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## Understanding the enactment of principle-based designs: Conceptualizing principle-based approaches as carriers of principles for learning

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**Abstract:** Using a metaphor of pharmacological carriers, we will present how teachers in a Singaporean primary school enacted the Knowledge Building Communities model (KBC model) as a new principle-based approach. Ideas First project was implemented in a Singaporean primary school and it has visible outward features such as the practices and structures that are external embodiments of the design principles. This study aims at advancing an understanding of the enacting of new educational models.

### Introduction

The Knowledge Building Communities model (KBC model) and its associated technology-based learning environment, Knowledge Forum, have been drawn attention in the field of CSCL for over 20 years (Bereiter, 2002; Scardamalia, 2002; Scardamalia & Bereiter, 1993, 2006). Although exemplars of the KBC model exist in various parts of the world, a better understanding is needed of how to bring the model to life in classrooms (Bielaczyc, Kapur, & Collins, 2011; Chan, 2011). Ideas First is a two-year science program co-designed with primary school teachers that has been operating in P3 and P4 classrooms in a Singaporean primary school since 2006 (Bielaczyc & Ow, 2007, 2010). The program is based on the vision of a KBC model where students work to advance the science understanding of the classroom community through engaging in collectively building knowledge in response to problems of understanding (Scardamalia & Bereiter, 2006). Students are supported in their work by Knowledge Forum, that allows learners to construct a communal multimedia knowledge base that visually traces the community inquiry (Scardamalia, 2004). One concern in the enactment of the KBC model is that of "lethal mutations" that undermines its principles and goals (Brown & Campione, 1996). What are the design features of Ideas First that set P3 and P4 classrooms on implementation paths (Bielaczyc & Collins, 2006) with fidelity to principles of the KBC model? We utilize the metaphor of pharmaceutical carriers to better understand the enactment of a KBC model in classrooms. Our goal in the poster presentation is to provide insights into design features gleaned using the metaphor of pharmacological carriers that support the enactment of principle-based designs with fidelity to the underpinning principles and goals.

### Understanding Teachers' Enactment of Ideas First

A metaphor of pharmacological carriers can be used to understand the enactment of principle-based approaches. Carriers are used in pharmaceutical science for the delivery of genetic material or medicine to the therapeutic sites of action. Pharmacological carriers take on a form that results in the encapsulation of material for delivery to the sites of action. Pharmaceutical carriers have characteristics that determine their efficacy. Some of these include, the body's recognition of carriers as foreign entities, the ability of the carrier to exist in prolonged circulation and the stability of the carrier.

Ideas First project has visible outward features such as the practices and structures that are external embodiments of the design principles. The external features of principle-based approaches are analogous to the external capsule of pharmacological carriers, while the principles of the principle-based approaches are analogous to the genetic material and therapeutic drug within the carriers. Similar to pharmaceutical carriers, these outward features facilitate the delivery or take up of the principles in the classroom. When the classroom community takes up the principles, the classroom culture shifts reflecting the different principles and educational goals of the approach. This is analogous to the effect when genetic material and therapeutic drugs achieve their therapeutic effects. We draw on our research on Ideas First project to illustrate teachers' implementation of KBC model the characteristics of pharmacological carriers to understand teachers' enactment of principle-based approaches:

- ***The foreign nature of principle-based approaches:*** Carriers are foreign entities introduced into the body. Likewise principle-based approaches are designed with different visions of learning compared to existing approaches in classrooms. The introduction of these approaches and their novel practices and structures are thus akin to the introduction of a foreign entity into the human body. As the class community will mount a defense against the foreign approach, the introduction of Ideas First may result in reactions to the new approach that includes the adoption of strategies without understanding of the deeper principles as well as the appropriation of strategies and structures into existing practices. Initially, the reactions can appear as mutations of the enactment of designs. However to avoid ongoing mutations to the extent that they become

lethal mutations, we have developed a realization of importance of designing practices and structures that lend themselves to long term use by the classroom community.

- ***The ability of principle-based approaches to have a “prolonged circulation” in the community:*** An important characteristic of carriers that increase their efficacy is their ability to prolong their circulation in the organism. In *Ideas First*, the tri-phasic design of the approach based on KBC principles enabled the repeated enactment of practices and structures. The constant enactment of the principle-based practices and structures provided multiple opportunities that reflected an emerging understanding of the principles.
- ***The stability of the practices and structures of the principle-based approach:*** Another important characteristic of carriers affecting their efficacy is the stability of the external capsule. This allows the carriers to achieve prolong circulation and reach their target areas. Likewise, it is important to design structures and supporting artifacts for principle-based approaches to establish stable learning environment for teachers and students in classroom. In *Ideas First*, artifacts such as the Think Cards (Ow & Bielaczyc, 2007) and hypothetical game configurations (Bielaczyc & Kapur, 2010) lend stability to the practices by making visible knowledge building practices and support the reflection, learning and enactment of practices consistent with the design principles.

## Significance

This poster presentation contributes to advancing an understanding of the enacting of new educational models, especially how the participating teachers perceive and implement KBC model as a new principle-based approach and how their perceptions and implementations have changed over time.

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