No Kidding-Exploring the Effects of Stories through the Window of Schema Theory

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Introduction

We encounter stories everyday and everywhere. They are the oldest and most natural form of sense making (Jonassen, Strobel, & Gottdenker, 2004). Story is a powerful tool that enables us to gain knowledge, understand phenomenon, remembers the unusual and to interact with the people around us. In this paper, we propose that stories can create an enormous impact on children, particularly those who are just entering the elementary school.

Based on Schema theory, we intend to model the impact of stories have on young children, in this case, the seven years old learners. The model created is one that demonstrates how stories can enhance the quality of schemas children possess. The quality of schemas will then in turn enhances the level of interpreting, predicting, and understanding stories.

Stories, Schema

Current research shows that reading stories to children is important (Allison & Watson, 1994). Some studies examining the influence of the teacher when doing reading to a whole class discovered that teacher's reading style affects children's comprehension of stories (Dunning & Mason, 1984). Storytelling today is increasingly recognized as having important theoretical and practical implications and it is part of the emerging fields of discourse and narrative analysis (Kim, 1999). In education, storytelling is always recognized as an important factor as it reflects moral standards, life-styles, fantasy, humor, emotions, and different ways of knowing (Kim ,1999). Mandler (1984) distinguishes between stories, scripts and scenes but mentions that they have much in common and result in common types of psychological processing and they are represented in the human mind by related schematic forms of organization. According to her explanation, stories are literary expressions that we hear or read and are often refer to times long past or to imaginary worlds. Scripts represent the everyday events which fill our daily lives and scenes represent places which our daily routines take place. For the sake of the model we present in this paper, we shall refer all the three mentioned by Mandler (1984) as stories.

Story telling helps us to understand human interaction, enhance our experiences and acquire the knowledge about the world we live in. We argue the importance of storytelling not only in school context but also at home. Family stories are important to the family as it involves the creation and maintenance of relationships, depicts rules of interaction, and reflect beliefs about family and other social institutions (Fiese, & Sameroff, 1999). The stories that are encountered among peers are also crucial as it plays a motivating context for literate behavior, as children communicate through narration to their peers in social play (Kim, 1999). According to Glenberg and Langston, 1992), comprehension of a story appears to result in multiple mental representations. One of these is a

representation of the context, that is, a representation of its words and sentences. Another may be a mental model of what the context is about. And the representational elements of the mental model stand for such things as ideas, objects, events, and processes.

Humans receive incoming information and organize it around their previously developed schemata, or what is called "networks of connected ideas." (Slavin 1988).

The term schema has a long and rich background (Marshall, 1995). It was first used by Plato and Aristotle and further defined and elaborated by the British psychologist Frederic Bartlett and the Swiss biologist and genetic epistemologist Jean Piaget. In general, schema theory views organized knowledge as an elaborate network of abstract mental structures which represents an individual's understanding of the world. We use schemas to interpret and also predict situations occurring in our environment (Widmayer 2003). Each individual has their own unique sets of schemas and these are built based upon individual's experiences and cognitive processes. Rumelhart and Norman (1978) continued to expand the definition of schema and proposed three learning modes. According to them, learners acquire knowledge through three different reactions: accretion, tuning, and restructuring. In Accretion, when learners encounter information, they assimilate it into their existing schema without making changes to their overall schema. In tuning, as learners come across a situation whereby their existing schema is inadequate for the new knowledge, they will then make modifications to their existing schema accordingly. Lastly, learners restructure and create a new schema when there is inconsistency between the old schema and the newly acquired knowledge.

Our model seeks to explore how stories can create an impact on the quality of schemas children possess through the window of schema theory. Specifically, we hypothesize that children's quality of schemas will be changed, restructured or modified accordingly to the three different reactions proposed by Rumelhart and Norman (1978).

Why Modeling?

Models have been at the forefront of research in the philosophy of science for the last two decades (Guala, 2001). According to Lesh and Doerr (2003), models are conceptual systems that are expressed using external notation systems, and that are used to construct, describe, or explain the behaviors of other systems-perhaps so that the other systems can be manipulated or predicted intelligently. They explicitly explained that such a system consists of elements, relations, operations, and rules that govern the interactions within the system.

Models are extensively used in many different fields, such as aeronautical engineering, agricultural sciences, business management or cognitive psychology (Lesh, & Doerr, 2003). In order to predict the effects of changes to system conditions on system outputs over time is the very root of scientific reasoning (Jonassen, Strobel, & Gottdenker, 2004). The model we present in this paper is what it is called a dynamic model. A dynamic system is different from static one as such that the latter can only represent a system at rest, but the former can also represent the time-evolution of the system (Guala, 2001). Moreover, a dynamic system is also capable of performing simulation, which is presenting the intricate relations between different entities.

The model (see figure 1) we presented using the software "STELLA" is one that depicts the intricate relations of variables and concepts. Our model displays sets of graphical representations that will interpret our understanding on how the quality of schemas is affected by stories encountered.

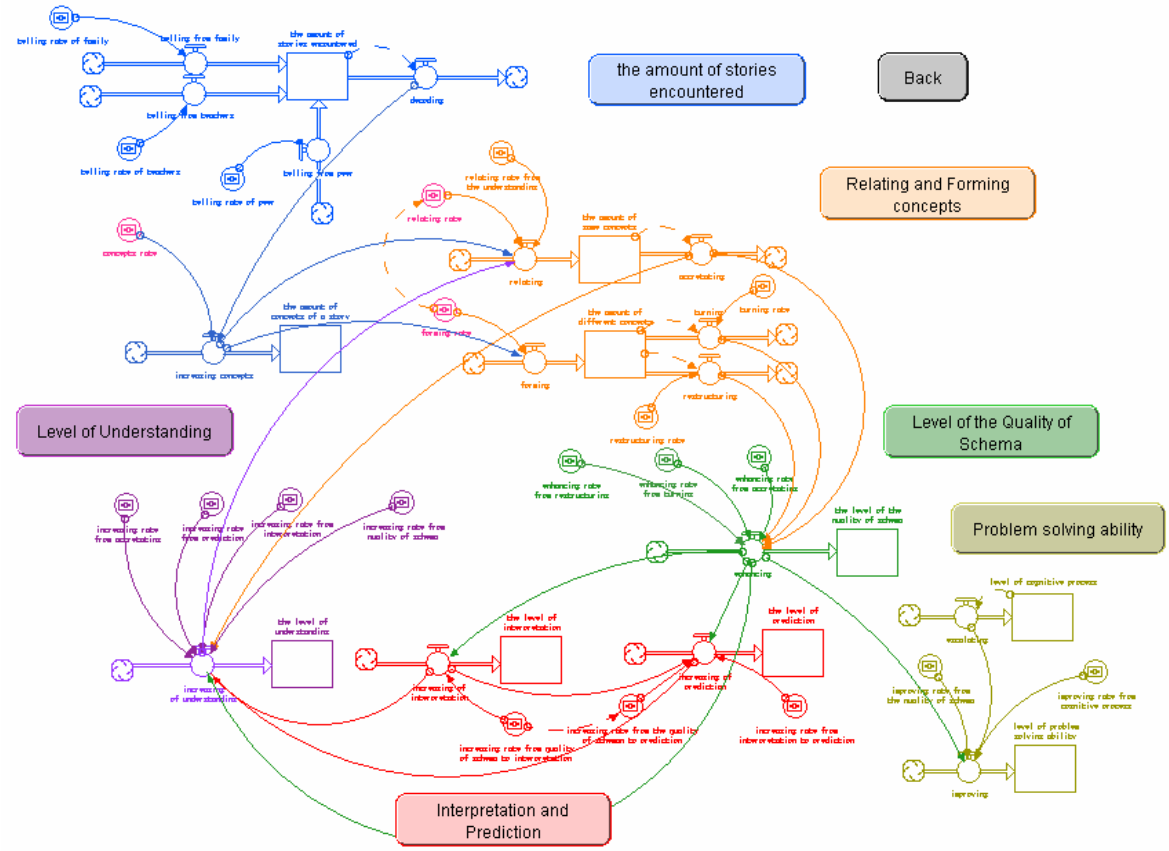

Figure 1. **Model that shows the impact of stories on children's quality of schemas**

Let the Model Runs!

The subjects identified are young children of age seven. This particular group of learners is selected for we assume that they have just finished their pre-school education and are entering the elementary school with the curiosity to explore new things and acquire new knowledge. At the same time, they have some prior social interaction knowledge in their pre school education.

The strength of this model is that it allows users to test hypothesis. Users are able to construct their own hypothesis and manipulate the variables and to run the models. This provides users the flexibility to make predictions and allows the users to make reasonable assumption on understanding the complexity of the system. Figure 2 shows the types of slider bar we have embedded in the model to allow users to manipulate the variables.

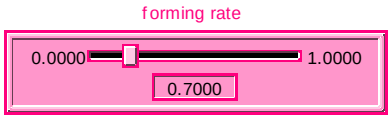

Figure 2. **Slider bar that allows users to manipulate the variables**

Before running this model, users have to make three assumptions. They will input the amount of the concepts in each story, the growth rate of same concepts, and the growth rate of different concepts.

In this model, the children received stories from three main sources: Family members, teachers and friends. We started with assuming that more stories are told by family members before they enter school. Later when they begin school, we make assumption that since they are just entering school, the probability to hear stories from their

teacher compared to their family will still be lower and young children have little skills in socializing. Therefore the average numbers of stories they hear from their peers will be lower than from their teachers. Figure 3 depicts this relation.

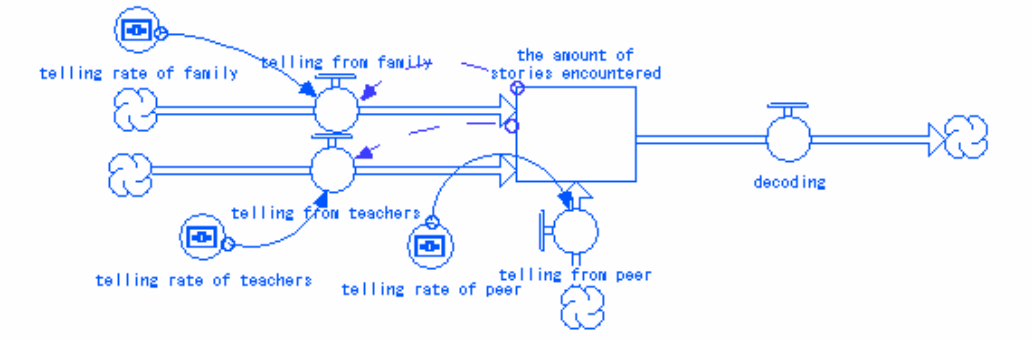

Figure 3. **Children's sources of stories**

After receiving stories from the three sources mentioned earlier on, children will start to process and decode them. They will relate the familiar stories with the concepts they have already possessed and as such, accreting (no change to the existing schemas) takes place. The assumption here is that young children who have just entered school are rather inquisitive and curious about the environment and learning. Hence, they will be eager to explore and acquire new information and knowledge. In the event of learning new information, the probability of forming new concepts will be higher. When new information enters their minds, it will then go through the process of either tuning (modification of existing schemas) or restructuring (forming new schemas). We supposed more new knowledge will go through the process of restructuring as kids are curious in nature. The chances of forming new schemas are higher than the chances of modifying their schemas.

When a child is able to interpret and predict the story, his level of understanding the story will increase. The other two factors that will also contribute to a child's level of understanding are the quality of schemas and also the amount of prior knowledge the child possess. As we hypothesize that the quality of schemas will have a greater impact on the level of understanding, we give the increasing rate from the quality of schema a higher value than the values for the increasing rates from accreting, prediction and interpretation. As one increases the level of understanding, he/she will be able to relate the concepts learned from the stories to his existing concepts.

As mentioned before, the quality of schemas is enhanced through three processes, accreting, tuning, and restructuring and the latter with the highest input value as it tends to form greater impact on the quality of schemas. Finally, the quality of schemas will determine the children's ability to interpret the stories. This means that the more quality schemas they possess, their ability level to interpret the stories will increase and hence their ability to predict the stories will also increase. Since prediction can only take place when one has already interpreted the story, the impact of interpretation must be higher than prediction.

We do not intend to further discuss how cognitive process impact problem solving ability as this is not the main purpose of our model. However, the model did show that children's ability to engage in cognitive processes remains constant at first but increases exponentially at a later stage. At almost the same time, problem solving ability also increases, and we want to highlight the fact that quality schemas do impact problem solving ability (see Figure 4).

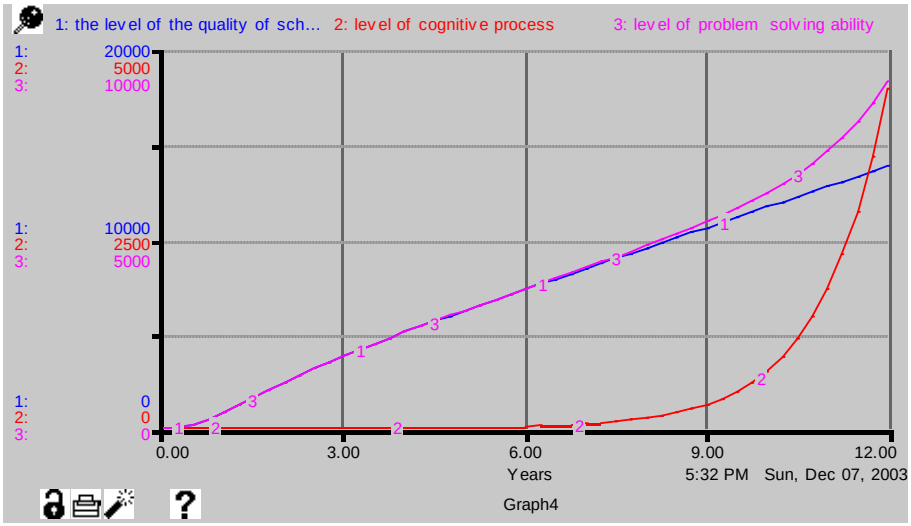

Figure 4. **The impact of the level of quality schemas on the level of problem solving ability and cognitive process**

The Impact of Stories on the Quality of Schemas

Our analysis shows that stories can improve the quality of children's schemas, and that their level of interpreting, predicting and understating of stories will be enhanced. Therefore, we propose that the more stories young children encounter, the higher the opportunity of enhancing their schemas. This will in turn enable them to better interpret, predict and understand stories. In one of our graphs (see figure 5), it is apparent that over a period of 12 years, the level of quality schemas and the level of understanding of our intended subjects improved at almost the same rate.

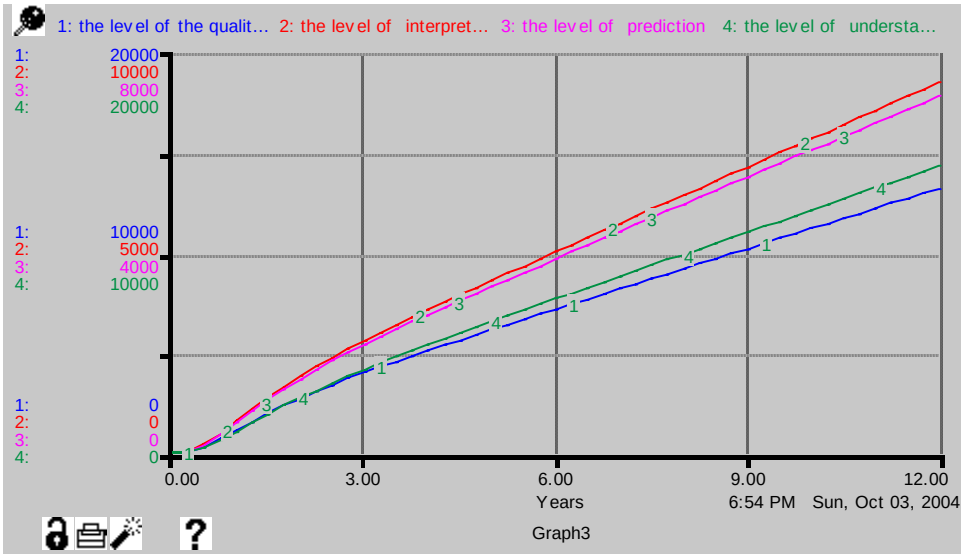

Figure 5. **The impact of quality schemas on the level of interpretation, prediction, and understanding**

Although we do not attempt to focus on how schema theory may apply to problem solving ability, we will like to state that one's problem solving ability is determined by the quality of schemas and the cognitive process. In figure 4, we see that the level of problem solving ability of our subjects will gradually increase. This is especially

significant at the 10th year. We believe that as young learners gain more experiences in life and becomes more mature, their problem solving ability will therefore increases at an increasing rate.

Our analysis also shows that the quality level of schemas and cognitive process will determine one's ability to solve problems. When children are exposed to stories, they do not only increase their schemas but also enhance their existing schemas. These enormous experiences which they encountered over time enhance their problem solving ability cumulatively. According to the study done by Price and Driscoll (1997), more than half of the learners are able to solve similar problems in a familiar context. This means that with more exposure to experiences (in this case, stories), children will be more capable of solving problems.

Our model helps to make a significant prediction, that is, when children encounter more stories during their growing up, their schemas of the world will increase.

Although computer modeling may not provide a perfect answer to our queries, it does provide an avenue for us to describe the phenomenon, to make prediction on complex systems and to help us better understand them. We strongly argue that system modeling is a way to systemically study what we don't know and reassure what we already know.

References:

Allison, D. T., & Watson, J. A. (1994). The significance of adult storybook reading styles on the development of young children's emergent reading. *Journal of Reading*, 34, 57-72.

Dunning, D., & Mason, J. (1984). *An Investigation of Kindergarten Children's Expressions of Story Character's intentions*. Paper presented at the Annual Meeting of the National Reading Conference, St. Petersburg, Florida.

Fiese, B. H., & Sameroff, A. J. (1999). The family consortium: A multidimensional approach to narratives. In Fiese, B. H (et al). The stories that families tell: Narrative coherence, narrative interaction, and relationship beliefs. *64, pp 1-36. Monographs of the Society for research in Child Development*
Guala, F. (2001). Models, simulation, and experiments. In Magnana, L., & Nersessian. N. J. (eds.) *Model-based reasoning: Science, technology, values* (pp 59-74). New York : Kluwer Academic/ Plenum Publishers

Glenberg, A. M., & Langston, K. (1992). Mental models contribute to foregrounding during text comprehension. *Journal of Memory and Language*, 26, 69-83.

Jonassen, D. H., Strobel, J., & Gottdenker, J. (in press). Model building for conceptual change. *Interactive Learning Environments.*

Kim, S, K. (1999). The effects of storytelling and pretend play on cognitive processes, short-term and long term narrative recall. *Child Study Journal*, 29, 175-91.

Phillips, J., Livingston, & Buchanan, B. (2001). Toward a computational model of hyppthesis: Formation and model building in science. In Magnana, L., & Nersessian. N. J. (eds.) *Model-based reasoning: Science, technology, values* (pp 209-226). New York : Kluwer Academic/ Plenum Publishers

Lesh, R., & Doerr, H. M. (2003). Foundations of a models and modeling perspective on mathematics teaching, learning, and problem solving. In Lesh, R. & Doerr, H. M. (Eds.), *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, teaching, and learning* (pp. 3-33). Mahwah, NJ: Lawrence Erlbaum Associates.

Mandler, J. M. (1984). *Stories, scripts, and scenes: Aspects of schema theory.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Marshall, S. P. (1995). *Schemas in problem solving.* Cambridge University Press.

Price, E. & Driscoll, M (1997) "An inquiry into the spontaneous transfer of problem-solving skill." *Contemporary Educational Psychology* 22, 472-494

Rumelhart, D. E & Norman, D. A (1978). Accretion, tuning, and restructuring: three modes of learning. In Cotton, J. W & Klatzky, R. L. (Eds.), *Semantic factors in cognition* (pp37-54) Hillsdale, NJ: Lawrence Erlbaum Associates.

Slavin, R. E. (1988) *Educational psychology: Theory into practice*. Englewood Cliffs, N.J.: Prentice Hall,

Widmayer,S. A. (2003) Schema theory: An introduction. Retrieved from [http://chd.gse.gmu/immersion/knowledgebase/strategies/cognitivism/SchemaTheory] on 11/10/2003