Investigating the Interplay Between Curricular Resources and Their Classroom Use: A Focus on Tasks[1]

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Abstract. *Curricular resources* include the different kinds of materials (digital or physical) that teachers use in or for their teaching (textbooks, lesson plans, etc.) and can have a significant influence on students' opportunities to learn. At the same time, teachers play a crucial role as interpreters and users of curricular resources, and so there is a complex relationship between curricular resources and their classroom use.

Prior research has mostly focused on developing approaches for studying either particular curricular resources or their classroom use but not both. These approaches, though useful for the purposes for which they were developed, are not well positioned to support investigation and understanding of complex issues on the *interplay* between curricular resources and their classroom use.

In this presentation I will draw on my book Curricular Resources and Classroom Use (Stylianides, 2016) that discusses and exemplifies new research approaches for studying, in connected ways, both curricular resources and their classroom use. I will focus on one approach discussed in the book that offers a practical way to investigate different "families" of curricular tasks (such as "argumentation tasks") and their use in different classroom settings. I will exemplify the approach in the area of mathematics, and I will explain how the approach can apply also in other subject areas including science.

[1] This paper provides an extended summary of a plenary delivered at the *3rd Panhellenic Conference with International Participation on Instructional Resources in Mathematics and Science* in Rhodes, Greece (November 2018). The paper draws on the book: Stylianides, G. J. (2016). *Curricular Resources and Classroom Use*. New York, Oxford University Press.

Research Context and Focus

In this presentation, I will use the notion of *curricular resources* to refer to the different kinds of materials (digital or physical) that teachers use in or for their teaching such as textbooks, lesson plans, etc. (Stylianides, 2016, p. 1). Curricular resources, especially textbooks which are the dominant curricular resource internationally, have traditionally been a major element of teaching and learning in science and mathematics. This finding was confirmed by both international studies, such as the Trends in Mathematics and Science Studies (TIMSS) (e.g., Mullis et al., 2012), and by other studies in different countries (e.g., Kaur, 2014; Pepin et al., 2013; Palha et al., 2013; Porter, 2002; Rezat, 2012; Schmidt, 2012; Tarr et al., 2006). For example, Tarr et al. (2006) concluded the following from their large-scale study in the United States:

[D]istrict-adopted textbook strongly influences both *what* and *how* mathematics is taught to middle school mathematics students. Coupled with the high frequency of textbook use by teachers, these data suggest that textbooks likely impact students' mathematics experience in important ways. (p. 200; emphasis in original)

Despite the importance of textbooks and other curricular resources in everyday practice, it is also clear that no curricular resource can predetermine the quality of instruction associated with its use. Teachers play a crucial role in the classroom *use* (*implementation*) of curricular resources because teachers select, interpret, and mediate how curricular resources are implemented in the classroom (e.g., Ball & Cohen, 1996; Corey & Gamoran, 2006; Gueudet & Trouche, 2009; Haggarty & Pepin, 2002; Pepin, 2014; Remillard, 2005; Ruthven et al., 2008). This, in turn, has an important effect on students' opportunities to learn (e.g., Cai et al., 2011; Otten & Soria, 2014; Remillard et al., 2014).

In this presentation, I will focus on the following research question:

To what extent is the classroom implementation of curricular content (notably tasks) aligned with what is designed in the respective curricular resource?

So my focus, as derived from the research question, will be on: (1) the learning opportunities designed for students in curricular tasks, (2) the ways in which curricular

tasks are implemented in the classroom, and (3) how this implementation compares to the tasks' original intent.

In my discussion, I will draw on my book, titled *Curricular Resources and Classroom Use* (Stylianides, 2016), that presents and exemplifies new research approaches for studying, in connected ways, both curricular resources and their classroom use. I will focus on one approach discussed in the book, which I will refer to as the *Practical Approach*.

The Practical Approach

In this section, I will describe briefly the Practical Approach. The description will be limited in many ways due to its brevity. The interested reader can refer to Stylianides (2016, pp. 63-111) for more details about the approach.

Some Key Features of the Approach

Three key features of the Practical Approach are the following:

1. *The Approach Focuses on Complex Issues*

There are many different aspects one could investigate in relation to curricular resources and their classroom implementation. One aspect relates to the amount of time classrooms spent on particular curricular content in comparison to the amount of time they were expected to spend on that content according, for example, to the textbook authors' recommendations. To investigate this aspect, a researcher could use simple classroom observations to identify the amount of time a classroom spent on a particular unit and then compare that figure with the recommended amount of time in the teachers' guide.

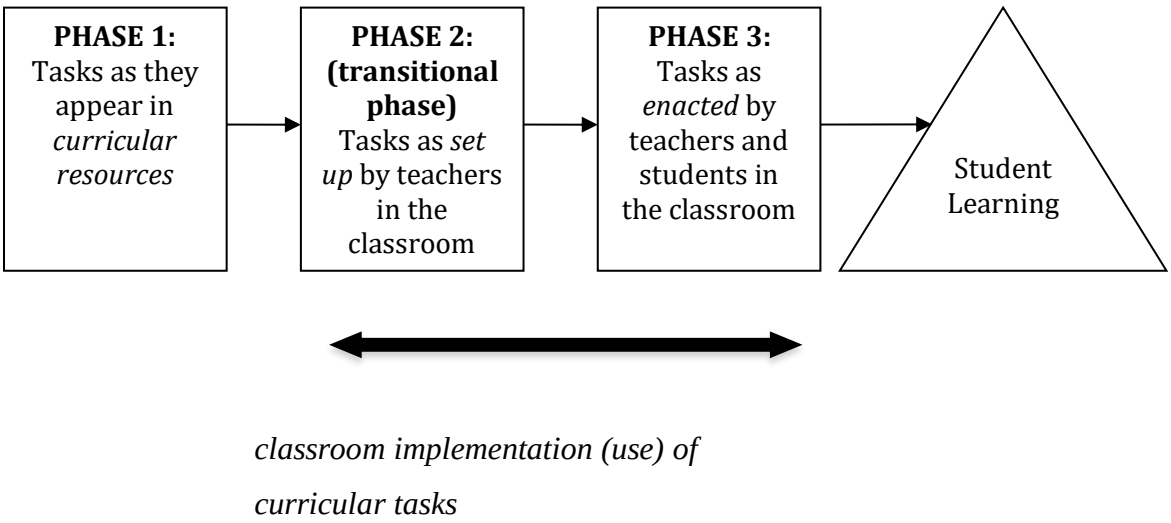
The Practical Approach aims to offer ways of studying more complex but equally important issues. Specifically, the approach can be used to study issues that: (a) are mathematically or pedagogically important and require specifically designed frameworks to adequately examine their complexities, and (b) cannot be studied adequately with simple classroom observations or straightforward inspection of teachers' guides.

2. *The Approach Focuses on (High-Level) Tasks*

At the core of the approach is the notion of *tasks*. The tasks used in the classroom limit or broaden students' views of the subject matter (e.g., Henningsen & Stein, 1997; Schoenfeld, 1992; Watson & Mason, 2005; Zaslavsky, 2005) and shape their learning experience in all areas of the school curriculum including science (Childs & McNicholl, 2015), history (Todd, 2015), English (Thompson, 2015), geography (Firth, 2015), religious education (Fancourt, 2015), modern foreign language education (Mutton & Woore, 2015), and mathematics (Stylianides & Watson, 2015).

The Tasks Framework (see Figure 1), which is an adapted version of the Mathematical Tasks Framework produced by Stein, Silver, and their colleagues (e.g., Silver & Stein, 1996; Stein et al., 1996, 2000), provides a useful representation of how tasks unfold in classroom practice.

Figure 1. The Tasks Framework. (An adaptation of the Mathematical Tasks Framework by Stein et al. 1996.)



In this framework, tasks are seen as passing through three *phases*, all of which are considered to be potentially important influences on what students learn or have an opportunity to learn. Overall, the Tasks Framework highlights the dynamic interaction between students and teachers as they work on tasks during classroom work (phases 2

and 3), and also points to the important role that curricular resources can play in contributing to this work (phase 1).

The Practical Approach can be used to analyze different kinds of tasks. In this presentation I will not be concerned with the relative worthiness of what has been termed as "low-level tasks" or "high-level tasks." Indeed, proficiency is a multi-dimensional construct (see, e.g., Kilpatrick et al., 2001) that encompasses a wide range of competencies, some of which require actions sometimes associated with "low-level tasks" and other times with "high-level tasks." Nevertheless, the focus of my discussion will be on how the approach can be used to analyze *high-level tasks*, i.e., tasks that require high cognitive demands for their solution. This choice was guided by the fact that high-level tasks are the kind of tasks that prior research has shown students find most difficult to understand or master and teachers find most difficult to teach.

3. *The Approach Starts from the Curricular Resources*

The approach has as its starting point the particular curricular resource (Phase 1 in Figure 1) that teachers use. This does not mean that a teacher should always consult a curricular resource to decide about what tasks to implement, and how, in their classroom. What it means is that the approach is not applicable to situations in which teachers do not use a curricular resource as the starting point for their planning. The reason is that, when teachers do not use a curricular resource in this way, it is not meaningful to talk about interplay between curricular resources and their classroom implementation, which is the issue of concern to me in this presentation.

Related to the previous point is that the approach requires that the curricular resource (textbook, lesson plan, etc.) that is being examined includes information to teachers about expected student solutions and suggestions for how to implement curricular tasks in the classroom. Without this kind of information a researcher cannot draw meaningful inferences about the intended purposes of the tasks in the resource. It is frequently the case that curricular resources provide this kind of information for tasks that students may find hard to learn and teachers hard to teach. Such tasks are more likely to fit in the category of high-level tasks that I discussed earlier.

A Brief Description of the Approach

The Practical Approach offers a way to examine the extent to which the classroom implementation of curricular tasks is faithful to what is designed for those tasks by their author in the respective curricular resource. An important idea in the Practical Approach is that tasks that are similar in some fundamental way can be grouped into a *family of tasks* and studied together. For example, the tasks in the family of "reasoning-and-proving" are similar in that they are all related to aspects of mathematical reasoning that are connected to the development of proofs. To study a particular family of tasks with the Practical Approach it is necessary to develop a framework that offers a reliable analytic tool to appropriately capture key aspects of the family of tasks, and that is applicable in an analysis of tasks *both* as they appear in curricular resources and as they are implemented in the classroom. The development of such a framework is challenging, but once the framework is developed, the Practical Approach can be applied to any number of tasks in the particular family and only that family.

Given the time and effort required to develop the framework, it would be strategic to reserve the Practical Approach for the examination of families of tasks that focus on activities that are not only important for students' learning, but also for which prior research has shown that students find difficult to understand and teachers find difficult to teach. Examples of such a families of tasks in mathematics are those of "reasoning-and-proving tasks" and "problem solving tasks." An example in science would be the family of "argumentation tasks."

Overall, the Practical Approach allows the examination of families of tasks using a specifically designed framework for each family, which streamlines the coding and makes feasible the analysis of a large number of tasks in the family. Application of the Practical Approach requires coding of a task using the framework at each of the three phases in the Tasks Framework.

After this brief introduction to the Practical Approach, a number of key questions remain unanswered which are important for understanding and applying the Practical Approach. In the presentation, I will consider the following questions:

(1) How can we determine the fidelity of implementation of tasks in the Practical Approach?

(2) How can we develop a framework for use in the Practical Approach?

(3) Once the framework is developed, how can we apply it in the Practical Approach? In more detail, how can the framework be used to: (a) identify the tasks in the sample that belong to the particular family we are interested in, and (2) code these tasks at each of the three phases in the Tasks Framework?

Final Remarks

This paper has first set the context for the presentation and then outlined key issues that I will address at the presentation. In addition to those issues, during the presentation I will exemplify the Practical Approach in the particular family of *reasoning-and-proving tasks* in the area of mathematics. The illustration will involve discussion of a "reasoning-and-proving framework" and its application in an analysis of curricular tasks and their implementation in school mathematics classrooms. I will also discuss implications of the Practical Approach for teacher education and the teaching practice.

The final issue I will consider relates to how my discussion of the Practical Approach could serve as a springboard for investigating similar issues in subject areas beyond mathematics. I will argue that the application of the Practical Approach in the area of mathematics could serve as a paradigmatic case of how similar issues can be studied in other subject areas in isomorphic ways. I will point out, for example, that, in any subject area, when a researcher is interested in a particular family of tasks, the researcher will need to develop a framework for the family of tasks and apply it to analyze tasks at each of the three phases in Figure 1. The development and application processes of the framework do not depend on whether the framework relates to a family of tasks in mathematics or a different subject area.

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