Open Peer Commentaries

on Chrystalla Papademetri-Kachrimani's "Learning about Learning with Teachers and (from) Young Children"

Backwards-and-Forwards from the Unexpected: Teachers as Constructionist Learners

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> Upshot • The activities that Papademetri-Kachrimani presents in her stories create situations that lead to unexpected results, thus opening the potential for learning about learning in teachers' professional development. These integrate modeling-based learning (MbL) – arguably a form of constructionism –, and allow learners to move back-and-forth between representations in order to develop strategies and rules.

« 1 » Chrystalla Papademetri-Kachrimani's target article presents three stories of teachers or children confronting questions related to what can be described as puzzle activities with bottle lids, which lead to surprising results for all involved (teachers, children and even the researchers). The idea of creating situations that lead to unexpected results, which open the potential for learning, is one of the aspects that I enjoyed most about the article. This is nicely referred to in the article through the Ackermann statement that diving into unknown situations – which can take the learner to experience a momentary sense of loss – is a crucial part of learning, leading to the adoption of different perspectives and a dialogue for reconciling incompatible experiences (Ackermann 2004, cited by Papademetri-Kachrimani). Certainly the activity sequences proposed follow a constructionist paradigm in that learners engage in processes of reflection, discovery and construction of strategies; as Papademetri-Kachrimani points out, these activities did not involve the use of digital tools, but the construction of strategies and, more so, the definition of rules (public and shareable rules) is akin to the computer programming that is at the core of the constructionism.

« 2 » A central focus of Papademetri-Kachrimani is on encouraging the integration of modeling-based learning (MbL) activities into teachers' practices. Let us consider the relationship between the two theoretical perspectives: MbL and constructionism. I myself have always considered that there is a deep connection between MbL and constructionism, and have used it in my own work. For Richard Lesh and Helen Doerr, from the modeling perspective, problem-solving activities are those where the products that students produce…

> "involve sharable, manipulatable, modifiable, and reusable conceptual tools (e.g., models) for constructing, describing, explaining, manipulating, predicting, or controlling mathematically significant systems." (Lesh & Doerr 2003: 3)

If we consider that constructionism proposes that learning and the construction of knowledge "happens especially felicitously when the learner is engaged in the construction of something external or at least shareable" (Papert 1990, cited in Cavallo 1999: 134), and promotes presenting students with environments, situations, or objects to "think with" that can help them engage with particular powerful ideas through exploration and discovery (Papert 1980a), then we can clearly see the connections that can lead us to affirm that MbL is a form of constructionism.

« 3 » However, despite decades of successful constructionist examples reported in the research literature, the implementation of constructionism in schools has proved difficult. Likewise, Papademetri-Kachrimani asks why teachers have difficulty implementing MbL in educational practice. She mentions how it is easier for teachers to adhere to pre-defined program plans while central aspects of constructionism such as play, fun and creativity are problematic for teachers and the traditional schooling system. I would add to that the fact that teachers tend to teach the way they have been taught, with their beliefs about teaching and learning shaped by their own experience as students (Ball 1988, Thompson 1992). This is why Papademetri-Kachrimani's approach to have teachers experience the same type of activities that she promotes students to have (and possibly teachers to develop) for MbL is so important. She acknowledges this in saying that

> "a good way to start educating and supporting teachers to implement MbL or any other approach that moves away from their traditional practice is by allowing teachers to experience 'diving into unknown situations' [… and] use this experience to reflect upon and refine their practice." (§40)

So to the question of who the learner is in the stories: Is it about children's learning or teacher's learning and if it concerns both what is the relationship between the two? Obviously it concerns all: teachers, children and even the researcher, who was also faced with some surprising results. I see this as a back-and-forth feedback process between

teachers' own experiences with these kind of activities (as in Story 1), their reflections of – and motivation by – the unforeseen situations they have themselves the opportunity to delve into; the observation and reflection of students' experiences (as in Story 2); and their involvement in designing a similar MbL activity (Story 3); all of which enriches the learning and professional development process for teachers. Papademetri-Kachrimani describes the reflective process as one that

> "begins with a new problem / challenge that drives towards a new cycle of collecting observations and making representations [leading] the learner to construct gradually a deeper understanding of the phenomenon / structure / concept under study." (§33)

« 4 » One thing that I find particularly important in this process is the role of representations, and the articulation between the ways in which the solutions are represented: e.g., as graphical representations and as equations. I very much appreciate that teachers are "encouraged to go backwards and forwards between what they actually saw and how they counted the circles in the shape and their representation(s)" (§14) in order to gain better understandings. Representations, either graphical, algebraic or in any form, are the produced shareable products that make this learning process constructionist. Furthermore, articulating and constructing links between representations is a fundamental component of developing meanings and understandings; part of what Richard Noss and Celia Hoyles (1996) refer to as webbing.

« 5 » In conclusion, I consider that Papademetri-Kachrimani's article is a helpful and interesting example of how teachers can experience valuable professional development experiences for future MbL / constructionism implementations in their practice. Furthermore, it includes a profound analysis of the processes and the role of representations that can lead to the development of understandings in teachers, students and also researchers. A further possible step in terms of the specific activities presented could be to ask participants (whether teachers or students) to write some kind of computer program that puts into action the rules and strategies for counting that they described during the activities (i.e., to program the model created).

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Elements of Surprise in Teaching and Learning

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> Upshot • In my commentary, I focus on the concept of surprise underlying the design of the learning experience presented in Papademetri-Kachrimani's target article. I treat surprise as a concept that integrates the creative, open and non-predictable characteristics of constructionist teaching and learning. In my analysis, I show that current technological and societal developments have made these ideas of constructionism more relevant than ever. Within this rendering, it becomes clear that there is a need to revisit the position of constructionism in education.

« 1 » In her target article, Chrystalla Papademetri-Kachrimani mentions the element of surprise as a principle that underlines the design of the learning experiences described. Furthermore, surprise in this article is not just a design choice. Instead, it is presented as a core element of a pedagogy that is not guided by a strictly defined curriculum (objectives, learning scenarios) and that places more emphasis on the rich, complex, dynamic and non-predictable nature of teaching and learning.

« 2 » In this sense I find "surprise" relevant to the constructionist and to the constructivist approach to education. Both, by postulating *that knowledge is actively constructed through the child's interaction with the world*, emphasize teaching not just as a process of directing learning towards a strict known end but as a process of *offering opportunities to kids to engage in hands on explorations that fuel the constructive process* (Ackermann 2004: 18). In constructionism, the constructive process of learning evolves around constructions with personal meaning for the learner (Papert 1980b), and is mediated by digital tools that empower learners to shape, express and share their inner ideas *in and through* their constructions (Ackermann 2004).

« 3 » Constructions – *being sand castles or theories about the universe* (ibid) – as public entities to be shared and discussed, integrate elements of art that relate not only to the end product (i.e., the construction) but also to the process: the art of learning how to learn (ibid). Teaching and learning as art of course can refer to and make use of a framework (a set of goals, objectives and directions) but it also creates a space for surprise, for creativity and for freedom.

« 4 » In Papademetri-Kachrimani's article and in this analysis, a set of core ideas of constructivism and of constructionism have been highlighted: learning as an active process as opposed to passive consumption of information; empowering learners to shape (internalization of actions) and express their inner ideas; focusing on learner-generated constructions that have the status of public artefacts in the sense that they are situated in a social space where they can be shared, discussed and re-shaped. These ideas, although not directly related to constructionism, have become prominent today in the world of technology, where tools with new characteristics are gaining ground.

« 5 » The current technological landscape is populated with tools that empower end-users to design, modify, extend, evolve and share their artefacts. Many examples are encountered in, but not limited to, the field