Instability Is a Feature, Not a Bug: How Teachers Grow Their Pedagogical Knowledge in an Interdisciplinary, Skills-Centered, Ever-Evolving School

Vered Resnick, Hebrew University of Jerusalem, Vered.Resnick@mail.huji.ac.il
Yifat Ben David Kolikant, Hebrew University of Jerusalem, Yifat.Kolikant@mail.huji.ac.il

Abstract: We examined how teachers' knowledge evolves in the face of pedagogical change. We followed a schoolwide pedagogical initiative of skills-centered interdisciplinary teaching, led by teams of teachers. Teachers faced the challenge of limited pedagogical content knowledge (PCK), the need to forge real connections with other disciplines, and the need to teach students to seek those connections. Our results highlight the need for reconceptualizing PCK to suit ever-evolving schooling, including transfer skills and future learning knowledge.

Introduction

Changing schooling to be skill-centered is much more than a shift in teaching practice or curricula. Teachers need to develop the ability and willingness to continuously construct meaningful knowledge and apply knowledge creatively in ever-changing contexts (Bereiter, 2002). Knowledge creation overlaps with transfer-related skills: to search, retrieve, recognize and exhaust the usefulness of previous knowledge and skills. In this work, we adopted Bransford and Schwartz (2001) broader concept of "transfer" as "preparation for future learning" (PFL): People's ability to facilitate their own learning in knowledge-rich environments.

We followed a school's initiation of a schoolwide pedagogical endeavor: skills-centered interdisciplinary teaching, led by interdisciplinary teams of teachers who co-taught the units in the same time and space. In this unique setting, teachers are positioned as learning designers who collaboratively craft their knowledge through cluster teams (involving teachers from different disciplines), mostly during designated weekly meetings. This setting served as an opportunity to shed light on teachers' professional growth and knowledge creation in a skill-centered non-fragmented schooling, which was the goal of this study.

This opportunity led us to reconsider the term Pedagogical Content Knowledge (PCK) (Shulman,1986), a term which was coined under an assumption of curricular stability, when school had an information-focused agenda and a fragmented structure.

Method

We followed three cluster teams throughout the school year (Humanities, Sciences, and Social Studies). We observed their weekly meetings, lessons of these teams, general teacher-management meetings, and teacher-teacher meetings, in which the cluster teams participated. All these meetings were audio-taped and transcribed, accompanied by field-notes taken during the observations. Additional research tools were as follows: (1) questionnaires with all the school's teachers; (2) in-depth interviews with the teachers observed; (3) in-depth interviews with school's management and change initiators and leaders and (4) collection of relevant school documentation, such as the school's vision, curriculum, and yearly plan.

We took an interpretive perspective. Data analysis was conducted through a series of codes, noting the presence of recurring themes. A prominent theme concerned the components of teachers' knowledge, which evolved through collaboration, the focus of this paper. Our work is inspired by Ball and her colleagues' (2008) who suggested an empirically-based alternative framework through which they mapped in-action knowledge of mathematics teachers.

Results and discussion

The three clusters we followed implemented three different integrative models: interdisciplinary (science cluster), multidisciplinary (humanities cluster) and transdisciplinary (social studies cluster). Each model, however, challenged teachers' knowledge, creating various learning opportunities. Even as teachers relied heavily on their own PCK, they realized that their PCK was insufficient for the task at hand. The multiple perspectives and the mutually-dependent relations with peers created a knowledge-rich environment. In this environment, teachers needed to use their previous knowledge to facilitate their own learning as well as the collaborative learning process (namely, to employ and develop PFL), resulting in the creation of new integrative content knowledge and new pedagogical knowledge to mediate the integrative content to students.

We identified the following new knowledge components which altogether comprised teachers' *Integrative Pedagogical Knowledge (IPCK)*:

- *Extended Content Knowledge* (ECK) and *Extended Pedagogical Knowledge* (EPK) refer to the additional knowledge (to one's own PCK), in content and in pedagogy, that teachers developed throughout the process.

- *Preparation for Future Learning* (PFL) refers to teachers' ability to transfer their prior knowledge and use it in new situations, especially when making meaningful connections among the different disciplines that are taught in the cluster, recognizing common themes and big ideas, i.e., growing their ability for future learning.

- *Pedagogical Preparation for Future Learning* (PPFL) refers to teachers' knowledge in facilitating students' understanding of relationships and connections between contents, themes and ideas and knowledge of advancing students' integrative thinking and transfer skills, i.e., nurturing their ability for future learning.

- *General Knowledge* (GK) refers to knowledge for the purpose of being aware of it, not for using it or teaching it. For example, in the humanities cluster, when the history teacher reads the play that is being taught by the literature teacher, she gains knowledge of a different discipline in her cluster, although she does not teach it. Sometimes, GK has a more substantial role than just "knowing," and it sheds a light on teacher's own teaching (for example, what does this play tell me about my understanding of the topic of Nationality that *I teach*)?

- *Deep Knowledge* (DK) refers to knowledge that the teacher uses in her own teaching or in her dialogue with other teachers. For example, the knowledge required for the chemistry teacher when she conducts a physics experiment in her class.

- *My Discipline* (MD) refers to the subject-area I teach in the cluster, and *Other Discipline*(s) (OD) refers to the other subjects that are taught in the cluster. Sometimes the teacher needs to teach those other subject-areas (for example, in the transdisciplinary model and in parts of the interdisciplinary model), which will affect the level of knowledge required.

Table 1: Teachers' Integrative Pedagogical Knowledge Framework (IPCK)

IPCK						
	Science Cluster (Interdisciplinary model)		**Humanities Cluster** (Multidisciplinary model)		**Social Studies Cluster** (Transdisciplinary model)	
	MD	**OD**	**MD**	**OD**	**MD**	**OD**
ECK	deep	deep/general	Deep	general	deep	deep
EPK	deep	deep/general	Deep	general	deep	deep
PFL	Deep		Deep		deep	
PPFL	Deep		Deep		deep	

Table 1 presents the level of each knowledge component we found, general or deep, and its expression for the two implications, my discipline or other discipline(s) in each cluster team. The level of knowledge is connected to the integrative model and the nature of connectedness it calls for. The tighter the connections, the deeper the (content, pedagogical, and future learning) knowledge they require. As the school starts its third year of the change process, and teachers move around clusters and models, the uncertainty and instability of the change process seem to characterise the new schooling. Hence, we argue that PFL, the ability for future learning, is an essential component of any teachers' knowledge model facing new challenges in an ever-evolving reality of constants changes.

References

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