Some Remarks on the Documentational Approach
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Gueudet and Trouche's (2009) recent E.S.M. article, *Towards new documentation systems for mathematics teachers*, introduced me to the documentational approach. As I was reading through their article, I was connecting it with an analysis of teacher change that I had, not long ago, carried out with some of my research colleagues. But, let me first point to some aspects of their approach, aspects that are relevant for the connections that will subsequently be drawn.

At the heart of their approach is a distinction between resources and documents, similar to Vérillon and Rabardel's (1995) distinction between artifacts and instruments. Borrowing from the instrumental approach and its notions of instrumental genesis, instrumentalization, and instrumentation, documentational genesis is considered to have an instrumentalization dimension that concerns the appropriation and shaping done by teachers in the process of transforming resources into documents, as well as an instrumentation dimension that concerns the influence on the teacher's activity of the resources she draws upon. Gueudet and Trouche emphasize, however, that:

> Documentational genesis must not be considered as a transformation with a set of resources as input, and a document as output. It is an ongoing process. … A document developed from a set of resources provides new resources, which can be involved in a new set of resources, which will lead to a new document etc. Because of this process, we speak of the *dialectical* relationship between resources and documents. (p. 206)

They have appropriately represented this process by a helix, wrapped around a time-axis (see Figure 1).
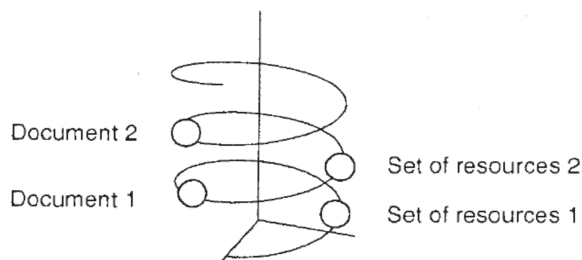

Figure 1. The resource/document dialectical relationship; this figure is drawn from
Gueudet & Trouche, 2009, p. 206

As suggested by their perspective on documentational genesis as that of an ongoing process, the analyses they present go beyond describing the integration of new resources. They entail elaborations of how these resources are being used and the more or less long-term evolution yielded by these uses in teachers' professional practice. The stories that Gueudet and Trouche tell recount the ways in which teachers have drawn upon various resources, including their students' reactions to their use, and have shaped these resources over time. Their accounts thus focus at once on several rounds of the evolutionary helix whereby students' reactions and inputs from colleagues, for example, have served as instrumentational resources for several cycles of the teacher's shaping and reformulation of these resources (the instrumentalization dimension). In other words, while a given classroom observation or teacher interview occurs at one moment in time of the evolutionary helix, the documentational geneses that are being probed are those that have taken place over several cycles or rounds of the helix.

Notwithstanding Gueudet and Trouche's insistence that documentational genesis is an ongoing dialectical process and not a transformation, I still wondered as I was reading the paper whether or not – at a more atomic level – documentational genesis could not be viewed as a set of transformations, albeit interrelated. This would permit the study of the impact of the introduction of salient new resources on the existing documentational systems of the teacher at the very 'moments' that the resources are being introduced. In other words, in addition to focusing at once on several rounds of the evolutionary helix – as do Gueudet and Trouche, I am wondering whether a fine-grained zoom-in on a much smaller part of the helix, say a point or a short arc, might also contribute to our knowledge of teachers' development of documents. Depending on where and when within the helix these zoom-ins are carried out, the descriptions could capture in a detailed manner the instrumentalization or instrumentation dimensions of the process of documentational genesis, that is, the ways in which the teacher is shaping or being shaped by these resources.

The recent research analyses that my research group has been engaged in have been focusing on just such an area, that is, one of the arc-like moments in the helix where new resources are being introduced to and integrated by a teacher into his practice. Although we have not been using the documentational approach as our theoretical framework, there is a certain degree of compatibility between our two types of analysis, especially if the documentational approach admits of such zoom-ins. Let me briefly describe an example from our analyses, one focusing on the teaching practice of a 10th grade teacher, who by his participation in our research project was being introduced to a set of new resources – CAS technology and an ensemble of novel tasks involving the use of this technology (see Kieran & Guzmán, 2009, or Kieran & Guzmán, in press).

After two months of observing the teacher, Michael, using these new resources in his classroom practice, we interviewed him. Michael told us that his participation in the research project was leading to new awarenesses on his part. These new awarenesses were constituting change in his i) knowledge of mathematics, ii) knowledge of mathematics teaching and learning, both of which were being reflected in his iii) practice of teaching algebra. More specifically, Michael was developing the following awarenesses:
* An awareness of what students at this grade level can accomplish mathematically – given appropriate tasks (the task aspect was considered very important) – as well as the realization that they can go further mathematically than expected.
* An awareness of the role that technology can play in the mathematical learning of students.
* An awareness regarding the culture of the class: it changes when technology is present – students become more involved; they are more autonomous.

Our analysis of his classroom lessons and subsequent interview pointed to five factors that were enabling the emergence of these awarenesses: a) access to the resources and support offered by the research group; b) use of technologies and tasks whose mathematical content differed from that usually touched upon in class; c) the quality of the reflections of his own students on these tasks; d) his disposition toward student reflection and student learning of mathematics; and e) his attitude with respect to his own learning.

The first two factors relate principally to the role played by resources 'from without', while the remaining three could be said to be 'from within' in that they concern the given teacher and his students. However, it was in the interaction of the two dimensions that teacher awareness and change were promoted. Had it not been for the *'from-without'* factors, that is, access to the resources and support offered by the research group and, consequently, the use of technologies and tasks whose mathematical content differed from that usually touched upon in class, then the

'*from-within*' factors, such as, the quality of the reflections of his own students on these tasks, would not have been put into play. Similarly, had it not been for '*from-within*' factors, such as Michael's disposition toward student reflection and student learning of mathematics, as well as his attitude with respect to his own learning, then the '*from-without*' factors related to the research team's contributions would not have taken root and flowered. Both types of factors supported each other in a mutually intertwining manner.

While further classroom observations and interviews with Michael the following year illustrated the ways in which Michael was modifying some of the tasks and his reasons for doing so, this evolution was not the main feature of our analyses. To use the language of the documentational approach, we were primarily interested in describing in detail the ways in which these new resources were initially impacting on Michael's thinking and his immediate practice involving them – the instrumentation dimension of documentational genesis. In Michael's own words during that first interview: *"The learning through the technology was amazing. But, the technology is nothing by itself. ... It was these activities; that's why [it was] so successful. ... With this technology, learning goes much further ... it involves more students. It gets them into it a lot more. They could discover things themselves."* This study thus provides *in situ* evidence of what can happen when teachers try out new resources, including the factors that can prompt them to decide to integrate these resources into their practice – eventually with certain shapings of their own. To close, this analysis illustrates the complementary nature of the findings that can accrue from focusing on one small arc of the evolutionary resource/document/time helix – findings that support, but also amplify, those obtained from an analysis using a many-rounds-of-the-helix approach, as presented by Gueudet and Trouche in their 2009 ESM paper.

References
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