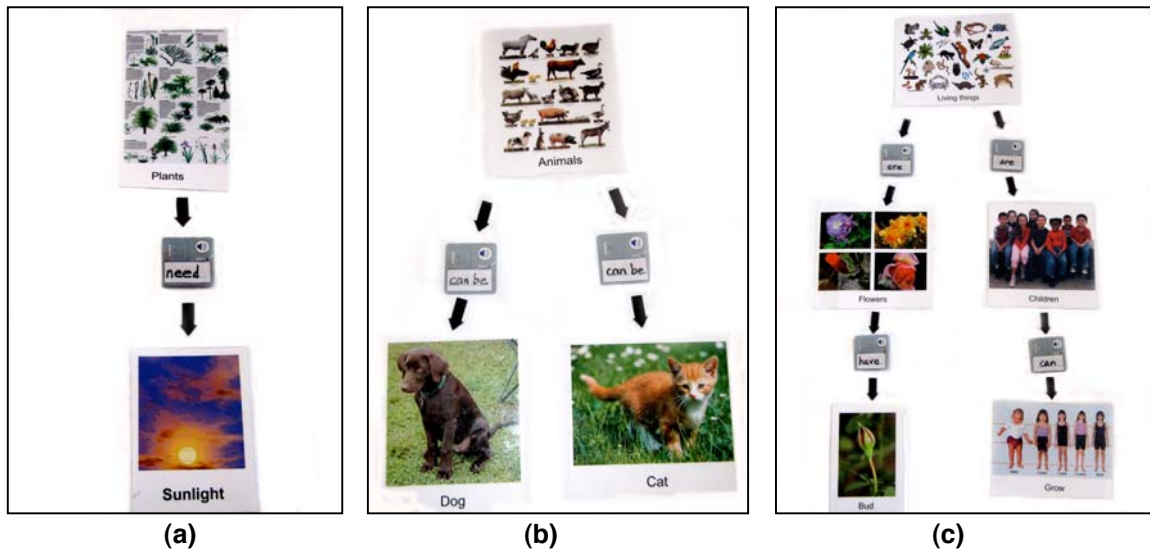
Figure 1. Examples of (a) 2-concept map, taught Weeks 1-2 (PHASE 1); (b) 3-concept map, taught Weeks 3-5 (PHASE 2), and (c) 5-concept map, taught weeks 6-8 (PHASE 3)

In the one-on-one and small group settings, Lynn supported the structure and language of children's stated propositions in a number of ways (see Table 1), by helping them think about defining attributes, category membership, and types of relationships that could be expressed with present-tense, "timeless" verbs. With this assistance, children were able to generate a large variety of different propositions, using the sets of concept cards in multiple combinations to construct meaning. As each unit built on the next, the set of concepts children were able to use increased, allowing a single concept to be discussed from many perspectives.

Defining Attributes	Category Membership	Logical Relationships
- What's one thing living things need? - Who can tell me something that is living? - What else is the same about living things? - How do you know a box is not alive? - What kind of living things need sunlight?...Do plants need sunlight, or do animals need sunlight?	- Is turkey meat? - Where would you put broccoli? Why don't you bring it up here and sort it for me? - Are trees animals? Are trees plants? - Can we say something else about the chicken? What group is it in? - Are plants living or non-living? - Is corn healthy or unhealthy?	- What do you wanna say about stems? Something that they, are part or, something they need? - Can you find a concept here, figure a way we can link it with water, so that it makes sense? - Think of something we can say about healthy foods, something they help, or something that…they do?

Table 1. Examples of decontextualized talk scaffolded by the classroom teacher

Small group interactions in particular revealed ways that expository sentences were co-constructed during the concept mapping activity. As Lynn encouraged children to make decisions together rather than individually, children used decontextualized language to talk to one another about concepts and their attributes. Lynn assisted children when necessary in negotiating the steps of the concept mapping task, explaining their decisions, guiding their behavior towards the goal of construction and checking the concept map for sense-making. Children in some small groups began to negotiate these regulatory tasks with one another with minimal teacher guidance. Two children, Alex and Tony, entered a period of rapidly "discovering" new propositions, showing a sense of excitement that increased as the map was constructed and they represented their thinking in the concept map:

Tony:	*(says to Alex)* Gimme those green beans.
Alex:	Green beans. Peas! *(hands "peas" to Tony)*
Tony:	*(puts "peas" at the top of the board)* Peas are –
Alex:	Vegetables.
Tony:	Yeah *(puts "vegetables" at the bottom left)*
Both:	Peas are vegetables
Tony:	Peas are, unhealthy food –
Alex:	Unheal – healthy!
Tony:	Oh! I got – I got one! Um peas are vegetables *(points to "vegetables")*
Alex:	*(puts "healthy foods" at bottom right)*
Tony:	Peas are healthy *(points to "healthy foods")*
T:	Those both make sense?
Both:	YEAH!
T:	Let's record em, let Tanya help write
Alex:	Marker! Marker!
Tony:	Write are, Tanya!
Alex:	Write are!

Although all the children in the classroom did not reach this level of group negotiation, the above excerpt illustrates the potential for concept maps to stimulate decontextualized thinking and peer-peer talk in a highly motivating context. The above examples demonstrate that young children are capable of using expository language forms to provide and share decontextualized information, and that through concept mapping, this genre can be taught explicitly using hands-on materials, teacher guidance and repeated opportunities for practice.

4.2   Scaffolding "Concept of Word" Using Concept Maps

In the one-on-one setting, Lynn spent a great deal of time helping children relate concept mapping elements to the parts of a spoken sentence. The language Lynn used when referring to materials reflected that each component (concept card or voice recorder) represents a "word," and each propositional arrangement of materials (topic concept card) – | linking word/recorder | – (related concept card) represents a "sentence." In explaining task instructions, Lynn reminded each child that they would be "making sentences." Lynn would frequently ask children, in helping them plan the content of their concept maps, "What's your sentence you're thinking of?" Lynn also related the materials to words by referring to their placement on the board and placement relative to one another in the concept map (see Table 2):

Abstract structure	Spoken word	Concept Map element	Placement
First word in sentence (subject)	"babies"	concept card	top
Linking word	"need"	voice recorder	middle
Related word (object)	"food"	concept card	bottom

Table 2. Correspondence between spoken word and concept map element, scaffolded by teacher

When checking the map for sense-making, Lynn stated that it was time to "play" or "read" the map (depending on whether the linking word was recorded or written), accompanied by running her hand over map, top to bottom, providing a nonverbal indication of where to start reading. Lynn modeled the reading of the concept map prior to asking the child to read the map, by pointing to each element as she stated each word from beginning to end. Allowing for a greater level of child participation, Lynn then pointed to each item (top-bottom) while the child said the corresponding word. Finally, when the child was ready to read the map on his or her own, Lynn pointed to first word of the proposition to direct a child's attention to where to start reading, giving the verbal instruction, "We'll read it all the way from the top, all the way down to the bottom," and the child was able to read the concept map as modeled by Lynn.

At times, children had difficulty understanding the one-to-one correspondence between word and symbolic element in the concept map, which was observed most frequently in concept map construction. A common "error" observed involved children recording the entire proposition into the recorder, instead of just the linking word or phrase. The process whereby Lynn worked with children to resolve this misunderstanding was frequently observed in one-on-one teacher-child talk, as illustrated in the conversation below:

T:	*(points to "baby")* Babies, *(points to recorder)*
Damian:	Need
T:	*(points to "food")*
Damian:	Food
T:	So what word are we gonna record here? *(points to recorder)*
Damian:	Need
T:	Good boy *(touches recorder)*
Damian:	*(speaks into recorder)* Babies, need –
T:	Alright now listen. Watch this *(touches "baby")* We have a picture of…
Damian:	Babies
T:	Now what – *(touches recorder)* So we have babies, *(touches "baby"),* and we're gonna do, NEED *(touches recorder)* so all you need to record is NEED

In this conversation, Lynn revealed an implicit understanding that each word is only represented once in the concept map, and while the concepts are represented by pictures, the linking words must be represented in the voice recorder. A similar but related understanding involved the knowledge that both the content and order of concept map elements must correspond the content and order of words in the spoken proposition. In the following example, the child chose an incorrect concept card ("orange") to correspond to the spoken concept ("food"). Lynn both modeled the one-to-one correspondence between spoken and symbolic element, and explained the necessity of matching spoken to represented concepts *in the order that they were stated*:

T:	So what do you wanna say?
Dejah:	Um. Children could – can eat food
T:	Alright well listen. We have a picture of what? *(points to "orange")*
Dejah:	Orange
T:	And we have a picture of…*(touches "children")*
Dejah:	Children
T:	Okay. If you're gonna say children eat food, then we need a picture of what?
Dejah:	Food
T:	Food. And what do we need to put at the top? Food, or children? What do we say first? Children eat food. So what goes at the top?
Dejah:	*(picks up "children" and shows it to Lynn)* Children

In the present study, children's ability to understand the correspondence between spoken and symbolic element was a determining factor in their success in creating concept maps that made sense and were interpretable to others. The fourteen children in the study displayed a wide range of individual differences in their "concept of word." Children struggling to understand the one-to-one correspondence between word and symbol required much greater teacher assistance, practice, and explicit instruction in creating their own concept maps. However, struggling children demonstrated qualitative improvements over time, requiring less teacher assistance and fewer hints during concept map construction at the end of the eight week period, suggesting that "concept of word" can be learned given appropriate resources and guidance.

4.3   *Understanding the Communicative Functions of Concept Maps*

Throughout the intervention, Lynn made salient the communicative function of concept maps in a number of ways. Lynn frequently followed a completed concept mapping task by a summative comment related to its "readability," such as, "Somebody can come and read what you wrote, right?" or, "Can somebody else read it?" Alternately, Lynn might read the map herself, pointing out possible sources of confusion for the reader if the map was missing information, for example: "Okay what are you missing here *(pointing to empty space where arrow should be)* cause I'm gonna read it, and I'm gonna get to here and then I'm not gonna know what to do. What am I missing?" Lynn further scaffolded the intentional nature of concept maps by inviting individual children to express their understandings of concept map elements as they relate to communicative purposes, for example: "What do we need a marker for?" or "What do arrows help us with?" In small and large groups, Lynn encouraged children to read one another's concept maps as a way of checking for sense-making. The following large group discussion illustrates ways that understanding the communicative function of the concept map was constructed as one child attempted to read another child's concept map:

T:	Luis, can you read her sentence if she hasn't written any words or recorded any words here?
Luis:	Children need food
T:	Now Luis think-
Tony:	Children <u>can eat</u> food
T:	Oh! Look at that. We have one saying it could say children <u>need</u> *(touches recorder)* food, and then Tony is saying, children *(touches "children")* <u>can eat</u> *(touches recorder)* food. If Renee doesn't record anything here, do we know what she's thinking?
Child:	No *(multiple voices)*
T:	No. She could be thinking either of those. Does children <u>need</u> food make sense?
Child:	Yes *(multiple voices)*
T:	Does…children <u>can eat</u> food make sense?
Child:	Yes! *(multiple voices)*
T:	Yes. Renee what were you thinking when you made this map?
Renee:	Um *(stands up)* I was thinking…I said…um…
T:	What did you want to say?
Renee:	I think I'm gonna…um…write the word
T:	You wanna write the word? You can write the word. *(gets dry erase pen)* What word are you gonna write?
Renee:	Need

The above discussion helped children understand that recording or writing the linking word is crucial to the "readability" of the concept map. The conversation required children to take Renee's perspective, as Lynn encouraged Renee to express her thinking aloud. Children were also required to take the perspective of the reader with a goal of finding out what Renee was thinking. Lynn emphasized two different children's interpretations of the map, highlighting that the intentions of the creator are unknown if the concept map has missing information. At the same time, Lynn encouraged Renee to plan her sentence by stating the linking word before recording it in the map. Lynn also encouraged monitoring by asking the group if the two propositions suggested made sense. These planning and monitoring activities were encouraged throughout the study, helping children consider the link between internal knowledge and final product, the completed concept map.

5   Discussion

The current study broadens the applicability of concept mapping for use with young children, highlighting the diverse ways in which creating and revising concept maps can contribute to children's developing literacy skills. Findings illustrate that concept mapping makes expository language explicit to young children through the creation and summative representation of logical propositions. Concept mapping allows for alternate interpretations of experience, including new ways of representing and organizing knowledge separate from the immediate context, and new linguistic forms to express and talk about concepts. Secondly, the physical, componential nature of concept mapping renders the task a natural tool for increasing children's awareness of individual words within sentences, as the concrete representation of each propositional element makes salient the relationship between spoken word and textual representation. Finally, concept mapping provides an opportunity for children who are not yet readers to plan, create, and check their own literary products. In this manner, concept mapping acts as a "precursor" to tasks of written expression. Representing knowledge in visual and auditory modalities allows content to be readily shared, and problems easily detectable, enabling children learn to both consider audience understanding, and to check the correspondence between the concept map and their own ideas.

Several structural parameters were built into the present study. To reduce task complexity, the children were not asked to draw, photograph, or label their own concept cards. The use of attractive color photographs with corresponding word label was motivating for children, and made most concepts easily identifiable for children who were pre-readers. Using this structure, the classroom was able to establish shared meaning of image to concept across all individuals, increasing ease of communication and reducing fine motor requirements of children with difficulty in this area. Likewise, children in the present study were instructed in how to make three specific map structures in order to reduce map complexity given time constraints. Reducing task complexity enabled children to devote more effort and mental capacity to engage in cognitive and metacognitive processes without becoming overwhelmed by other task demands.

A next research step may involve developing causal models between dimensions of emergent literacy facilitated by concept maps, and conventional measures of reading and writing, over time. However, developing an outcome-based study based on "measures" of literacy behaviors may have several limitations given that components of literacy are developed gradually, rather than "all-or-nothing," they work in interaction with one another rather than in isolation, and they are context-dependent. A more fruitful approach may examine, through observational methods, whether engagement in natural literacy practices changes in relation to classroom concept mapping activities. It will be important for future studies to expand research settings beyond those presented in the present study, to include a greater number of children, individuals from diverse ethnicities and backgrounds, and in different geographic regions. The intersection of concept mapping and early literacy development is ripe for investigation, as concept mapping potentially "bridges" young children's ability to engage in complex literacy practices, building familiarity with and motivation for activities involving meaningful textual representation.

6   Acknowledgments

7   References

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