Knowledge Building pedagogy in Kindergarten, an exploratory study

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Abstract
This paper presents the research conducted in kindergarten and consist in ensure that children in the third year of this level conduct research according to Knowledge Building pedagogy with particular emphasis on four principles: Real Ideas - Authentic Problems, Idea Diversity, Pervasive Knowledge Building and Democratizing Knowledge. If it comes to placing children in a complete process of creating knowledge from early age, the first school age is in kindergarten and target with them must also be advancing the frontiers of knowledge as perceived themselves. Although children still are unable to write, they can organize their ideas and represent their thoughts through drawings; in addition to that at this stage also they develop literacy, Knowledge Building pedagogy helps. Children from his first steps at school, they learn to ask, to seek answers and organize their research process so that they can create a natural way to build knowledge that is easier than to change the methods and processes of traditional education when they are in higher grades. The interests of children who undergo this research are directed to the study of dinosaurs in the first stage and insects in the second stage and the research focuses on the way they respond to questions that they raised. The KF can't be used when children still can´t write and are just learning to read

and especially when there is no infrastructure for this technology, however, this research shows that it is possible for children construct knowledge collaboratively as demonstrated in the second phase reported in this paper.

Key words: Knowledge Building in kindergarten, children learning collaboratively, idea diversity, democratization of knowledge, shared knowledge.

Introduction

This research has as objective the introduction of Knowledge Building pedagogy in a kindergarten school located in a low-income area at the northeast of the city of Puebla, México and to observe how is possible for the small children to make investigations according to this pedagogy even though they are in the process of learning how to read and write. This study does not try to find out if Knowledge Building promotes the process of reading-writing like a primary target, but to find out if the children can develop their capacity to research and investigate according to the principles of Knowledge Building without using the Knowledge Forum because it is not possible to use it in this context, since they lack equipment and Internet connection, being a school for children and families with limited resources.

From f the 12 principles of Knowledge Building, the researchers chose 4 in which it was necessary to emphasize and put more attention and see how the children develop. The principles selected to be prioritized over others were:

• Real Ideas, Authentic Problems
• Ideas Diversity
• Permanent Building Knowledge
• Democratization of Knowledge.

The sense of KB in collaborative learning

In Kindergarten, collaborative learning is considered a descriptive process because one recognizes that a group of students who learn and collaborate is seen like the mechanism that causes the learning. Like a pedagogical process, the collaboration is seen like a prescribed method in which one asks one or more people to collaborate; because that's the way they learn more efficiently (Dillenburg in Stoilescu, 2010). Comparing these concepts with Knowledge Building, we found that this last one goes on more deeply, establishing not only a mutual benefit between the members but it also is committed with the advance of knowledge in that community. As the name suggests, the main goal of Knowledge Building is not to complete projects or tasks, but the knowledge creation (Scardamalia, 2003).

For Scardamalia (2003), in knowledge building, theory collaboration takes place through symmetry in knowledge advancement. This means reciprocal exchange among learners, "the fact that to give knowledge is to get knowledge". This is an important notion of the twelve principles of the Knowledge Building theory.

Interacting within a community, the effort of synthesis in a Knowledge Building class improves the capacities and abilities of the students reflecting how the different ideas are related and how they are possible to be integrated in the best way. This means that the students raise their understanding to a new level of knowledge. When a community satisfies that level, their members have the capacity to foment integration, to improve and to make a synthesis of new ideas originating understandings of different sources. Scardamalia and Bereiter (2003) recommended that a computer environment should not become overly prescriptive. Instead, a flexibility of the discourse that makes it consistent with the emergent goals should be pursued. Also, for a Knowledge Building community, they did not recommend the use of pure computer artifacts (such as intelligent agents, prescribed projects, fixed task sequences, templates) or any other tools designed to narrow-down learners to known endpoints. Instead they recommended "capturing the human capacity for inventiveness and help convert that inventiveness into something of social value"

Previous studies of KB in kindergarten
Studies like *"Knowledge Building and Early Literacy Development in Kindergarten"* and *"Building knowledge and literacy skills: Kindergarten junior"* realized by researchers of the OISE have demonstrated the advantages using Knowledge Forum with children from 4 to 5 years old in kindergarten. In a case, they worked with two different schools but in an equivalent manner; a group was formed by children of 4 year olds, whereas the other was constituted by children of 5 years old. Both groups used a diary with photographs in paper to introduce them to writing. They did this activity during three months. The group of younger children used in addition the Knowledge Forum to discuss some topics that were treated in class. Measurements of alphabetization before and after, besides the samples of the degree of writing in diary and notes, were realized in KF. The results demonstrated that the group of younger children, the same that had used Knowledge Forum, had a major progress in alphabetization than the group of older children that did not use KF. In the second case, a group of children of "junior kindergarten" were piloted during a period of two years. It was a group of children of the "Institute Child Study Lab School" of the University of Toronto. The professor discovered that the children began to construct notes on those of other children and to work with the ideas of their companions. Surprisingly, the conversations of the students went beyond the particular subjects. The notes written by the children demonstrated that those young kids are able to put in practice some principles of Knowledge Building (Halewood, Reeve, and Scardamalia, 2003).

The first part of this study was conducted in 2009-2010, it have shown that is possible that students learn to differentiate the cognitive scaffolding and could place their contributions in the corresponding scaffold. This study was focused on the management of four of the 12 Principles of Knowledge Building: Real Ideas - Authentic Problems, Diversity of Ideas, Knowledge Permanent Building and Democratization of Knowledge.

We found that the children learned that the contributions of other partners are important for knowledge construction, iconographic scaffolding helped them organize to address an issue and reach conclusions that explain the questions

posed at the beginning and other that arose in the course of the study. An important aspect that I we see is the emotion for understanding the topic, students always showed interest as it was a topic chosen by them and showed joy to know ever more about the fascinating life of the bugs and animals.

Research context
The school is located in "La Guadalupana" neighborhood, in the periphery of the city of Puebla, and is considered a low-income residential unit. The residents are workers who receive low wages, that being a main reason why both parents in a household work. The residential unit has public transport, lighting system, potable water, but lacks paving in the majority of its streets. In one of these streets is the "Instituto Rabindranath Tagore" where the research took place. Services such as telephone landlines and Internet are almost inexistent.

The second part of this research was conducted in the 2010-2011 school year with a population of 20 children of whom 13 are girls and 7 boys, with an average age of 6 years. The total population was 56 kindergarten kids; this study was performed with the third group of kindergarten. The study was conducted 2 researchers who conducted research in the 2009-2010 cycle and already had experience in Knowledge Building pedagogy, work experiences were recovered with the first group experienced this pedagogy without technological support, that is, Knowledge Forum were not used.

Objectives
The intention to introduce Knowledge Building as part of the course of the third year of kindergarten was:
- Children undertake investigations according to Knowledge Building pedagogy without the use of Knowledge Forum to work with special attention to four of the principles of KB: Real Ideas - Authentic Problems, Ideas Diversity, Permanent Building Knowledge, and Democratization of Knowledge.
- Use cognitive scaffolding iconographic drawings showing the scaffold according to the research topic to help in the process of understanding and knowledge construction.
- Get products of student learning as evidence of collaborative knowledge construction mainly produced by the management of the five scaffolds already mentioned, this reflecting the effectiveness of Knowledge Building pedagogy, and measure their use and the proportion in which makes use of them.

Design of the research
The research began in the 2009-2010 school year and will finish on the 2010-2011 academic cycle. At the beginning, although the school year initiated in the month of August, the research began at the end of the month of October. The initial intention was to involve all children of the kindergarten in the project of introduction of the Knowledge Building pedagogy, but due to the difficulties that implies to work with children of three different levels, like the fact that they do not know how to read or

write, and the ignorance of this pedagogy on part of the teachers, we decided to work only with the third grade. For second group the research began at the end of the month of August 2010. Like part of the academic activities, we decided to work the problem that the children decided to solve or the subject that they wanted to investigate on Thursdays.

Methodology
The research focuses on the four Knowledge Building principles selected under the criteria of which they are those that can be observed and better worked with kindergarten children; Real ideas - Authentic Problems because they can express what are their interests and what they want to know; Idea Diversity, because each child has his or her own idea, they ask their family and contribute thinking they have a good answer; Pervasive Knowledge Building, because the doubts and preoccupations they carry home, involving their family asking them to read about the subject, help them answer the questions and be explained by their parents what they don't understand; and Democratization of Knowledge, because they must recognize the value of his or her opinions as well as those of his or her companions.

At the beginning, the video *Comconèixer* was presented to the teachers of the Institute and material of the Knowledge Building pedagogy was provided. Another session was realized to share the understandings and to solve any doubts. In this meeting the importance of the principles of the KB was emphasized. The following step consisted in making an agreement on the way in which the scaffoldings of KF would be realized and their name. We decided to use drawings of dinosaurs representing each scaffold for first group and bug for second, for best understanding of the children. A name and representative drawing for each of the scaffolds was selected, and are the following: My theory, I need to understand, new information, Shared knowledge, and I already understood.

 These scaffolds were put under approval with the children and they were very pleased with the colors and the expressions on the drawings representing the scaffolds. The teacher worked with the subject like part of the curriculum and not as an additional activity, assigning specific time and resources to research activities. There were times in which the teacher worked more than once per week on this subject.

 The operation of the scaffolds designed in this way was already proven in the field of Dinosaurs. The teacher gave special attention to the issue of insects, as was done with the dinosaurs, be worked as part of the curriculum and not as an additional activity by allocating time and resources to research activities, several times worked with these issues more than once a week.
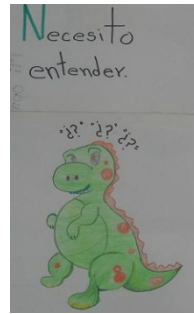
Scaffolds of the topic dinosaurs
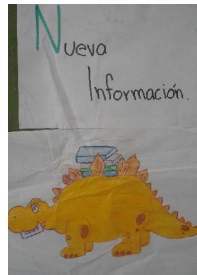
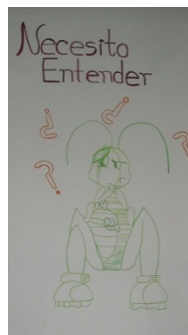| My theory	New information	I need to understand	Shared knowledge

Scaffolds of the topic Bugs
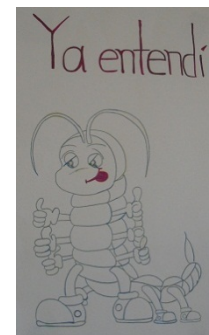
My theory	New information	I need to understand	Shared knowledge	I already understood

Process Description

Having explained how to work, first addressed the real problem, the study of spiders. He put the scaffold "I need to understand" and children who had already created their questions placed under the scaffold. It was explained to children that parents can help them find "New Information" in authoritative sources, opened to look for information in books, magazines, specialized articles and online, also explained that what we know not only learned in school but when we're out of it too is learned, we get the doubts out of school and we think about the problem (Permanent Knowledge Building).

The children investigated with the help of parents about their concerns and come to class with new information. On the black board were placed scaffold "I need to understand" and "New Information" as the children read the information placed in the appropriate scaffold, thus learned to distinguish what it means to ask for something and have an answer.

After each child read his "New information" were asked to express and translated into a drawing what they understood by placing them on the scaffold "I already understood." Throughout the drawings showed their understanding, they

had in mind the notion that spiders have needles, and not have 8 legs flexible to help them move, they learned that the spider produces in a bag (gland) a protein with the weaving its web, and it is strong yet flexible. They expressed their understanding by explaining that the spiders are born from eggs that her mother placed in a network. They were taught that all information provided is important and that if the contribution of a partner is short also help them all to better understand the problem, (democratization of knowledge).

As theories arose new questions were improved so that more information was required on new concerns such this: how spiders live? When the spider appeared on earth? We visited the library for children to seek new information in groups of 3 students and what they read what they talked among themselves thereby strengthening teamwork. It is important to build knowledge in a collaborative way that children learn to listen to their peers and that this way you learn thanks to the contribution of the other, that means the community is enriched.

It was explained to parents the importance of using authoritative sources for research. They emphasized the importance of parental involvement in the process as this strengthens the child's confidence to feel supported. They were also asked parents know the importance that all children enjoy their right to participate and comment, this is the democratization of knowledge, and it is desirable to show the children that this attitude to work every day we learn to value what other contributors, they learned that in this way gives value to the other, the partner and that "the colleague can contribute something that I had not taken into account in the investigation."

All understandings of the topic grouped under the scaffold "I already understood" were expressed with pictures and short texts, iconic expression is very natural to children at this stage of its development and express more with them than with the texts, however, there noted that during the working process the children developed reading and writing in a nice way as the research problem was in their interest, and any input either a text or a picture was read by children, soon began to read texts and to translate their ideas in their drawings.

We emphasized in the principles of Knowledge Building and how to make it understandable for children, so the scaffolds were represented by insects. To carry out the project is planned to take the following methodology: with the intention that students become familiar with the scaffolds were small pictures of them and worked for a week, the children colored and cut to paste in their notebooks in this case the idea was that made them know yours and distinguish.

The children chose which bugs research, decided to study the following insects:

- Spiders
- Bees
- Stick Insect
- Ladybug

The week following the presentation of the project, took up the scaffolding, then the children came forward with a picture and explain what his scaffold was. Once children correctly identified and started taking up the initial theories that had

expressed when talk about research and spiders were chosen as a real problem, it noted the theory that they were about spiders and placed under the scaffold my theory, they explain to the children that these theories had to check, and that the next step was to formulate questions about what "I need to understand" the spiders and wrote the following questions: Why do spiders bite? Spiders have fangs legs or spiders have needles and knit? How spiders live? Do insects bite us with needles? When did the spiders on earth? and all these questions were placed low scaffold "I need to understand. "

Children worked together to pool their knowledge as expressed through drawings and watercolors with a brush. If the subject touched on the development of the posters were taught the elements of the poster, title, content, author, date, and was linked to the problem we were trying so that the child expressed patterned scaffold "I already understood "the child would think of putting a name to its lineup but would have to agree with the team because it would only be a name, and draw the contents of the bill with his insights on the real problem.

Results of the investigation
This research had two stages, the first such survey conducted by way of exploring how to introduce the Knowledge building in kindergarten and served to limit the principles that would be managed more intensely and intentionally and type of scaffolds would be required in the interests of children.

Results of this first stage
The 2009-2010 school year was an exploration stage whose purpose was to determine a methodology to later make a deeper study with the tools generated in this first stage, the way it was designed the course followed a course based on Knowledge Building previous experiences of researchers and the teacher's teaching experience that children respond favorably to the investigation and that parents would support the work of their children, so it happened, but the information was not collected systematically so it was possible to make some kind of measurement, the evidence presented are revealing of the children's progress, but not included a quantification of the shares or of the results.

Results of the second stage
The second group that conducted the research consisted of 20 children, were worked 5 scaffolds (New Information, I Need to Understand, My theory, I already understood and Joining our knowledge) to conduct research on 4 bugs (Spider, stick Bug, Bee and ladybug) and 4 principles priority of pedagogy Knowledge Building (Real ideas - Authentic Problems, Diversity of ideas, Permanent Building and Democratization of Knowledge Knowledge) with an exploratory approach, the objective of this research was to introduce children in research along the principles outlined of knowledge building pedagogy without the use of knowledge Forum scaffolds using cognitive iconographic representative of the scaffold design drawings according to the research topic to help in the process of understanding and knowledge construction. The observations allow to see how children recognize the scaffold for their participation, how it enhances their collaborative process of knowledge construction and how to help manage the principles of this pedagogy, empirical evidence of this can be seen in photographs and videos collected during

the 2010-2011 school year, the products of student learning reflected in the posters and oral presentations and iconographic texts are supported with some evidence of collaborative knowledge construction mainly produced by the management of the five already mentioned scaffolds this helps verify the effectiveness of Knowledge Building pedagogy in kindergarten.

Measurement was made of their use in studying scaffolds the 4 bugs referred allows to observe the consistency in the proportion of use made of them, there are a number of questions posed to trigger investigation 5.75 questions average classified as "need to understand" that lead to a search for "New Information" on the insects under study, 96 on average, and that led to understandings in students expressed through investments classified under the scaffold "I already understood" , 74.75 on average and led them to conclude on ideas expressed under the scaffold "My theory", 5.5 on average, 34.75 in scaffold classified under "Let us join our hands."

The working hypothesis expressed as "the process of building knowledge about 4 bugs is equal" can be represented by the expression:
Ho: stick insects = spiders = bees = ladybug
 For n = 20 with α = 0.05

Checking through an analysis of variance in Table 1 we can observe how this table shows that F = 3.26 for rows corresponding to the scaffolds: My theory, I need to understand, New Information, I already understood and finally, Putting our Knowledge together.
For columns F = 3.49 Table 1 shows that the process of study on spiders, stick insects, bees and ladybugs are the same.

Ideas in Scaffolds Board

Expressing ideas with drawings

Putting the ideas together

Modeling Stick bug

	Spiders	Bee	Stick Bugs	Ladybug
My Teory	6	6	5	5
I need to understand	6	7	4	6
New Information	108	96	72	108
I already understood	90	90	68	51
Putting our Knowledge together	20	54	38	27

Analisis of variance

RESUMEN	Cuenta	Suma	Promedio	Varianza
Fila 1	4	22	5.5	0.33333333
Fila 2	4	23	5.75	1.58333333
Fila 3	4	384	96	288
Fila 4	4	299	74.75	358.25
Fila 5	4	139	34.75	219.583333
Columna 1	5	230	46	2414
Columna 2	5	253	50.6	1878.8
Columna 3	5	187	37.4	1074.8
Columna 4	5	197	39.4	1823.3

ANÁLISIS DE VARIANZA

Origen de las variaciones	Suma de cuadrados	Grados de libertad	Promedio de los cuadrados	F	Probabilidad	Valor crítico para F
Filas	26713.3	4	6678.325	39.0869141	8.62111E-07	3.259166727
Columnas	552.95	3	184.316667	1.07876896	0.39497687	3.490294819
Error	2050.3	12	170.858333			

Discussion
Research conducted during two school years allowed first determine how to make an approach to how children learn and adapt Knowledge Building pedagogy for best results with children learning to read and write. The expressive nature of children has the characteristics of cultures whose legacy today still do not quite understand and iconography used to express their knowledge, this is the case of the ancient inhabitants of Mesoamerica like the Maya, Nahua, or Mixtec-Zapotec who left their legacy in the codices, some still little studied. Understanding the expression of the children can help to understand the rich tapestry. The study allowed observes the way children cognitive plotted in the search for answers, and that this path is traversed by a more or less defined.

Conclusions
Through the daily use of scaffolding children are able to differentiate, when is a question that corresponds to the scaffold "I need to understand" and What is the one that corresponds to "I get it" and when it comes to "putting our knowledge together". Children understand the importance of seeking information to clarify doubts and answer questions also realized how the response to questions lead to new questions and mays are deep. They learned that listening and respect for others not only helps build knowledge but to maintain harmonious relations between members of a community. They learned that the contributions of other partners are important for the construction of knowledge. Children choosing real problems are more motivated to learn about and keeps the interest attached to it, namely the pursuit of knowledge is significantly and cheerful. This experience shows that it was possible to build a collective knowledge, students self-appropriated ideas and clear concepts about the real problem they were concerned. In the work that students are able to learn to differentiate the scaffolding and that could place their contributions in the corresponding scaffold. The categories helped them organize the approach to a topic. We note as an important part in understanding the emotions of the subject, the students always showed interest as it was a topic chosen by them and showed joy to know ever more about the fascinating life of dinosaurs in the first study and the life of insects in the second study.

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