Building knowledge and literacy skills: Junior Kindergarten

Cindy Halewood
Institute of Child Study Laboratory School of the University of Toronto

Richard Reeve
Institute of Child Study Laboratory School of the University of Toronto

Marlene Scardamalia
Institute of Knowledge Innovation and Technology
OISE/University of Toronto

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ABSTRACT

This paper reports on the first ever implementation of Knowledge Forum® (KF) in a Junior Kindergarten (JK) classroom. This pilot study took place over a two year period at the Institute for Child Study Lab School (ICS) at the University of Toronto. The original intention for implementing KF in JK was to serve as a tool for supporting literacy in an early years classroom. Children in this classroom started by commenting on digital photos taken through out the school day and posted on the KF database (Hancock & Carver, 2001). When they wrote, students were assisted by teachers or work-study students. Moreover, the children became accustomed to writing in the database as a regular part of their day. Iterations in the classroom design occurred as the students began building onto each other's notes and working with the ideas of other classmates. Children in Year 1 wrote about their experiments in the Buoyancy view using build-on's that emphasized their need to define and label ideas. In Year 2, children began having conversations about their experiments in the Space view. They queried ideas and developed theories that other's then built onto. As their notes indicated what was meaningful to them, the children were given more decision-making control over the science curriculum. Most recently, the children have been responsible for conceiving and designing the Food view of the database with a link to the Greenhouse view. Student's conversations have gone beyond the focus of the particular view into subjects as daunting as gender role stereotyping. Student's notes demonstrate that these very young children are, indeed, able to put into practice some of the principles of knowledge building. The class database as well as the teacher's narrative account of the year provide data for this study.

Introduction

The educational innovation of "knowledge building" refers to the social construction of knowledge by a community of students. In schools, knowledge building typically takes the form of a class of students building knowledge together about a shared problem of understanding. Knowledge building classrooms have been likened to scientific research teams (Scardamalia & Bereiter, 1999). Scardamalia and Bereiter have stated that the class that adopts a knowledge building approach must make a dramatic shift from an incidental focus on learning activities to a focus on the construction of collective knowledge as its central purpose (Scardamalia & Bereiter, 1999). Therefore knowledge building is not simply another form of learning but is instead a new way of conceiving of the goal of education (Scardamalia, 2001). To make the shift to knowledge building a teacher must be innovative themselves in working between how they previously functioned as a teacher and how they envision they need to function to make knowledge building a success in their classroom. It has been said that the key to the success of any new educational innovation, including knowledge building, is the ability of practitioners to envision the possibilities the innovation represents (Bereiter, 2002). This paper is part of a group of four papers written by Laboratory School teachers at the Institute of Child Study. In previous papers by this group (Messina, 2001, Moreau, 2001, Caswell, 1998, Reeve, 1998) has reported on the often dramatic changes they needed to make to how they previously functioned in their classroom settings. This paper reports on one teacher's attempt to broaden the scope of the knowledge building work going on as her students attempted to understand the concept of evolution.

As is the case with any innovative educational environment the knowledge building approach is conveyed through a set of guiding principles. In the case of knowledge building there are twelve principles (Scardamalia, 2000). Ann Brown (1996) and David K. Cohen (2000) have both argued that in order for an educational innovation to be disseminated from its first principles it must be specified in a way that informs practitioners of the real possibilities that exist in the innovation. Linda Darling-Hammond (1997a) and other educational researchers have for some time now been pointing to teacher learning and the development of highly skilled teachers as a key component in the adoption and improvement of educational reforms (Cohen and Ball, 1999; Darling-Hammond, 1997b; Lieberman, 1995; Goodlad, 1994; Cochran-Smith, 1991; Shulman, 1987). There is general consensus then is that teachers need to have opportunities to see images of what these new educational innovations might look like in practice so that they can envision the possibilities in their own contexts. Unfortunately, experimentation is not always welcome in most of our schools today. Therefore it is important that these educational innovations have a place to be tried out and improved a role Laboratory Schools were created to address. John Dewey, the creator of the first Laboratory School, felt that this was to be the primary purpose of his school. He stated that it was to be a place that would, "create new standards and

ideals and thus (to) lead to a gradual change in conditions" (Dewey, 1896, p.437). Unfortunately, the history of Laboratory Schools (since the Dewey Laboratory School) is uneven at best with respect to their status as sites of innovation (Cronbach, et al, 1969). Many Laboratory Schools today serve the same role Normal Schools served 100 years ago as teacher development centers where best practices in education are demonstrated to new teachers but they are not places where they are "going beyond best practice" to give a vision of what is possible in education (National Association of Laboratory Schools, 1991). For the past three years the knowledge building design research that has been happening at a Laboratory School has attempted to explore and represent a new possibility for education. Initially, this research was intended to follow the design experiments methodology (Brown, 1992; Collins, 1999). However, the work to date is best described as group action research where the goal of this group of teachers has been to improve the knowledge building work of the teachers and students in these classrooms beyond their previous best practices.

Background

In the fall of 1999, the Institute of Child Study (ICS) Laboratory School was established as the first hub school in the Knowledge Society Network (KSN). The KSN is a network-of-networks joining people from schools, universities, community groups, cultural institutions, service organizations, businesses--simultaneously building knowledge within their primary groups while advancing the knowledge of others (Scardamalia, 2000). The goal of this network is to align human and digital resources in ways maximally conducive to knowledge advancement. A hub school in this context should be committed to constructing and describing a progressive approach to curriculum and to be continually advancing the growing edge of that innovation. Over the past three-years the ICS Lab School has demonstrated exceptionally high levels of educational achievement while continuing to press the field of knowledge building forward. At the beginning of this three-year study there was little for the classroom teachers to go on with respect to knowledge building, so the focus in the first and second years (1999-2001) was on the initial development and specification of a Lab School approach to knowledge building. Several processes were put in place over the past three years so the staff at the Lab School could begin to develop and refine their approach to knowledge building such that it could become a "hub" of activity around the development and improvement of knowledge building pedagogy. To facilitate the transition of the Lab School into a "Hub School" in the Knowledge Society Network (KSN) a teacher, with previous experience with Knowledge Building and the use of Knowledge Forum, was hired as a Teacher/Researcher for the project. In addition the teachers and the design researchers were asked to record their actions and observations in a Knowledge Forum database "view" (in each class database) which was referred to as the Calendar of Inquiry (COI). In addition, the teachers met weekly (sometimes bi-weekly) to discuss the knowledge building work that was going on in their classrooms. Videotape was gathered of many of the large group activities and discussions.

Knowledge building in Junior Kindergarten - A pilot study

Narrative Account by the teacher

My story is about how I came to use Knowledge Forum® in a classroom with four-year-olds and the subsequent shift in the way I deliver curriculum. My account spans my attempts to use Knowledge Forum® with two different groups of Junior Kindergarten children. While my journey is still in its infancy, I am committed to the principles of knowledge building and the exploration of their applicability in an early years classroom.

I teach in a small Laboratory School located at the University of Toronto. I have a classroom of 22 children, all of who are four years of age when they come to participate in Knowledge Forum® activities. These children attend class all day, so they have a lot of uninterrupted time to explore the database. I am fortunate in having a student intern placed in my classroom, as well as the assistance of many work-study students who have much more expertise in technology than I possess. The lab school also has a teacher-researcher on staff whose vision of knowledge building in the classroom is a constant source of inspiration for me. It is in this supportive setting that I used Knowledge Forum technology in Junior Kindergarten for the first time last year.

For me, the attraction to KF was that it was something that was being used successfully in the older grades at the school. Teachers and students delighted in creating classroom environments that supported a community of learners through this technology. Still, I couldn't imagine how I could apply it in a classroom of very young children. They need the developmental capability to understand the constructivist approach to knowledge building; the difficulty being that the experience of young children is still egocentric.

I was also critical about the role of computers in a busy kindergarten classroom. I thought that they took up much-needed space. I found that the same children were using the computer and that those children were often the most in need of participating in the more social aspects of kindergarten life. The programs themselves, while occasionally challenging, rewarded children with bells and whistles- the same approach one would use to train a dog. Mostly, I found that I was doing a lot of "policing" around the use of the computers. I was setting up a schedule so that everyone who wanted a turn got one and shooing away the crowd of kids who would askew other activities in favor of watching someone else play a computer game. This constant vigilance took away from other, more interesting things that I could be doing in the classroom. I began to limit the amount of time that the computers were available. The restrictions had the effect of a prohibitive substance- when they finally got the chance to use the computers, the children viewed them as a rare treat and they clamored all the more for them. Obviously, in order for me to embrace the idea

of computers in the classroom, I had to experience a seismic shift in the way I thought about their usefulness.

Ironically, my attitude began to change because I was exploring applications for another piece of technology- the digital camera. I was using it to capture images of the daily life of the classroom and, then, getting the children to write about them in their own Photo Journals. The idea of Photo Journals came from the lab school kindergarten at Carnegie Melon where the teacher used group and individual journalling as a way of promoting early literacy. In my classroom, children could select from a multitude of photos and dictate or write their ideas about the pictures on a daily basis. When used in conjunction with phonics instruction, Photo Journals certainly promoted early writing skills.

But the really interesting feature of journalling was how this activity prompted the children to think reflectively about their experience. It was as if the pictures acted as catalysts for their memories. Children either wrote a little or a lot about the photos but they always contributed something. Even those children who were largely nonverbal in other classroom activities seemed drawn to choosing and describing pictures of themselves and what they were doing. As I observed the children recall details or situations or even parts of conversations, I realized that I had assumed that their perceptions of their world were very much in the moment. Based on my belief that children are egocentric at this age, I had not credited them with an ability to construct meaning out of their experiences. I wondered if there were other ways to support children in their thinking.

Once the Photo Journals were an established part of the language curriculum, I began to talk about them with the teacher/researcher. It was his suggestion to post these digital pictures on our own Knowledge Forum database to see what the children might do with them. He imagined the children might comment on pictures of one another's block structures - kind of like sending and opening messages email-style. Together we wondered if there might be a difference in the children's writing compared to the writing they were doing in their Photo Journals. Indeed, could KF be a tool for supporting early literacy? I began to see that this was a direction worth pursuing. Rather than the computer acting upon the child, the child could act upon the technology to shape ideas. Rather than withhold computer time because it interfered with kindergarten, I could use the natural draw of the machine to attract those children who were the more reluctant writers in their Photo Journals. Within a week, both computers in the classroom were outfitted with KF software and we were embarking upon an innovative approach to technology in kindergarten. The children were introduced to KF individually and they were instructed in the KF method of closing and contributing. From the beginning, we used the words "Knowledge Forum" to describe the activity of writing in views and they seemed comfortable with using that terminology.

Our first view was simply an electronic version of the Photo Journals, with children clicking on digital photos and commenting upon them. To the extent that the children were all interested in working in our view, KF was useful in attracting those children who had more limited participation in Photo journals. When asked for their preference, students indicated that they liked writing on KF for a number of reasons. Many stated that they simply liked the computer (proves my point about the undeniable attraction of the machine). They liked the color photos (we are unable to produce color photos for Photo Journals). A few astute children said that they liked looking at what their peers had written. I also noticed that some students whose fine motor control made it difficult to form letters were able to write (using initial consonant sounds) by "hunting and pecking" at the keyboard. Mostly, the children dictated their ideas to an adult who also assisted them with exploring the database (the double-clicking feature is difficult for young children to manage).

I was excited by the students' interest in KF and I began to introduce them to the notion that they could "build-on" to someone else's note. As in Photo Journals, the children were able to provide details about the pictures. However, in KF they sometimes built on to each other's notes in a way that suggested that they had more information or a different point of view. One child would say of a photo of a play castle in the classroom, " we are looking in the castle". Then, another child would build on with their point of view: "You are waiting for a turn in the castle". We still ran "traditional" skill and drill programs occasionally but the bulk of our time spent on computers was KF related. Now, the cluster of students who hovered around the computer was a welcome feature in our classroom.

The question of paper versus electronic journals was and is an ongoing research topic in this classroom. ICS has applied for and received funding through the National Association of Laboratory Schools to study the effectiveness of these two tools in promoting literacy in the early years. Our study is ongoing and we are in the midst of deciding on measures and means to determine control groups using our JK classroom and the Kindergarten at Carnegie Melon. I remain committed to both forms of journalling but as I continued to find new applications for KF, I discovered that it was providing the children with another means to communicate.

Indeed, students' interest was high enough that I felt I could connect KF with other subject areas. I chose science because it offered opportunities for hands-on experience and ongoing discussion and because I could photograph our experiments for our view in KF. With the help of two of my student teachers, I designed a unit on buoyancy that included Knowledge Forum as a means for discussion as well as the site for pre and post testing of knowledge. In the pretest and post test, we asked children to look at pictures of five objects (a shell, a ball of plasticine, a banana, a rubber duck, and a toy boat). They were then asked if they thought each object might float or sink and to give their reasons why. The children's responses were recorded in the

KF view on buoyancy so that we could compare them with their responses to the same questions after the conclusion of the unit. Our goal was to teach concepts of float and sink, to introduce the idea of displacement, and to explore the effect that temperature has on water. The teachers designed and delivered experiments that reflected those goals.

These are lofty goals indeed. Here's what those ideas look like in a classroom of four-year-olds: Our classroom was literally awash. We were wet for weeks (a young child's clothes act as wicks so that they are quickly soaked up to their necks). We tested our theories about the five objects with hands-on experiments. We attempted to design unsinkable boats. We made materials float simply by changing their shape (plasticine balls formed into rafts)! We caused overflow by putting as many objects in a vessel as possible. We made warm water rise from the bottom of an aquarium filled with cold water. All this time, we dutifully recorded our activities with the digital camera and posted them on KF, along with a few key words for the children to read and use in their own writing.

With all this activity, it was what was happening in the buoyancy view on KF that was most startling for me. One student in particular was very interested in reading and commenting on what others said. Advanced in his abilities, he was able to read with very little adult assistance and his writing, while in the emerging stages, used many of the conventions of spelling and sentence formation. One day, I noticed that he was exploring our database on his own. He was opening and closing the notes of others and then moving them around so that the entire view looked like a spider web. That is, he was exercising control over the data and the ideas in the database. I made a mental note to clean the view up as soon as he left. However, another child soon joined him and together they opened and closed several notes. At one point, they opened a note and the more advanced student began to sound out the note: " The can sinks." (The picture here is of the experiment that proves warm water rises. Once the jar has released its warm water it floats to the surface.) He said to his friend, " That's not right." To my amazement, he began to create his own note, only occasionally asking for my assistance with spelling. He had written, "It is not a can. It is a beaker." As I understand it these actions are consistent with the KB principle of Epistemic Agency (see Appendix A) - students taking control of their ideas in the classroom and database.

Now, in my own omnipotent view as a teacher, I had imagined that this advanced student would have written some compelling argument for warm water rising and that the placement of the jar was an after-effect of its having expelled its liquid. How brilliant of me that I had so successfully taught this subject area that the writing in KF would prove how effective I had been. In fact, what this student wrote was absolutely developmentally appropriate and very much reflected what was important to him. In his attempt to make sense of his world, this student needed to give the correct name to that object. It turned out

that his comment was important to others in the class as well. Many children read his note and concurred that it was, indeed, a beaker. In the culture of the class, the word "beaker" found its way into the daily conversations of the children: Any object that was clear glass with numbers on it and had a pouring spout was henceforth referred to as a "beaker" by everyone in the class.

It is of interest to note that the pre and post tests for the buoyancy unit revealed that the children already had a great deal of accurate information about the concept of float and sink before we began the unit. The answers both pre and post were virtually the same. Not only was the extent of the children's knowledge humbling to me, I found that my own grandiose notions about forging advanced ideas through the use of KF in Junior Kindergarten were misguided. When I allowed the children to direct the conversation, they were obviously much more effective at addressing misconceptions at a level that was accessible to them. I ended year one with KF with the feeling that I would continue with it as a tool to support literacy and to address other subject areas in the curriculum. I still viewed myself as the best conduit for knowledge. To be sure KF, would be the best place to discuss what we were doing, but it would be my lessons, my ideas, that the children would absorb. In fact, it would take another term with KF in year two before I would begin to reassess my own role as a teacher.

I began the following September by launching into a unit on the farm. The students expressed an interest in animals and I grew up on a farm so I thought this might be a good starting place. This time, my goals for KF were to get the children to write as much as they could about farm life. I recounted stories from my childhood experience and posted the pictures that pertained to these stories on KF (no small feat since these photos needed to be scanned and were a few decades old). Still in literacy mode, I was looking for the children's skills in recalling details of my stories. As well, this group of children was new to KF and I wanted to find an easy way for them to begin writing. At the same time, we began Photo Journals with pictures taken of daily life in the classroom. What I noticed was that the farm view was interesting to some children but that the Photo Journals were attractive to almost all because they pertained to them! Inherently, I knew that we are all more attracted to ideas that are about ourselves but, once again, I was attempting to make KF a tool for delivering my own curriculum.

I began to rethink my ownership of the KF view. How could it become more theirs? I knew that the grade 1 class, also involved in KF activities, was working first offline, in groups, and then typing their group's ideas on KF with the help of a work study student. The teacher's concern that the Knowledge Building principle of democracy be upheld was her reason for forming groups. Like me, she also had a powerful student the previous year whose ideas lead KF but may have left others (whose skills were less developed) out of the conversations. I realized that in my classroom, I was the driving

force behind the conversations- they were my stories after all. I was impeding the democratic process.

So that my presence was less visible on KF, I decided that for our next unit, Space, we might adopt the idea of forming groups. These groups would generate questions that they wanted to answer and the conversations could come from their own curiosity. The groups that formed were the Sun, the Planets and the Stars. The children's questions stemmed from a genuine curiosity about the mysteries of the unknown. Their answers were thoughtful, sometimes charmingly naive and sometimes, based on scientific fact. What was missing from these conversations was a kind of "banter", a back and forth that would indicate to me that the reader had absorbed what the writer was saying and, then, had something to add to that. I wondered if the topic of was Space less accessible than Buoyancy (last year's unit) and, therefore more difficult to explore on KF.

To make it more accessible, I had a link created from the Space view called "Our Space Stories". These were the children's own drawings that were scanned on to KF. They could describe or write about their own or someone else's picture. Many of the stories were imaginative and had an entertainment value for the reader. Still, the "banter" was absent. Children enjoyed reading each other's stories but they often declined to comment or question them. They were more likely to comment upon the pictures that accompanied the stories. When I asked one student why he didn't have anything to say about another student's story, he said that it was "her story". Obviously, authorship implied ownership for this student. I could see that I had narrowed the field of communication for the children by designing a view that isolated each picture and story. Children couldn't call the Space Stories view theirs because the stories were viewed as the intellectual property of individuals! Could it be that these young children were resisting interacting in this view because the activities did not lead to collective knowledge? The old kindergarten song that goes, "The more we get together, the happier we'll be..." kept coming to my mind. I had to find a way back to the way last year's class had created meaning out of a glass jar.

Last year's success at Knowledge Building had been due to all those hands-on experiments we had done around buoyancy. I decided to bring back the digital camera, photograph our experiments, and post them in a Science in the Classroom view that was inside our Space view. Our first experiment was in making baking soda and vinegar volcanoes. As a class, we discussed what we knew about volcanoes from books that we read. We knew that volcanoes were active here on earth as well as on many other planets in the solar system. We took digital photos of the teacher demonstration as well as the individual volcanoes the students created and posted them on the Science in the Classroom view. That view took off as the children clamored to share their thoughts on KF.

In fact, I could see by their discussions that the children building onto each other's ideas in a way that connected our experiments to

real volcanoes. The conversations they were having on KF revolved around what forces create explosions in real and experimental volcanoes. Some children also queried the temperature of volcanoes and whether lava is ever cold enough to touch (whereas we were able to touch our experiments). Their notes were thoughtful and supported by examples or contemplative and backed up by their own theories. Occasionally, a student would preface a note with "good question" or "I agree". It was obvious that the children were knowledge building in a way that was absolutely appropriate for their own needs. They were discussing and building on their experiences, they were constructing their own meaning, they were truly knowledge building!

Yet, my excitement over their abilities was tempered by the sobering realization that I needed to redesign the curriculum in a way that redefined by role as teacher. My experience with KF taught me that my ideas about how and what the children should learn were not a priority. No longer could I assume the role of the "deliverer of knowledge". This should have been obvious to me, a teacher with a background in early childhood education and a strong belief in inquiry. I espoused a pedagogy that was imbedded in child-centered learning. Moreover, I was comfortable when children made mistakes in the process of learning (as long as they came to the "right " answer). I reflected that I had considered myself the central player in the script called "The Curriculum". I set the goals, I designed the lessons, I delivered the information.

What if the curriculum was a shared endeavor? As a community of learners, the students and teachers could design the learning environment together. We would all better served because the learning would reflect the class's actual needs. The idea of relinquishing control in this way was revolutionary to me. Especially in children this young- who looked to me for everything from dressing them for outside to handling the occasional toileting accident- were they capable of directing their own inquiry? There was only one way to find out. I had to trust in their abilities, trust the direction they wanted to go. Thus, I began a by asking the children what they wanted to do next, as a class.

After much discussion as a group, we decided that we wanted to know more about food. The direction came from a child who has many food sensitivities and the children wanted to know why certain foods could make you sick. But soon, the conversation was lead by a student who wanted to know what foods you needed to be strong and healthy, "like a superhero". I asked the group if they could think of ways that we could find out about healthy foods. Many decided to go the library with their parents on the weekend. Others said they would ask doctors or their parents. I told the Food was a subject about which we could all learn and that I would do some research, as well. At this point, I wasn't sure if what we were doing was redesigning curriculum principles or providing an opportunity for an extended Show and Tell.

But it was the introduction of an old poster of the Food Pyramid found in a parent's closet that jump-started the conversation in the direction KF. The idea of food fitting neatly into categories or groups was really interesting to them. When I asked them what they thought we could do with these groups, the children decided that they wanted to do experiments around food. Children offered suggestions for experiments, all of which we discussed and voted upon the rule in kindergarten is that you can vote as many times as you want). Now came the "trust" part for me: I said, "How can we let others know what we discover about food?" They answered that they wanted to put on a cooking show for their parents and that they could talk about food on Knowledge Forum®.

Truthfully, I wasn't prepared for this direction because I still thought that I had imposed KF onto the children. However, I was starting to see that they had been shaping knowledge building all the time and that using the technology to communicate ideas was just another means for them to converse. Secure in this validation, I took another leap of faith: I told the class that the teachers had been designing the views Knowledge Forum all this time. I told the class that the food view was their view and that they could design it anyway they wanted. Though there were many suggestions, the class settled on using the diagram of the food pyramid as the first picture you see when you click onto the view. They decided that the experiments we did could go into each food group on the pyramid. Click onto a food group, and the links opens for Grains, Vegetables, up to the so aptly named Candy group (where pictures of making butter experiments are posted).

Some of the explorations in the food view have been overwhelming for both the students and myself. One afternoon, a particularly adept work study student helped one if the children to draw the food pyramid for this view, as well as create the links for each of the food groups. This felt like a really significant step toward creating a new classroom environment. But we took a few steps back the next day when the children asked us to type keywords under each of the pictures they had chosen and I simply lacked the technical skills to do so. Yet the children's growing proficiency with KF as a medium for knowledge building was compelling.

Sometimes their notes appear to be veering far away from the chosen topic. An example of this occurred when a child wrote he was not interested in planting (this from a planting vegetables experiment). He stated that planting was "girl stuff". This note was read by a girl who stated that planting was both "boy and girl stuff" and ,besides, she had seen him playing in the garden (we have a garden center in the classroom). This response by a peer addressed the larger issue of gender stereotyping that often plagues kindergarten classrooms. I have never been able to successfully broach the topic without it sounding like a lecture and I am thrilled that KF provided the vehicle to have this short discussion. It is interesting that this conversation then returned to the topic of planting and the importance

of nectar to flowers. How appropriate for two five year olds to shift gears so quickly and get back to the matter at hand. My faith in the children is unshakable, however. So is my belief that my role is to support, not to lead the inquiry process.
Where will KF technology lead us next? I am not sure. I now realize that this state of disequilibrium is a good thing for knowledge building. Those queries and comments lead to a greater desire for yet more information. Once we wrap our heads around a new concept, another idea crops up (pardon the garden pun). I do know that I feel as if I have caught wind of a revolution in education and I am thrilled to be along for the ride.

Classroom design - A review with principles

My experience with using KF in a Junior Kindergarten classroom is thus divided over two distinct years. During this time I experienced a shift in the way that I deliver the curriculum based on my own emerging realization that very young children could and should be supported as knowledge builders. What follows is a review of my implementation of KF over those two years along with direct references to the applicable knowledge building principles (see Appendix A).

In the first half of Year 1, I used the technology as another way to reach those children who were reluctant writers. I had already implemented the use of Photo Journals - a way for children to reflect on their experiences by writing about digital photos taken during the day. I found that some students askew writing in their journals in favor of other, more interactive activities in the classroom. In addition, some children were able to articulate ideas about the photos that their emerging writing skills simply could not support. I was looking for a way to enable the children to write without the mechanical hindrances of traditional writing tools. I was also looking for a venue for writing that was enjoyable for all.

Our teacher-researcher suggested that the KF technology might have interesting applications in the JK room as a tool for supporting literacy and writing in particular. The idea was that the same digital photos that the children used in their photo journals would be made available to the students on the KF database. Children could comment upon a the pictures either with the help of an adult or by typing themselves; thus, freeing themselves from the laborious task of printing and allowing for the greater articulation of their ideas.

It was with terrific ease that the children assimilated KF into their classroom life in the first year. Students were attracted by the use of the KF technology because they were already attracted to the computers in the classroom and to the familiar computer programs of skill and drill that were loaded on them. The children's response to KF was encouraging, with each student expressing a desire to "work" on Knowledge Forum. When children wrote about a picture, others built-on

with their own ideas and impressions. They were curious about what one another said and, often had differing points of view.

It was apparent that the technology was providing a forum for these young children to communicate in a new way, a way that allowed for everyone's point of view to be stated and without interruption (this is a common feature in discussion groups with young children).Although I was unaware of what knowledge building principle was at play, KF's application in the JK classroom was supporting an underlying principle of knowledge building - that of **democratizing knowledge**. Indeed, KF had the effect of empowering children who may have been reluctant to share their ideas in the larger milieu of the classroom.

In the second half of Year 1, I wanted to connect the children's ability to contribute various ideas to a specific area of the curriculum. I chose science because it allowed for the opportunity for hands-on problem solving and for becoming deeply involved in the process of discovery. With the help of my student teacher, I designed a unit on buoyancy with experiments that could be posted on the KF Database. The students were introduced to the ideas of displacement, float and sink, and the effects of water temperature through experiments that they conducted themselves.

A JK Buoyancy view was created and photos, along with key words appeared on the screen for the children to comment upon. What the KF database made evident was that my own grandiose ideas of imparting knowledge to the children were quickly usurped by the children's own interests. The notes the children wrote focused on what was actually happening in the photos rather than the scientific principles behind buoyancy. For example, one student wrote to correct the assumption of another that the glass jar of warm water in one experiment was not a can but a beaker. Defining "beaker" was what was important and appropriate for this five-year-old, not grappling with a prescribed set of expectations. It became clear to me that the children were demonstrating another determinant of Knowledge Building: Understanding the world through labelling and naming represents **authentic problems** to this community of very young learners. The notes were a reflection of the **real ideas** they had about what we were doing in the class and, thus, a determinant for knowledge building. I ended Year 1 determined to implement KF in my classroom the following year and to introduce it to the children as early as possible.

By September of Year 2, KF was up and running in the classroom. My intention was to return to the original thrust of this pilot, which was to support literacy through the technology. I designed a unit on the Farm and familiarized the children with stories of my own experiences as a child growing up on a farm. Old photos that accompanied the stories were scanned and posted on the KF Database. Children could click on the pictures and comment upon them. My hope was that the children's writing would indicate how much of the stories they comprehended. The resulting notes were a mixture of the children's own stories that used the pictures as story-starters and

curt one-word descriptors. While interest in working on KF was high, the student's interactions were missing. There were no problems to solve, no ideas to debate. I was reminded that the kinds of communication on KF from Year 1 were spawned from a focus on science.

I decided to design the next view in KF to conform to a scientific area of the curriculum. As a class, we next chose Space as our focus for study. Moving from a look at rural life to contemplating the universe may seem like a jump in logic. In fact, this is an easy transition for young children to make as they are not hindered by preconceptions of order. Our Space view was comprised of questions that were generated by our discussions of the stars, the Sun, and the planets. Children had many theories about and some actual knowledge of Space. But the problems of Space were not real to them. The "banter" that was present in the notes of Year 1 was not present in this set of notes.

I thought that if the idea of Space was personalized, I might generate more discussion- back to the real ideas of knowledge building. Students drew pictures of their own aliens and I posted them on a link in the "Space" view called "Space Stories". Children could click on each other's pictures and comment on them. What transpired was that many children wrote imaginative stories about their aliens. When I asked one child why he didn't write about what someone had said, he replied, "Because it is their story." Clearly I had defined the boundaries of knowledge building too narrowly here. True KB has to be a result of **community knowledge and collective responsibility**; not the idea of one but the ideas of many. How amazing that someone who has been on this planet only five years could help me to see that!

I had to design the inquiry into Space in a way that allowed the students to explore, once again, in a hands-on way. Pictures of our experiments around volcanoes that occur on earth and other planets proved , once again to be the springboard for discussion in the database. One student querried the properties of lava ("What makes it come up?") and came up with a theory ("It is the bubbles"). Another student built on this note by describing the subsequent action of the lava experiments in our classroom ("Yeah, and it spills over"). Here I believe we had achieved a better sense of **community knowledge and collective responsibility** - at least the way that it can occur in a Junior Kindergarten classroom.

The example of how the students took charge of the food view was compelling for me. Even though it was difficult to do, the students exercised a level of control over the growth of the database that was beyond what I had previously allowed to happen in the Junior Kindergarten classroom. I believe I had reached a level of understanding about knowledge building that it was essential that the children had some **epistemic agency** over their own knowledge building environment.

What comes from this kind of classroom environment is most unexpected. Conversations that take place sometimes appear unconnected to the material, yet have a value to the community that is beyond measure. The discussion about "girl stuff" provides evidence that, though unconnected to the focus on planting, the students were grappled with a theory that was submitted by another and attempted to make a knowledge advancement. Here, we had true **knowledge building discourse** in the pursuit of **improvable ideas**.

As I have said, my own belief about what children can do has been dramatically altered by the implementation of KF in my classroom. It has changed my approach to teaching and redirected my energies in a way that supports these little human beings in a journey toward knowledge building with others that will hopefully pervade their lives.

Conclusion

This paper is about the changes that I made as an educator and specifically my dawning realization that I needed to make the curriculum the student's curriculum - one that is meaningful for them and allows them to go in a direction that may not fit perfectly with my expectations. What was initially a pilot project to look at ways that KF technology could support early literacy became the catalyst for self-reflection and a revolution in the way I teach. Once it became obvious to me that KF could facilitate knowledge building discussions in very young children, I knew that I had underestimated their ability to direct their own learning. I no longer hold the "Big Picture" when designing what the children will learn. Instead, I support the student's inquiries, allow them to ask divergent questions, and provide them with the materials that are meaningful for them.

This is an especially daunting task when the class is so young. There are many practicalities to consider. First, a kindergarten class is by nature a busy, sometimes boisterous place where the focus is on integrating everything from new social skills to learning bowel control. There are no times in the day when children can work in relative quiet, though we are lucky to be able to provide them with ample one-on-one time with an adult.

Another issue is the limited ability that children of this age have to read and write. The KF technology only provides the means to communicate through the written word. I dream of the day when KF advances to a stage that this barrier is lifted for those whose abilities to communicate are challenged. In our class, we got around this problem by hiring work-study students who came in each afternoon to assist either by reading or typing the children's notes for them.

The work-study students often had much more technical know-how than I had and were generous with their time in scanning old photos and

pictures onto the database or in helping the children to uses the drawing tool. Still, the issue of training adults to work with young children and to interact with them in a way that makes KF seem exciting is an ongoing concern for me. I grapple with my own sense that true knowledge building shouldn't depend upon an enthusiastic adult as the "hook". Yet, I communicate enthusiasm in order to grab the student's attention in many other areas- from washing up for meals to reading them a book. Perhaps it is a pre-condition of knowledge building with very young children- and in this way, different from KB in older grades- that a supportive adult needs to be there to lead the child to the technology.
I also know that children of this age depend upon the power of pictures to make learning real to them. Our database looks very different from that of the others at ICS because we used digital photos of our experiments and posted them on the views. The children are still emerging from egocentrism so their interest is primarily in what they, themselves, are doing. Photos with pictures of the children inevitably generate notes about the particular child in the picture, not necessarily about the experiment in question.

Very young children are capable of considering meaningful ideas, but their experience is very much in the moment. I have learned to move fast when the children go from experiment and inquiry to discussions in the database. Children need to discuss their experiences while the ideas are fresh in their minds. I have found that their excitement is immediate and they are less likely to revisit old notes or previous views at this stage in their development.

Lastly, this is an ongoing process for me and for my classroom of children. As far as I know, mine is the only kindergarten that is using the KF technology to support knowledge building. We are a bit like pioneers in this endeavour and that is exciting. But it is lonely out here. Many educators of young children feel that knowledge building is a skill that these young children are not ready for. I would argue that children have been constructing knowledge for themselves since emerging from the womb and that KF provides the tool by which that knowledge can be shared and advanced.

Appendix A

Socio-Cognitive and Technological Determinants of Knowledge Building

REAL IDEAS, AUTHENTIC PROBLEMS
Socio-cognitive dynamics: Knowledge problems arise from efforts to understand the world. Ideas produced or appropriated are as real as things touched and felt. Problems are ones that learners really care about usually very different from textbook problems and puzzles.
Technological dynamics: Knowledge Forum creates a culture for creative work with ideas. Notes and views serve as direct reflections of the core work of the organization and of the ideas of its creators.

IMPROVABLE IDEAS
Socio-cognitive dynamics: All ideas are treated as improvable. Participants work continuously to improve the quality, coherence, and utility of ideas. For such work to prosper, the culture must be one of psychological safety, so that people feel safe in taking risks revealing ignorance, voicing half-baked notions, giving and receiving criticism.
Technological dynamics: Knowledge Forum supports recursion in all aspects of its design there is always a higher level, there is always opportunity to revise. Background operations reflect change: continual improvement, revision, theory refinement.

IDEA DIVERSITY
Socio-cognitive dynamics: Idea diversity is essential to the development of knowledge advancement, just as biodiversity is essential to the success of an ecosystem. To understand an idea is to understand the ideas that surround it, including those that stand in contrast to it. Idea diversity creates a rich environment for ideas to evolve into new and more refined forms.
Technological dynamics: Bulletin boards, discussion forums, and so forth, provide opportunities for diversity of ideas but they only weakly support interaction of ideas. In Knowledge Forum, facilities for linking ideas and for bringing different combinations of ideas together in different notes and views promote the interaction that makes productive use of diversity.

RISE ABOVE
Socio-cognitive dynamics: Creative knowledge building entails working toward more inclusive principles and higher-level formulations of problems. It means learning to work with diversity, complexity and messiness, and out of that achieve new syntheses. By moving to higher planes of understanding knowledge builders transcend trivialities and oversimplifications and move beyond current best practices.
Technological dynamics: In expert knowledge building teams, as in Knowledge Forum, conditions to which people adapt change as a result of the successes of other people in the environment. Adapting means adapting to a progressive set of conditions that keep raising the bar. Rise-above notes and views support unlimited embedding of ideas in

increasingly advanced structures, and support emergent rather than fixed goals.

EPISTEMIC AGENCY
Socio-cognitive dynamics: Participants set forth their ideas and negotiate a fit between personal ideas and ideas of others, using contrasts to spark and sustain knowledge advancement rather than depending on others to chart that course for them. They deal with problems of goals, motivation, evaluation, and long-range planning that are normally left to teachers or managers.
Technological dynamics: Knowledge Forum provides support for theory construction and refinement and for viewing ideas in the context of related but different ideas. Scaffolds for high level knowledge processes are reflected in the use and variety of epistemological terms (such as conjecture, wonder, hypothesize, and so forth), and in the corresponding growth in conceptual content.

COMMUNITY KNOWLEDGE, COLLECTIVE RESPONSIBILITY
Socio-cognitive dynamics: Contributions to shared, top-level goals of the organization are prized and rewarded as much as individual achievements. Team members produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community.
Technological dynamics: Knowledge Forum's open, collaborative workspace holds conceptual artifacts that are contributed by community members. Community membership is defined in terms of reading and building-on the notes of others, ensuring that views are informative and helpful for the community, linking views in
ways that demonstrate view interrelationships. More generally, effectiveness of the community is gauged by the extent to which all participants share responsibility for the highest levels of the organization's knowledge work.

DEMOCRATIZING KNOWLEDGE
Socio-cognitive dynamics: All participants are legitimate contributors to the shared goals of the community; all take pride in knowledge advances achieved by the group. The diversity and divisional differences represented in any organization do not lead to separations along knowledge have/have-not or innovator/non-innovator lines. All are empowered to engage in knowledge innovation.
Technological dynamics: There is a way into the central knowledge space for all
participants; analytic tools allow participants to assess evenness of contributions and other indicators of the extent to which all members do their part in a joint enterprise.

SYMMETRIC KNOWLEDGE ADVANCEMENT
Socio-cognitive dynamics: Expertise is distributed within and between communities. Symmetry in knowledge advancement results from knowledge exchange and from the fact that to give knowledge is to get knowledge.
Technological dynamics: Knowledge Forum supports virtual visits and the co-construction of views across teams, both within and between

communities. Extended communities serve to embed ideas in increasingly broad social contexts. Symmetry in knowledge work is directly reflected in the flow and reworking of information across views and databases of different teams and communities.

PERVASIVE KNOWLEDGE BUILDING

Socio-cognitive dynamics: Knowledge building is not confined to particular occasions or subjects but pervades mental life in and out of school.

Technological dynamics: Knowledge Forum encourages knowledge building as the central and guiding force of the community's mission, not as an add-on. Contributions to collective resources reflect all aspects of knowledge work

CONSTRUCTIVE USES OF AUTHORITATIVE SOURCES

Socio-cognitive dynamics: To know a discipline is to be in touch with the present state and growing edge of knowledge in the field. This requires respect and understanding of authoritative sources, combined with a critical stance toward them.

Technological dynamics: Knowledge Forum encourages participants to use authoritative sources, along with other information sources, as data for their own knowledge building and idea-improving processes. Participants are encouraged to contribute new information to central resources, to reference and build-on authoritative sources; bibliographies are generated automatically from referenced resources.

KNOWLEDGE BUILDING DISCOURSE

Socio-cognitive dynamics: The discourse of knowledge building communities results in more than the sharing of knowledge; the knowledge itself is refined and transformed through the discursive practices of the community practices that have the advancement of knowledge as their explicit goal.

Technological dynamics: Knowledge Forum supports rich intertextual and inter-team notes and views and emergent rather than predetermined goals and workspaces. Revision, reference, and annotation further encourage participants to identify shared problems and gaps in understanding and to advance understanding beyond the level of the most knowledgeable individual.

EMBEDDED AND TRANSFORMATIVE ASSESSMENT

Socio-cognitive dynamics: Assessment is part of the effort to advance knowledge it is used to identify problems as the work proceeds and is embedded in the day-to-day workings of the organization. The community engages in its own internal assessment, which is both more fine-tuned and rigorous than external assessment, and serves to ensure that the community’s work will exceed the expectations of external assessors

Technological dynamics: Standards and benchmarks are objects of discourse in Knowledge Forum, to be annotated, built on, and risen above. Increases in literacy, twenty-first-century skills, and productivity are by-products of mainline knowledge work, and advance in parallel.

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