

Theorising the design of professional development web modules

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This paper theorises the design of Skolverket's preschool and preschool class professional development web modules. By contrasting different models of teacher change, components are identified that designers of professional development materials may need to consider. Data from the decisions taken in designing the Skolverket project were analysed in relation to these components. From this analysis, it was found that some design considerations were not represented in the previous models. Consequently, a new model is proposed.

Introduction

As centralised education systems across the world try to raise the pedagogical content knowledge of mathematics teachers (Joubert & Sutherland, 2009), new professional development programmes often using information and communication technology (ICT) (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009) are being designed. Sweden is no exception to this, with the government initiating an extensive national professional development project (Skolverket, 2012). Teachers are expected to work in groups with web-based materials, known as modules (see Skolverket, 2012). Modules were divided into parts. For example, the preschool and preschool class professional development each had 12 parts. Each part contained four sections, A (individual studies), B (group discussion and planning), C (enactment/ observations in own teaching situations) and D (group discussion and follow-up). Several modules for teachers working at different levels of the school system have now been published by Skolverket, the Swedish Agency for Education (see Skolverket, 2012).

Each module is designed by teams from different universities at the bequest of Skolverket, who provide guidelines on the structure of the material as well as indications of the content to be covered (see Skolverket, 2012). As the designers of the professional development web-modules for teachers of preschool (concerning children 1 to 5 years old) and preschool class (children aged approximately 6 years old), we wanted to ensure that the material in the web modules would be in alignment with research on the professional development of teachers. In this paper, we describe previous models that theorised aspects of professional development and compare them with the decision-making process

from our own design work. In particular, the model of Fishman, Marx, Best and Tal (2003) and their suggestions for the elements needed in the development of professional development material is examined.

Theorising the design of professional development materials

Although there are numerous models which theorise teacher change as a result of professional development (for example, (Meaney, Trinick, & Fairhall, 2011) (Clarke & Hollingsworth, 2002; Conway & Clark, 2003; Warren, 2008/2009), virtually no research-developed models about designing professional development exist. Similarly when Dede et al. (2009) set out a research agenda for online teacher professional development, they did not include a recommendation to theorise the design of material. Yet as Whitcomb, Borko and Liston (2009) stated:

Attention to the preparation and support of professional development providers is essential to sustainability and scalability. The program must provide materials and resources that are sufficiently well specified to ensure that multiple facilitators in diverse settings can maintain integrity with the designers' intentions. Designers and early adopters must build the program's capacity by cultivating the knowledge base, experience, and leadership skills of novice professional development providers. (p. 211)

Without research about the design of professional development material, it seemed relevant to consider models of teacher change that occurred as a result of professional development. This is because professional development materials, through their implementation, are expected to contribute to teacher change. For example, Guskey's (1986) seminal model links professional development to enhanced student achievement (see Figure 1).

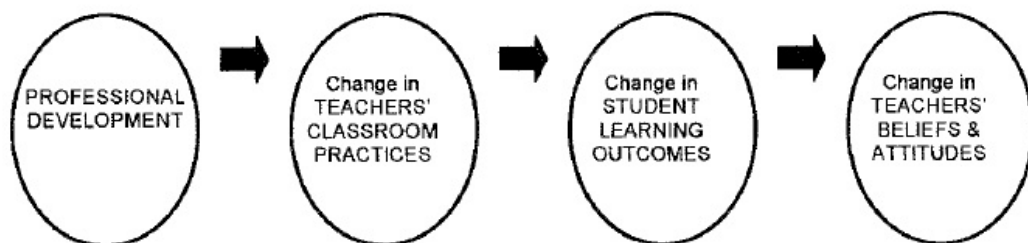


Figure 1: Guskey's model of teacher change (Guskey, 2002, p. 383)

Guskey (2002) considered that sustainable change in teacher practices only occurs after teachers' beliefs and attitudes had changed, but proposed that these changed as a result of seeing improvements in student learning outcomes that resulted from changes in teaching practices. Other models, such as Clarke and Hollingsworth's (2002), include the same components but do not consider the

process to be linear. Rather they saw teacher change as being initiated as a result of changes in any of the other components.

Fishman, Marx, Best and Tal (2003) considered that teachers' beliefs, attitudes and knowledge changed as a result of professional development, which had an impact on enactment of classroom practices and awareness of student performance (see Figure 2). Compared to Guskey's (2002) model, enactment, in Fishman et al.'s model can be equated with "changes in teachers' classroom practices", student performance with "changes in student learning outcomes" and teachers' knowledge, beliefs, and attitudes with "changes in teachers' beliefs and attitudes".

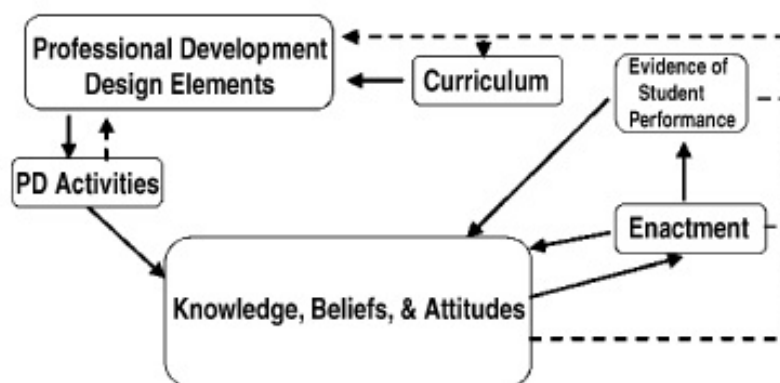


Figure 2: Model of teacher learning (Fishman et al., 2003, p. 645)

Fishman, et al.'s (2003) project is one of the very few that also considered the design of the professional development.

There are four primary "elements" over which designers of professional development have control: the content of professional development, the strategies employed, the site for professional development, and the media used. These four elements can be combined in various ways to create professional development experiences for teachers. (Fishman et al., 2003, p. 646)

Content refers to the pedagogical content knowledge that teachers are expected to gain from participating in the professional development. The need for content learning is usually why teachers are considered to need professional development (Joubert & Sutherland, 2009). For Fishman et al. (2003), the curriculum was the starting point for considering the content to be covered. Still "participants in professional development can often come away with unintended learning that can include misconceptions or otherwise problematic understandings of the intended content" (Fishman et al., 2003, p. 647). Strategies are how teachers are expected to learn about the content. These can be considered as the professional development designers' teaching practices for supporting teachers' learning. Sites are the physical environments where teachers engage in the professional

development. Fishman et al. (2003) do not take a position that one site is more beneficial than another. Rather they state that each site will have different affordances for the type of engagement expected. Thus, the choice of site(s) will have an impact on the strategies and media used. For Fishman et al. (2003), the media through which the professional development is conducted is the least important of the elements and is connected to both strategies and sites in affecting the format of the professional development.

We anticipated that to better understand our design process, it would be valuable to compare what we had done with Fishman et al.'s (2003) model, both the components that were related to Guskey's model (2002) and the design elements. By identifying if there were any components or elements that we had not considered, we would be able to improve our practices as professional development material designers.

Methodology

So that we could analyse our design process, we kept notes and audio-recorded the meetings that were held once a month from December 2012 until November 2013. Artefacts, such as contracts and email exchanges, were also kept. For this paper, we analysed a summary of our discussions from the first third (4 parts) of each module, which were developed simultaneously. The summary was used in the final preparation of these parts of the modules and acted as a reminder to ensure that the parts were in alignment with the agreements made during the first six months of work. The agreements came from our self-initiated discussions as well as reflections on a meeting with Skolverket's evaluation committee.

Table 1: Matrix of discussion points

| | Content | Strategies | Site | Media |
|-------------------------------|---------|------------|------|-------|
| Teacher attitudes and beliefs | | | | |
| Teacher knowledge | | | | |
| Enactment | | | | |
| Student outcomes | | | | |

Based on Fishman et al.'s (2003) model, we used a matrix with columns labelled with the 4 design elements and rows labelled with the components: teacher attitudes and beliefs; teacher knowledge; enactment; and student outcomes (Table 1). Although Fishman et al. linked the 4 design elements specifically to professional development tasks, we considered that tasks would be designed to affect each of Guskey's (2002) components. In line with Clarke and Hollingsworth's (2002) model, we separated knowledge from attitudes and beliefs as they seemed to require different kinds of design considerations.

The decisions in regard to the first third of the module were categorised as one or other of the four design elements by comparing each one to the Fishman et al.'s (2003) descriptions. Further, each decision was also categorised according to if it concerned attitudes and beliefs, knowledge, enactment (concerning something the teachers were asked to do in their normal preschool environment) or student outcomes (observation, assessment, documentation or discussion of own or other student's actions related to some activity or objective). In this way discussion items were slotted into the different cells of the matrix.

Examples and analysis

Our aim was to examine the general agreement between our design work and the components and elements of Fishman et al.'s (2003) model. As such, it was a qualitative study to see the level of agreement between what we had done and what seemed to be suggested as best practice. Therefore, we wanted to see if our decisions in the summary overview for the first four parts could be classified as fitting into all the cells in the matrix. Initially we were unsure that this would be the case. After the analysis showed that all cells could be completed, we were surprised to find that there were decisions which did not seem to fit any of the cells of the matrix. These are discussed in a later section.

Before discussing what was missing, we describe four examples of how the analysis was conducted. First we present an actual statement from the web material for preschool and then an explanation of the design team's intention with that statement which is connected to its classification in the matrix.

Example 1. Statement intended for Part 4D: *Update your pedagogical stance. Compare with what was written in 1A: What is same and what is different? Why? Compare with colleagues: What is the same and what is different? Why are there similarities and/or differences?*

The statement instructs the teachers to edit a text about their pedagogical stance that they wrote in part 1A. Writing and reflecting on an explicit pedagogical stance is a way of making one's beliefs and attitudes about teaching and learning visible. The instruction does not introduce new content, but asks teachers to compare changes in how they view their pedagogical stance from engaging with parts 1-4. As such it was a strategy about their beliefs and attitudes. Consequently, this was classified in the cell beliefs-attitudes/strategies.

Example 2. Document intended for Part 3C: *Observation matrix of forms of explanations.*

This observation matrix presents several ways of categorising children's explanations and is part of the content of the professional development. The intention was to let the teachers use this tool in their own practice, that is, themselves enact using the tool. Hence, the classification is enactment/content.

Example 3. Statement intended for Part 4B: *We have a range of documentation –*

How can we use this documentation? How can the documentation be shared or used with children?

This statement is concerned with student outcomes documented in a previous activity in the preschool environment. In an effort to deepen the discussion about the outcomes, teachers are to plan a subsequent learning situation in which the documentation is utilised by the children. In order to carry out this task, teachers must be aware of the interplay between the site in which the original documentation occurred and the site where the new situation will be enacted and how this might affect the new situation. The discussion is classified as student outcomes/sites.

Example 4. Video intended for Part 1A. *The video models how teachers could justify an observation's classification. Include the example of a child emptying a bucket.*

As a design team, we chose to build the modules around Bishop's 6 mathematical activities (Bishop, 1988). These are described in several texts in the module, but to connect the theory from Bishop to practice, the design team also wanted the teacher's to look at children playing and see if they could identify the 6 activities in the play. For this video was an important choice of media. We classified this decision as knowledge/media.

What was missing?

It was interesting to find that we could complete each of the cells in the matrix, more or less easily, but what was more interesting was that there were some points, which did not fit into any cell of the matrix. One important class of such discussions concerned relationships. For example, we had long discussions about how we addressed the users/readers and had decided that the plural form of you, "ni", would be used in instructions concerning activities and the singular "du" in instructions concerning reflections.

Concern about relationships turned out to figure in almost every discussion. In discussions about content and knowledge, attitudes and beliefs, we considered that it was important to build a relationship as designers of the materials with the teachers who were the users of the material, in a way that respected them as professionals. We also needed to consider how teacher tasks involved both providing a situation for children and documenting the children's interaction were affected by the relationships between the teacher and the children. It could be considered that Guskey's (2002) component of student outcomes as affecting teacher knowledge was a potential way of understanding the relationship between teachers and children. However, the actual examples of decisions that we were trying to categorise did not seem to fit easily into this row. Primarily, reflections on the task was done by prompting the teachers through discussion question. Thus, the decision to use discussion questions could be considered a

strategy. Yet it seemed to require reflection about the relationship between teacher practices and children's participation and so was more than a strategy about student outcomes. It also seemed that implementing and documenting these situations would give teachers shared experiences that they could discuss with their colleagues. In this sense, such tasks also concerned and were affected by relationships between the teachers in the group and as designers, we had to take seriously the need for teachers to build relationships together.

Inter-relationships between Fishman et al.'s elements

In addition to the emerging category of relationships, some interesting relationships between Fishman et al.'s (2003) elements were apparent during the analysis. As exemplified by Example 3, most site considerations were a part of discussion involving strategies. Similarly, media choice also seemed to be closely connected to strategies. In cases where media choice was limited due to the web based nature of this PD, as designers we spent longer considering the strategies available us in designing tasks because of lack of choice about how a task could be presented. As well, when particular content only seemed possible to introduce through a particular media such as with the use of video in Example 4, media discussions also seemed to be strategic discussions. Consequently, sites, media and strategies seemed to be part of the same considerations rather than three separate considerations.

In contrast to Fishman et al.'s (2003) suggestion that media was the least important element, our circumstances meant we spent considerable amount of time discussing them. We wanted the teachers to watch videos, so that they could see typical Swedish preschool and preschool class children engaging in tasks from different mathematics education perspectives. Finding videos that were not exemplary teaching/learning but rather raised issues, took much time. Similarly, we wanted the teachers to document their and the children's participation and we considered that simply writing about it would not produce important reflections. Therefore, it seemed that the purpose of the tasks were related to media considerations and so it seemed unnecessary to split this decision-making between the component PD activities and the element media.

In the analysis of our discussions, many of them turned out to be related to the category of knowledge. As Skolverket's (2012) purpose was to "lift" teachers' knowledge about teaching and learning mathematics and consequently student performance, this is not surprising. However, research on the impact of teachers' attitudes and beliefs made us aware that we needed to provoke discussions about these and we chose to do this by asking questions for shared reflections. Similarly, enactment seemed related to strategies. Whereas enactment was concerned only with tasks done with children in their own preschool or preschool class, strategies seemed to be a larger construct because it enabled considerations of different kinds of tasks.

A model for designing professional development materials

The Fishman et al. (2003) model provided a good starting point for exploring our own work in designing the web-based mathematics education modules for preschool and preschool class teachers. However, there were difficulties in trying to operationalise it to understand our decision making process. The limitations that we found in existing models may be because their focus was on teacher change following the implementation of the materials, whereas our focus was on the types of considerations that professional development designers needed to respond to

Consequently, we propose a model specifically for the design of professional development material. It can be seen in Figure 3 and outlines the kinds of decisions that designers need to consider in developing materials which are likely to promote teacher change. Therefore although it draws on models of teacher change, it does so from the perspective of what is needed to design professional development material.

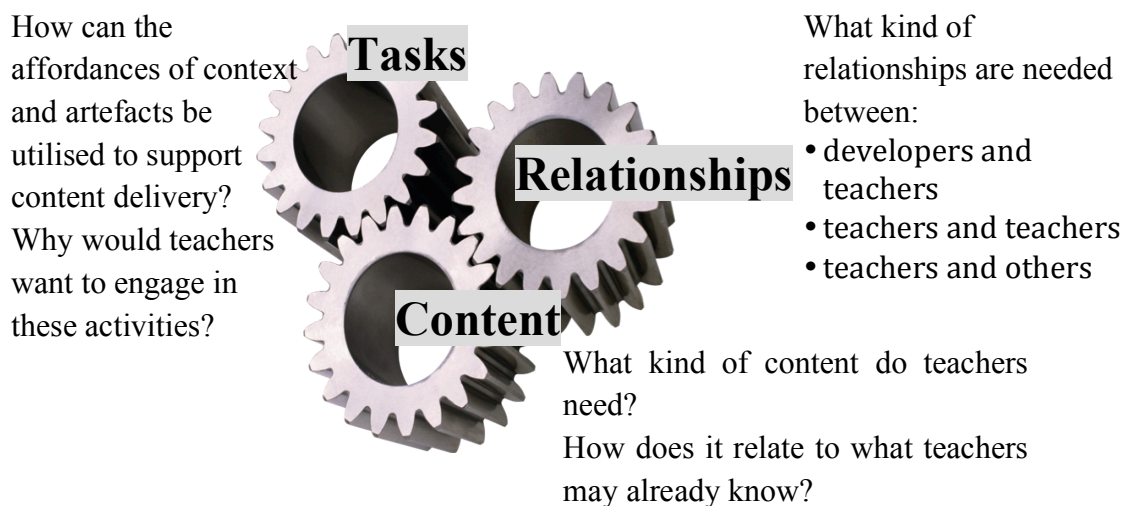


Figure 3: Professional Development Material Design Model

This model has three core components: the content; the tasks; and the relationships. These components interact with each other as decisions about one component is likely to affect the other two components, making it an integrated rather than linear model.

In projects, such as the one for Skolverket, content is the cog that drives the other two. This is because Skolverket identified the need for many preschool and preschool class teachers to improve their understanding of mathematics and how to develop mathematical task for young children to engage in. Even though designers often need to fulfil expectations of centralised education systems, there are likely to be some choices that designers can make in regard to content. In our case, we made the choice to present the content using Bishop's (1988) 6 mathematical activities. We discuss our reasons for this in another paper, but

here it is suffice to say that content decisions were related to the new knowledge that teachers were likely to need and how this related to the knowledge that they already had. This knowledge could be both discipline knowledge and/or pedagogical knowledge.

The second component in our model is to do with decisions about the tasks. This component is linked to Fishman et al.'s (2003) elements of site, media and strategies in relationship to the contexts and resources available for the teachers. The tasks connect to the content, but not just as a "deliverer", where teachers are asked to implement some aspect of the discussed content. Rather, the design of the tasks includes considering how they could be used to provoke teachers' reflections on their current practice and knowledge and relate these to new content perspectives. This means that the tasks were something that teachers enacted but also something that teachers needed to reflect on to gain other insights than were possible from merely reading about new content.

Our final component is relationships. We felt that it was a significant limitation in Fishman et al.'s model that there was no mention of relationships. For example, teachers are likely to gain more insights from their reflections if they are shared with other teachers. Thus, a relationship of trust between teachers is vital. Moreover, the content of the professional development might promote particular kinds of relationship with the children that teachers should reflect on which may result in changes to their existing practices. To contribute to the development of teacher-teacher and teacher-children relationships, it is important that the designers consider the relationships that they wish to be developed when designing the tasks. Tasks cannot only be designed to convey some content to individuals but they also need to develop appropriate relationships for maximising the potential for teacher change that will benefit children's engagement with mathematical activities. As well, we considered it important to consider the relationship between designers and users of the material. When designing, theories, ideas and experiences from research literature are packaged into professional development material for teachers who have experience, sometimes extensive, of what it means to support children's participation in mathematics activities in preschools. Consequently the material mediates between a scientific and a cultural (practice) perspective. Therefore, as designers we needed to have both an *expert* and a *philosopher perspective* (Certeau, 1984). The expert perspective concerns delivering certain, ideas, models, activities etc. The philosopher perspective uses the designer's scientific, specialist knowledge to ask questions, challenge routines and stimulate reflection.

In the new model, relationships, tasks and content are three equally important components in the design of professional development. As outlined earlier, decisions about one will affect the other two components. Although based on

research into our own experiences, the usefulness of this model for designers will only be shown after extensive use and research in other projects.

References

- Bishop, A. J. (1988). *Mathematical enculturation: A cultural perspective on mathematics education*. Dordrecht: Kluwer.
- Certeau, M. d. (1984). *The practice of everyday life*. Berkeley CA: University of California Press.
- Clarke, D. J., & Hollingsworth, H. (2002). Elaboration a model of teacher professional growth. *Teaching and Teacher Education, 18*, 947-967.
- Conway, P. F., & Clark, C. M. (2003). The journey inward and outward: a re-examination of Fuller's concerns-based model of teacher development. *Teaching and Teacher Education, 19*, 465-482. doi: 10.1016/S0742-051X(03)00046-5
- Dede, C., Ketelhut, D. J., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education, 60*(1), 8-19. doi: 10.1177/0022487108327554
- Fishman, B. J., Marx, R. W., Best, S., & Tal, R. T. (2003). Linking teacher and student learning to improve professional development in systemic reform. *Teaching and Teacher Education, 19*, 643-658. doi: 10.1016/S0742-051X(03)00059-3
- Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher, 15*(5), 5-12. Available from: <http://www.jstor.org/stable/1174780>
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: theory and practice, 8*(3/4), 381-391. doi: 10.1080/135406002100000512
- Joubert, M., & Sutherland, R. (2009). *A perspective on the literature: CPD for teachers of mathematics*. [online]. National Centre for Excellence in the Teaching of Mathematics. Available from: https://www.ncetm.org.uk/files/387553/RECME_Literature_Review.pdf
- Meaney, T., Trinick, T., & Fairhall, U. (2011). *Collaborating to meet language challenges in Indigenous mathematics classrooms*. Dordrecht: Springer.
- Skolverket (2012). *Matematiklyftet*. [Mathematics lift]. Stockholm: Skolverket. Available from: <http://matematiklyftet.skolverket.se>
- Warren, E. (2008/2009). Early childhood teachers' professional learning in early algebraic thinking: A Model that supports new knowledge and pedagogy. *Mathematics Teacher Education and Development, 10*, 30-45.
- Whitcomb, J., Borko, H., & Liston, D. (2009). Growing talent: Promising professional development models and practices. *Journal of Teacher Education, 60*(3), 217-212. doi: 0.1177/0022487109337280