Common Knowledge Construction Model for Teaching and Learning Science: Applications in the Indian Context

Jazlin Ebenezer
Wayne State University, Detroit, MI, USA

Sheela Chacko & Nanibala Immanuel
Spicer Memorial College, Poona, India

Objectives

Teacher centered pedagogical practices, which focus on acquisition of facts, still dominate the Indian Science classrooms. Transmission of facts result in clutter of 'inert ideas,' which the students are not able to use effectively in familiar contexts and creatively in open-ended problem - solving situations (Rao, 2003). A teaching model that promotes new directions in science teaching and considers students' personal meaning in lesson sequences is referred to as the *Common Knowledge Construction Model* (CKCM) (Ebenezer & Haggarty, 1999). This teaching model advocates scientific reasoning through conceptual change inquiry using students' multiple meanings of natural and social phenomena. The objective of this poster presentation is to report two aspects of our major, on-going complex study based on the implementation of the CKCM in the Indian context. Correspondingly, we answer two research questions based on the first phase of the model, Exploring and Categorizing students' ideas.

1. What are grade 7 students' conceptions of excretion?

2. What are the classroom teacher's perceptions when the researcher modeled the CKCM in a unit on excretion?

Significance of the Study

This study helps teachers to understand how they can meaningfully connect students' prior ideas to the curriculum. It orients the science teacher of the importance of common knowledge, which can be a base line from which he/she can spiral the scientific ideas of the students to higher level of reasoning. The teacher becomes conscious of how children's ideas develop and conceptual change occurs in the progression of a unit of study.

Underlying Theoretical Framework

CKCM is a philosophically sound teaching model that is premised on Marton's "relational learning" (Marton, 1981), Bruner's view of language as culture's symbolic system (Bruner, 1986), Vygotsky's zone of proximal development (Vygotsky, 1968, 1978), and Doll's post modern thinking on scientific discourse and curriculum development (Doll, 1993). This model acknowledges that children hold beliefs about the world that they have constructed through personal interaction with natural phenomena and through social interaction with other people (Ebenezer & Haggerty 1999)

Research Design & Procedure

To answer the first question, we explored 7th standard students' ideas of excretion by having them answer the following question in writing using paper and pencil/ pen.

Draw and write how waste products are produced and removed.

We collected their "ideas sheets" and categorized their ideas into "phenomenographic categories" following the research tradition of Marton (1981).

To answer the second research question, an interview was conducted with the classroom teacher who observed Sheela Chacko teaching a unit on excretion of animals from the CKCM perspectives.

Findings

The phenomenographic categories are presented in Table 1.

This study shows that children have prior idea on excretion, which can be used as a basis for developing a sequence of lessons. The researcher, in fact, upon the invitation of the regular 7th standard teacher, developed lesson sequences based on the ideas represented in Table 1, and taught the class a unit on the excretion of animals for a period of 2 weeks. Several teachers were curious and observed Sheela's newly developed teaching ideas.

This study has generated students' ideas for curriculum development. The classroom and excerpts from

Table 1. Seventh standard students' conceptions of how waste products are produced

Students' Conceptions	**Students' Expressions**	**Frequency (n=31)**
Digestion of food (n=18) By eating food	"They are produced by when we eat it, is going to be digested so this is the way waste is produced" "We eat our food and it goes to the small intestine and digest and it is produced" "They are produced when the food is digested… when we eat the food the food goes to the stomach it is digested and it is pushed out. "	9
Food that is/not digested	"By the food which is not digested"	2
More food than the body requires	"They are produced when we eat more food that is not required for our body the left over food becomes waste"	2
In-take of needed food and excretion of the left over food	"They are produced when we eat food it get s digested and all we need for our energy, like protein calcium etc and the left over is waste"	3
When we eat the food the good products are taken and bad are excreted (1)	"They are produced when we eat the food the good products are taken and bad are excreted…first we eat the food it goes in the stomach and into the small intestine which takes the good products and the large intestine which take the bad products are excreted."	1
The intake of vitamins	"They are produced after we eat the food the digestion takes place the vitamins will go into the body and then when waste food are left it will be sent out."	1
Kidneys produce waste products	"With the help of our kidneys" "Kidneys help."	4
Digestion of food and urinary ducts	"They are produced because of digestion takes place in our body and produced in urinary ducts"	1
Miscellaneous	"When we eat food or water the stomach is full and it produce gases and we go toilet" "They are produced by excreting our" "They are produced by bacterial" "By eating, the waste products will come out. by eating they are produced" "They are produced from smallest particle from the body" "It goes in and then it mixes and it is removed." "They are not needed so they are product" "Some harmful effect" "The waste products is done something and excreted"	9

an interview with regular teacher revealed the following insights about the CKCM model: requires much preparation, needs to reduce class load; highly interactive; student understanding is better; the size of class needs to be considerably reduced; learning is fun; and eagerness to learn. Because this is the first time the teacher attempted to implement the CKCM, she was able to see first hand, how it played out in the classroom. Both the researcher and teacher developed understandings of how students generated their own ideas based on the meaningful experiences given in the classroom. This classroom-based research context gave the participants to generate useful knowledge for themselves. And because of this experience they will be able to teach inquiry-based conceptual change models such as the CKCM in school science. Because of the learning experience in this classroom-based experience, the researcher and the teacher will develop the capacity and confidence to implement lesson sequences that aim to explore, assess, develop, and monitor children's ideas of science concepts as well as develop children's knowledge, understandings, and skills in "doing," "writing," and "talking" science, using relevant curricular materials, resources, and technologies.

References

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