Salamah Agung

Facilitating Professional Development of *Madrasah* Chemistry Teachers

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Analysis of its establishment in the decentralized educational system of Indonesia

**Facilitating Professional Development
of *Madrasah* Chemistry Teachers**
Analysis of its establishment in the
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**Facilitering van professionele ontwikkeling
van *madrasah* scheikundedocenten**
Analyse van de implementatie in het
gedecentraliseerde onderwijssysteem in Indonesië

(met een samenvatting in het Nederlands)

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Chapter 1

Introduction and Thesis Overview

1.1 Introduction

Providing favorable conditions for implementing an educational change is a major challenge for all actors in education, including the government, schools, principals and teachers (Fullan, 2007). The conditions are particularly important for teachers as the key actors in education in order to act in accordance with the educational objectives. For the purpose of providing favorable conditions, it is important to understand educational change. Such change can be understood through an analysis of the coherency of curriculum development, from the government to teachers and to students. Coherency of curriculum development is particularly critical in a decentralized educational system in which educational matters are transferred to local authorities and schools. Through determining the coherency in curriculum development, problems in the educational system can be defined and thus measures can be taken to provide favorable conditions which are appropriately attuned to teachers' educational practices.

Many studies have been carried out on the coherency in curriculum development in the process of educational change (Liu & Fulmer, 2008; Roberts, 1995; Van den Akker & Voogt, 1994; E. Wood, 2004). However, few studies have been conducted on the coherency of the curriculum development in the setting of a decentralized educational system. Such studies are important since the local educational actors do not automatically work in favorable conditions during curriculum development within a decentralized system. When the curriculum development, from the intentions of the policy makers to the students' outcomes, is incoherent, it influences the practice of education, particularly at the local level (Fuhrman, 1993). This deviation from coherency is described by Goodlad as "the slippage from any ideal formulation to what reaches the student, or of working backwards from what the student perceives to what the Formal Curriculum intended for him or her" (Goodlad, Klein, & Thye, 1979, p. 64). This slippage, a term also used by Van Berkel (2005) to describe this incoherency, will certainly create problems for the program, i.e. the objectives of education are not achieved (Cohen & Spillane, 1992; McLaughlin & Talbert, 1993). Therefore, it is relevant to analyze the coherency of the curriculum development in the decentralized educational system.

In any educational change, including that in a decentralized educational system, the role of teachers is undeniably very significant for the success of the change (Fullan, 2001; Harris, 2002; Pilot, 2005). Most studies of teachers in the process of educational change are related to professional development (PD) activities which are widely believed to contribute to the development of teachers' knowledge and practices (Buczynski & Hansen, 2010; Jeanpierre, Oberhauser, & Freeman, 2005; Yager, 2005). With respect to the development of teachers, several studies have reported the importance of establishing communities for teachers' PD activities (Cox-Petersen, Spencer, & Crawford, 2005; Grossman, Wineburg, & Woolworth, 2001; D. R. Wood, 2007).

However, systematic studies are lacking on how to establish communities of teachers and how to develop PD activities in a decentralized educational system. Considering this, it is therefore relevant to conduct research on establishing a community of teachers within the decentralized educational system, including the development of teachers' PD activities in such communities, and specifically pay attention to the conditions in which teachers have to give shape to their teaching practice.

The knowledge gap on the understanding of curriculum development in a decentralized educational system and on the understanding of the establishment of a community of teachers, including the corresponding professional development activities, leads to two important aspects that need to be taken into consideration. The first aspect deals with the national educational policy which implies the transfer of responsibility to the local authorities and to the schools. An initial framework is needed in order to determine the coherency in the curriculum development from the intentions of the curriculum designers (i.e. policy makers) to the outcomes of the students. This first framework is based on the typology of curriculum representations developed by Van den Akker (1998) who adapted the curriculum representations of Goodlad, Klein & Thye (1979) combined with Robert's (1982) concept of curriculum emphases. The result of such analysis is expected to provide an understanding on whether or not the development of the curriculum is coherent.

The second aspect is related to the conditions at the local level within which teachers play their roles. Considering this, more understanding of the conditions of the teachers regarding their development and implementation of the curriculum is needed. The results of such study should provide an understanding of what conditions foster the coherency of the curriculum and are supportive for the teachers. When the conditions are not favorable, they may contribute to slippage in the curriculum development and thus influence the extent to which the educational objectives are achieved. Specific measures might probably be needed in order to facilitate teachers to enhance the conditions for their practices and for the development of a coherent curriculum. Taking advantage of the decentralized system, these measures should provide a promising change within a local system. The participation of local educational actors is also important. This study uses a framework which integrates an analysis of the conditions of Infrastructure, Authority, and Consensus (IAC model; Havelock and Huberman, 1978) to provide a full understanding of these conditions for educational change. This framework should be suitable for the analysis of the conditions and for facilitating teachers and local educational actors to work together. This may contribute to reducing problems at the local level and to developing a coherent curriculum (Darling-Hammond & McLaughlin, 1995; McLaughlin & Talbert, 1993).

These two aspects, the analysis of the (in)coherency of the developed curriculum and the analysis of the conditions in which teachers give shape to their teaching practice, are the focus of the studies in this thesis. These aspects are scientifically relevant because they are needed to understand any effort to improve education in a decentralized educational system that puts weight on teachers as the key actors in the educational system.

1.2 Setting of the research in this thesis

This research project involves an in-depth study to understand the situation and rationale of measures described in the previous section. This research comes from a concern about the educational practice in the Islamic schools (*madrasah*) in Indonesia within the new decentralized educational system, particularly within the domain of science education. Especially important is the practice of *madrasah* chemistry teachers regarding the new curriculum policy as it is currently being established. Therefore, this case study was conducted in the setting of the new curriculum policy of chemistry education, studying the conditions within which chemistry teachers in *madrasah* give shape to the new curriculum. A local measure was conducted in a district in Indonesia in relation to facilitating the chemistry teachers of *madrasah* in the district to carry out professional development activities in order to contribute to the development of a more coherent curriculum.

Madrasah schools are rooted in Islamic values and previously offered only Islamic studies in their teaching (Mukhtar, 2001). This is why *madrasah* are governed by the Ministry of Religious Affairs (MORA). For a long time, the teaching in *madrasah* was not comparable with the teaching in the other schools, i.e. the general schools. As a consequence, the *madrasah* were not part of the formal education in the nation. The graduates of *madrasah*, therefore, did not receive diplomas from the Ministry of National Education (MONE) which is responsible for the education in the general schools. As a consequence, the graduates of *madrasah* could not continue to higher general schools or seek employment where candidates were required to hold a MONE diploma.

Attempts have been made by MORA to make *madrasah* equal to the other schools in this respect. The three-ministerial decree in 1975 was a great achievement of MORA for an acceptance of the *madrasah* as part of the national educational system. This decree brought about a regulation stipulating a 70/30 ratio of non-Islamic subjects and Islamic subjects respectively for *madrasah*. Following this came Decree No. 2/1989 on the National Educational System of Indonesia, which specifically defines the *madrasah* as "schools with Islamic characteristics" (madrasah *bercirikan Islam*) (Mukhtar, 2001; Zuhdi, 2006). With this decree, *madrasah* were required to offer all the subjects of the general

schools, i.e. secular subjects, including science, as well as the Islamic subjects from MORA, such as Arabic language, *Qur'anic* lessons (the history and interpretation of the Koran), rituals (*Ibadah*), and ethics (*Akhlak*). The status of *madrasah* as part of the educational system in the nation has been strengthened in the current decree of national education, passed in 2003, whereby *madrasah* schools are put side by side with the general schools. Considering the historical background of *madrasah*, the general subjects, including science, are relatively new and they have brought challenges to the *madrasah*.

The decentralization policy of 2004 has become a major challenge for *madrasah* to cope with science. With respect to MONE, this policy has the consequence that the educational system of Indonesia is decentralized, indicating a transfer of responsibilities of educational matters from MONE to the local authorities and to the schools. However, unlike MONE, MORA is one of the ministries that is not decentralized. The management of all matters under MORA's portfolio, including *madrasah*, remains centralized.

Following the decentralization of MONE in 2004, the curriculum policy has gradually been changed. The competence-based curriculum *Kurikulum Berbasis Kompetensi* (KBK) introduced in 2004 was the first attempt to adjust to the decentralization system (Utomo, 2005). As a transition from the previously centrally managed curriculum in place until 1999, KBK was still relatively centralistic in nature, noting that all the competencies (i.e. standards of competencies, basic competencies, basic lessons, and indicators of performance) were developed by the government (MONE), and schools in the nation were required to teach all the competencies in their Operational Curriculum. In this setting, the Operational Curriculum is expected to be the same for the whole nation. However, under certain conditions determined by the government (i.e. the availability of resources), schools might be allowed to develop an Operational Curriculum based on the considerations of the particular school, such as the background of the students and the capacity of the schools to support the implementation of the Operational Curriculum.

After two years of implementation, a new curriculum policy was established in 2006, and the curriculum was considered as a school-based curriculum, *Kurikulum Tingkat Satuan Pendidikan* (KTSP). Using minimum standards (i.e. competencies, content, and students' performance) determined by the government, this KTSP policy requires each school or *madrasah* to develop its own standards and create its own Operational Curriculum based on the resources of the school or *madrasah*, students, district (local) educational aims, etc. Compared with the KBK, this KTSP curriculum policy was determined as a refinement of curriculum policy towards a complete decentralized educational system.

Within the described setting, three problems emerged and became challenges for *madrasah*. The first is related to the struggle of *madrasah* in dealing with science. The second is the status of *madrasah* which is in between the decentralized MONE and the centralized MORA. And the last is the challenge in curriculum development influenced by the school-based KTSP curriculum policy. Those three problems influence the educational actors of *madrasah*, particularly the teachers who are the key actors in education.

1.3 Objectives, research questions, and scope of the studies

Given the problems faced by *madrasah*, measures are needed in order to facilitate the work of science teachers in *madrasah*. The aim of the research project is therefore to investigate the facilitation of *madrasah* science teachers in their professional development activities during a curriculum change in a decentralized educational system. Accordingly, the main question of the research project is:

> *In what way can professional development activities of* madrasah *chemistry teachers be facilitated during curriculum change in a decentralized educational system in Indonesia?*

Therefore it is necessary to study the national educational policy and the conditions at the local level to achieve the aim of the research project. A study of the new chemistry education should be conducted first, in order to understand the problems in the curriculum development of chemistry and in the conditions of the new Operational Curriculum where teachers play their roles. With the understanding of curriculum development and the conditions for teachers in which this development takes place, local measures could be developed to investigate the facilitation of teachers' professional development activities to support teachers when they give shape to the new Operational Curriculum. Considering these two aspects, two sub-questions were derived:

1. *What are the characteristics of chemistry education in* madrasah *as a result of a decentralization policy in Indonesia and what are the conditions during this curriculum change?*
2. *In what way can professional development activities of chemistry* madrasah *teachers be facilitated in their community?*

The empirical studies in this research were conducted from the middle of 2008 to the end of 2010. In the start of the studies, the KTSP policy had been applied for two years and it was continued in the following years. The studies were carried out within the domain of grade 11 of senior secondary *madrasah*. The senior secondary *madrasah* are relatively independent compared with elementary and junior secondary *madrasah*. This is because both elementary and junior secondary are defined as basic education and thus they receive considerable support from the government for their development. In addition, science teaching (i.e. chemistry, biology, and physics) starts in senior secondary

madrasah (grade 10). In grade 11, students are required to choose one of the programs offered by the *madrasah*, namely, science, social science, or language. Particularly for the science program, students of grade 11 will be taught more advanced science than in grade 10. In grade 12, these students will spend most of their time preparing for the national examination to obtain their graduation and qualification for studying in tertiary education. Teaching science in grade 11, therefore, is considered very important. Students of grade 11 who cannot manage to understand science will likely face difficulties in learning the science curriculum in grade 12. This will influence their performance in the exam. Considering the importance of grade 11, this grade was chosen to become the domain of the studies in this thesis.

1.4 Overview of the thesis

In order to answer the main question, this research consists of a series of studies that are described in the chapters of this thesis and that focus on the following issues:

a. An understanding of the characteristics of the chemistry curriculum using the curriculum emphasis concept of Roberts (1982) and the typology of curriculum representations (Goodlad et al., 1979; Van den Akker, 1998). Such characteristics allow an understanding of the coherency of the curriculum, particularly with respect to the Operational Curriculum at the school level (Chapter 2).

b. An understanding of factors that support or hinder teachers in conducting the development of the Operational Curriculum (Chapter 3).

c. An understanding of strategies identified and implemented by local educational actors, to fulfill the conditions to establish a community of teachers and to enable teachers to conduct their professional development activities (Chapter 4 and Chapter 5).

d. An understanding of teachers' professional development activities in the community that teachers consider to be meaningful for their teaching practices (Chapter 6).

Each of the chapters as described below will answer specific research questions that in combination provide an answer to the main research question. Figure 1.1 provides an overview of all chapters in this thesis.

Chapter 2 focuses on the characterization of the chemistry curriculum of *madrasah* in Indonesia after the issuing of the decentralization policy. This study addresses the question: *What are the characteristics of Indonesian upper secondary chemistry education in* madrasah *in terms of curriculum emphases and curriculum representations?* A framework is developed from two perspectives on the curriculum, namely, the curriculum representations and the curriculum emphases.

CHAPTER 1 Introduction and overview of the research
Main Research Question
In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?
Sub-Research Question 1
What are the characteristics of chemistry education and the conditions during the curriculum change?

CHAPTER 2	CHAPTER 3
Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah*	The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the new school-based curriculum change in a decentralized educational system of Indonesia
Research Question	**Research Question**
What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?

Sub-Research Question 2
In what way can professional development activities of chemistry *madrasah* teachers be facilitated?

CHAPTER 4 Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah* **Research Questions** 1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers? 2. What indicators of favorable conditions are formulated from the actors' shared agreements?
CHAPTER 5 Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah* **Research Question** To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?
CHAPTER 6 Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system **Research Questions** 1. What changes did the teachers perceive after their professional development activities? 2. What PD activities did the teachers perceive to be meaningful for their practices? 3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?
CHAPTER 7 Conclusions and Reflection

Figure 1.1   Overview of the thesis

Chapter 3 investigates the conditions in the Perceived and Operational Curriculum. This study focuses on the question: *What are the conditions for chemistry teachers of* madrasah *when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?* A model analyzing the conditions Infrastructure, Authority and Consensus (IAC model; Havelock and Huberman, 1978) is used to enable a comprehensive assessment of these conditions.

Chapter 4 reports a study in which the educational actors tried to identify strategies in order to establish a community of teachers and to provide favorable conditions for teachers' professional development activities. Two research questions are addressed in this study: (1) *What strategies and arguments do the educational actors agree upon in establishing a community of teachers?* (2) *What indicators of favorable conditions are formulated from the actors' shared agreements?* Four perspectives were used to answer the questions: the community of teachers, the participatory work of the educational actors, the agreements upon strategies of the actors, and creating favorable conditions.

Chapter 5 reports the further development of the strategies identified in the study described in Chapter 4 in order to fulfill the conditions. Using the same theoretical considerations as described in Chapter 4, the question addressed in this study is: *To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?*

Chapter 6 focuses specifically on teachers' professional development activities within the fulfilled conditions described in Chapter 5. In this explorative study, three questions are addressed: (1) *What changes did the teachers perceive after their professional development activities?* (2) *What PD activities did the teachers perceive to be meaningful for their practices?* (3) *What factors did the teachers find supporting or hindering the use of their new knowledge and skills in their practices?*

Chapter 7 provides a synthesis of these studies and gives the combined understanding of the problems and solutions addressed in this thesis. In the conclusions and the subsequent reflection on these conclusions, the contribution of the studies to the theoretical knowledge of this domain is presented. The limitations of the studies are discussed. This chapter ends with implications for further studies and recommendations for policy makers, principals, and teachers.

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CHAPTER 1 Introduction and overview of the research

Main Research Question
In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?

Sub-Research Question 1
What are the characteristics of chemistry education and the conditions during the curriculum change?

CHAPTER 2	CHAPTER 3
Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah*	The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia
Research Question What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	**Research Question** What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?

Sub-Research Question 2
In what way can professional development activities of chemistry *madrasah* teachers be facilitated?

CHAPTER 4
Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah*
Research Questions 1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers? 2. What indicators of favorable conditions are formulated from the actors' shared agreements?

CHAPTER 5
Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah*
Research Question To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?

CHAPTER 6
Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system
Research Questions 1. What changes did the teachers perceive after their professional development activities? 2. What PD activities did the teachers perceive to be meaningful for their practices? 3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?

CHAPTER 7 Conclusions and Reflection

Chapter 2

Chemistry education in Indonesian *madrasah*
An analysis using curriculum representations and curriculum emphases

Abstract

It is important to analyze the coherency of the curriculum in a decentralized educational system in order to understand whether the intentions of policy makers reach the students. This study used the framework of curriculum representations and the concept of curriculum emphases to characterize the chemistry curriculum of Islamic schools (*madrasah*) in an Indonesian context. Using triangulation in the data analysis, this study found a "slippage" in the curriculum development. The Ideal Curriculum showed most emphases that Roberts defined, with an additional emphasis on religious orientation. Only two emphases, i.e. Everyday Coping and Correct Explanations, remained in other curriculum representations (Formal to Attained Curriculum). A further study is needed to understand the situation and conditions for the teachers related to this slippage, because it influences the practices of teachers in *madrasah*. This understanding is valuable to determine appropriate measures to support the teachers in shaping their instructional practice.

2.1 Introduction

Giving shape to a new curriculum policy within a decentralized educational system is a major challenge for all actors in the system, including the government, local authorities, principals, teachers, and students. A decentralized educational system indicates the need for a coherent message in curriculum development from the government or the policy makers, who define the objectives of the curriculum of the nation, to the outcomes of students (Bybee, 1991; Klein, 1992; Miller, 1992). Without a coherent message in curriculum development, educational actors at the local level may face conflict in how, practically, to interpret and act upon the demands of the objectives of the curriculum (Fuhrman, 1993a).

The coherency of curriculum development can be analyzed by characterizing the purpose of learning as defined along the way from the objectives of education to the outcomes of students. Many studies have been carried out to characterize the purpose of science curricula in secondary education (e.g. Roberts, 1995; Van Driel, Bulte, & Verloop, 2008). However, most studies deal with only one representation of the curriculum. Roberts (1995) analyzed the purposes of the Learned Curriculum and Van Driel et al. (2008) investigated the emphases of curricula from the teachers' perspectives. Such studies can only determine problems that occur within a particular representation. Few studies have been carried out to analyze the coherency in the purpose of learning from the intentions of the policy makers to students' learning outcomes. However, it is widely acknowledged that understanding the level of coherency helps determine problems in education (Roberts, 1982; Rogan, 2007; Van den Akker, 1998; Van Berkel, Pilot, & Bulte, 2009).

Decentralization of education in Indonesia has recently been established after more than three decades of a centralized educational system. The coherency in curriculum development within this new system has not been studied extensively. Such studies are certainly needed especially with respect to Islamic schools (*madrasah*). Different from general schools, which are governed by the Ministry of National Education (MONE), *madrasah* schools are governed by the Ministry of Religious Affairs (MORA). Since MORA is one of the ministries that remain centralized, the management of *madrasah* is governed by the centralized system. However, as part of the national educational system, the *madrasah* schools are required to follow the national curriculum policy, which employs a school-based curriculum (KTSP) that has a decentralized character. Considering the decentralization of education and the new KTSP curriculum policy, an analysis of the development of the curriculum is important. This is particularly important for the domain of science, which is a new domain for *madrasah* since they are rooted historically and culturally in the Islamic mainstream. The result of the analysis of the

science curriculum is valuable to identify the problems that *madrasah* face to make the teaching of science consistent with the objectives of the national science curriculum. Understanding the problems, furthermore, will help educational actors of *madrasah*, from policy makers to teachers, to find ways to provide better science education.

While the tools that exist to analyze a curriculum in the process of educational change vary (Fullan, 2007; Roberts, 1982; Rogan & Grayson, 2003; Van den Akker, 2003), little is known about tools to analyze the purposes of learning in terms of curriculum emphases within the different curriculum representations. Such a tool is important to give a full overview of the curriculum development and the extent of the coherency of the emphases from the policy makers to the students' outcomes. The present study employs two theoretical perspectives of curriculum analysis that accommodate such a full overview. The first perspective is the typology of curriculum representations developed by Van den Akker (1998), who adapted the curriculum representations of Goodlad, Klein and Thye (1979), and the second is the typology of curriculum emphases of Roberts (1982). While the first typology describes different curriculum representations, the typology of emphases describes the purpose of learning. These two perspectives are expected to provide a clear picture and understanding of the characteristics of the chemistry curriculum in the context of *madrasah*. The results of such understanding may provide not only a strong basis for educational measures that aim for better education but also new insights for other educators interested in the analysis of a curriculum in other contexts.

2.2 Theoretical framework

2.2.1 The typology of curriculum representations

Goodlad et al. (1979), in their studies on assessing science curricula, found five representations of the organization of curricula; Ideal, Formal, Perceived, Operational, and Experiential. These representations describe different perspectives on the teaching and learning process. Van den Akker (1998; 2003) further developed these representations by adding a new representation at the end, which is the Attained Curriculum.

1. The Ideal Curriculum describes the original philosophy (rationale, vision and mission) of the designers of a curriculum.
2. The Formal Curriculum describes an elaboration of the Ideal Curriculum, presented in a written document and materials such as a curriculum guide.
3. The Perceived Curriculum represents interpretations of users, such as teachers and textbook writers or publishers, regarding the Ideal and the Formal Curriculum. While teachers' perceptions of the curriculum are demonstrated in syllabi, lesson

plans, or personal interpretations, textbook writers present their interpretations in their textbooks.

4. The Operational Curriculum can be observed in the actual instructional process in the classroom. This instructional process is conducted by the teachers and supposed to be guided by their interpretations of the curriculum as described in the Perceived Curriculum and the interpretation of the textbook writers.

5. The Experiential Curriculum reflects the perspectives of students from their actual experience with the Operational Curriculum in the classroom.

6. The Attained Curriculum describes more precisely the learning outcomes of the students after their learning activities.

According to Goodlad et al. (1979), all representations of the curriculum should be connected to each other and should represent a coherent curriculum policy. This connection can either affirm or contradict the influence of any single representation. Understanding this connection, Van Berkel, Pilot and Bulte (2009) propose that the curriculum representations have the potential to become a tool for a good characterization of a curriculum as a whole, and might make it possible to gather and structure data according to each of the representations, to identify discrepancies in each of these representations, and to determine the relations between these representations.

2.2.2 The typology of the curriculum emphases

Since each of the curriculum representations presented above is influenced by different educational actors, the purposes of learning in each of the representations can show differences (Fuhrman, 1993b; Pinar, 1992; Schubert, 1992). In agreement with this, Schubert (1992) mentioned that the background of curriculum developers influences to a certain extent the direction of the curriculum. This is more likely to happen when the direction is different from what developers, especially teachers, expect within their context. Meanwhile, Pinar (1992) argued that "the existence of the others" in the development of the curriculum creates boundaries for teachers to operate their teaching and learning. Therefore, an analysis of the purposes of learning in each of the curriculum representations is important.

Science education is always related to certain learning purposes and emphases. Analyzing the emphases allows one to characterize the objectives of a specific science curriculum. According to Roberts (1982), there are seven emphases in the purposes of science education:

1. Everyday Coping: "science is an important means for understanding and controlling one's environment – be it natural or technological" (p. 246).

2. Structure of Science: "the substance of this emphasis is a set of messages about how science functions intellectually in its own growth and development" (p. 247).
3. Science Technology and Decisions: "concentrates on the limit of science in coping with practical affairs […] a set of messages which distinguish science from technology, first, and subsequently distinguish scientific/technological considerations from the value-laden considerations involved in personal and political decision making" (p. 247).
4. Scientific Skill Development: this emphasis directs towards developing fundamental skills required in scientific activities. It is "a set objectives within science […] process is more important than products" (p. 247).
5. Correct Explanations: "stresses science 'product' as heavily (high exclusively) as the former one stresses 'processes'" (p. 247). This emphasis is summarized as "master now, question later" (p. 248).
6. Self as Explainer: "deals with the character of science as a cultural institution and an expression of one of man's many capabilities" (p. 248).
7. Solid Foundation: "science instruction should be organized to facilitate the student's understanding of future science instruction" (p. 249).

These seven emphases have been widely used by many researchers to analyze the curriculum from different perspectives. Roberts himself, for instance, used the emphases to analyze the change of policy in science education in Canada from 1978 to 1990 (Roberts, 1995). Van Driel, Bulte and Verloop (2008) have investigated teachers' beliefs about the chemistry curriculum during an educational reform in the Netherlands from the perspectives of emphases. Van Berkel et al. (2009) used these emphases in their evaluation of science textbooks to understand how to "Escape from Dominant School Chemistry". Pilot and Bulte (2006) used the emphases to analyse the use of "contexts" in different approaches of context-based chemistry education. All these researchers found the curriculum emphases useful for understanding a curriculum and devising appropriate measures accordingly to improve educational practices.

Since the curriculum representations describe the level of organization of a curriculum, and the curriculum emphases describe the purposes of learning, combining these two perspectives is expected to produce a clear mapping of a curriculum and provide a holistic understanding of the curriculum. The framework used in this study is constructed from both curriculum perspectives and the results described in section 2.5 are shown in a matrix where the rows determine the representations and the columns describe the emphases (see Table 2.1).

With this framework, it is possible to analyze the differences in emphases that are related to each of the curriculum representations. The difference between emphases in the Ideal Curriculum and the realization in the Attained Curriculum is described by

Table 2.1 The emphases (Roberts, 1982) found in the curriculum representations (Goodlad et al., 1979; Van den Akker, 1998)

Curriculum representations / Emphases	Ideal Curriculum	Formal Curriculum	Perceived Curriculum	Operational Curriculum	Experiential Curriculum	Attained Curriculum
Religious Orientation	To create a positive attitude towards the beauty of nature, as well as praising the One God	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Everyday Coping	Relating concepts, laws, and theories to everyday life and technology	Indicated to understand certain laws in everyday life and industrial settings	No indication in the development of syllabi and lesson plans	Indicated in examples given during lectures	Indicated in discussions of examples during lectures	Indicated in a few items in the exam, involving everyday contexts
Structure of Science	To cultivate scientific attitudes To gain experience in implementing scientific methods	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-

Curriculum representations / Emphases	Ideal Curriculum	Formal Curriculum	Perceived Curriculum	Operational Curriculum	Experiential Curriculum	Attained Curriculum
Science, Technology, and Decisions	To develop awareness of the application of chemistry	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Scientific Skill Development	To cultivate scientific attitudes To gain experience in implementing scientific methods	-No indication-	-No indication-	Indicated in laboratory experiments using guided procedures; were rarely conducted	Indicated in laboratory experiments that used guided procedures and were rarely conducted	Indicated in a few items in the exam involving use of results of experiments
Correct Explanations	To understand concepts, laws, and theories	Indicated to understand concepts, laws, and theories	Indicated to understand concepts, laws, and theories	Indicated by teaching concepts, laws, and theories	Indicated that students were taught concepts, laws, and theories	Indicated in most items in the exam
Self as Explainer	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Solid Foundation	-No indication-	-No indication-	-No indication-	Indication of the strong need to teach concepts as prerequisite to teach other ones	Mostly learned concepts, laws, theories; no laboratory experiments	Exams consist of items about concepts, laws, theories, and calculations

Goodlad as "the slippage from any ideal formulation to what reaches the student, or of working backwards from what the student perceives to what the Formal Curriculum intended for him or her" (Goodlad et al., 1979, p. 64). The term "slippage" is further used to describe this shift in emphases.

2.3 The setting of this study and the research question

The establishment of the 2006 school-based curriculum Kurikulum Tingkat Satuan Pendidikan (KTSP) is a response to the decentralization of education and the autonomy of the districts recently implemented in Indonesia. The KTSP policy gives each school some possibilities to design and develop its own Operational Curriculum by considering the resources it has available. However, the vision and the standards of the curriculum are set by the Ministry of National Education (MONE) which is responsible for all education in the nation. In addition to the vision and standards, MONE also establishes centralized national examinations as one of the determinants to assess the results of students' learning throughout the nation. These exams are obligatory for all students at the end of their elementary and secondary education.

Regarding standards, MONE developed a curriculum guideline that provides detailed explanations and expectations of the KTSP policy through its Body of National Education Standards (BSNP). Included in the guideline are the standards for content and the standards of graduate competences that are used by teachers to develop their syllabi and lesson plans. The content standards (SI) comprise the scope of topics to be taught by a teacher (called the competence standards or SK) and the minimum competences for the topics to be acquired by the students (called the basic competences or KD). The standards of graduate competences (SKL) describe the minimum standards for qualification of students as a result of their learning within one year of study. The SKL are particularly used to develop items in school exams and national exams. Both SI and SKL only provide the minimum standards. It is recommended that every school should develop and go beyond the standards, based on the individual school's characteristics and potential resources.

Considering the analysis of the KTSP policy, this study aims at bringing together the curriculum representations of Goodlad et al. (1979) and Van den Akker (1998; 2003) and the curriculum emphases of Roberts (1982) in order to understand the characteristics of the chemistry curriculum in the context of *madrasah*. To come to this understanding, this study addresses the following research question:

> *What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and curriculum representations?*

2.4 Method

This study was conducted from late 2008 to early 2009, implying that *madrasah* can be expected to have implemented the KTSP policy which was established in 2006. It was carried out within the domain of chemistry education of grade 11 of senior secondary *madrasah*. Science (i.e. chemistry, biology, and physics) is taught in *madrasah* from senior secondary level (grade 10). In grade 11, students are required to choose one of the programs offered by the *madrasah*, namely, science, social science, and language. Particularly for the science program, students of grade 11 will be taught more advanced science than in grade 10. In grade 12, these students will spend most of their time preparing for the national examination which is decisive for their graduation and for continuation of their studies in tertiary education. Understanding science in grade 11, therefore, is considered very important. Students of grade 11 who cannot manage to understand science will likely face difficulties in developing their understanding of science in grade 12. This will influence their performance in the national exam. Considering the importance of grade 11, this grade was chosen as the domain of this study.

This study uses a "concurrent procedure" of mixed methods of research in which quantitative and qualitative data are gathered in order to gain a comprehensive analysis of the problem (Creswell & Clark, 2007). To answer the research question about the curriculum representations and emphases, multiple stakeholders and sources will be involved in the data gathering. The concurrent procedure of mixed methods is considered to be appropriate to "confirm and cross-validate corroborate findings within a single study" (Creswell & Clark, 2007, p. 248).

2.4.1 Participants
Participants were chosen from eighteen *madrasah* (six public and twelve private *madrasah*) that had a science program from all 35 *madrasah* in two districts, Kota Cirebon and Kabupaten Cirebon, in the province of West Java, Indonesia. Eighteen chemistry teachers who taught grade-11 students, one from each *madrasah*, participated in this study; they are indicated as TCHR-1 to TCHR-18. Their students also participated in this study, consisting in total of 249 male students and 336 female students, most of them 16 or 17 years of age.

2.4.2 Data Collection
Data were collected from different sources: documents, semi-structured interviews with teachers and students, observations of classes and results of exams. Depending on the purpose of the information these sources were used to understand each of the curriculum representations and emphases. For information regarding the Ideal and Formal Curriculum, data from the curriculum guideline were used as these were established by the BSNP. Only content related to chemistry education was selected.

Particularly the section in the guideline about the objectives of chemistry education was used to analyze the Ideal Curriculum. The Formal Curriculum was analyzed from the SKL (standards of graduate competence) and the SI (content standards) for chemistry, involving SK (competence standards) and KD (basic competences).

Data for the Perceived Curriculum were gathered from semi-structured interviews with the teachers, teachers' syllabi and lesson plans, and chemistry textbooks. Regarding the syllabi and lesson plans, data were collected from that part of the content that was supposed to be developed by the teachers. While in the syllabus the content (the topics for learning), learning activities, and indicators were examined, in the lesson plans only the content of core activities was analyzed. The semi-structured interviews were conducted with five teachers (two from public *madrasah*, i.e. TCHR-1 and TCHR-2, and three from private, i.e. TCHR-3, TCHR-4, and TCHR-5) and consisted of questions about their perceptions of the curriculum policy and their beliefs about teaching chemistry. Examples of questions in the interviews were: "What do you consider as the purpose of teaching chemistry? How do you develop your syllabi? Do you generally use the syllabi and lesson plan as directed by the curriculum guideline or books, or do you generally modify? How do you maximize student learning chemistry in your classroom? How do you decide what to teach and what not to teach?"

For the Operational Curriculum, data were gathered from observations of the teaching and learning process in four classrooms and two laboratories, and from teachers' interviews. For this curriculum representation, the focus of the observations was limited to the activities done by the teachers, such as, what teachers did (lecturing, grouping students, etc.), what message or content they conveyed to students and what questions they asked students. To gather richer information, semi-structured interviews were conducted with the teachers. Examples of questions were: "Do you generally complete all the activities and address all concepts in the syllabi you made? If no, why and approximately what percentage of the average planning do you generally complete?"

Data for the Experiential Curriculum were collected from observations of students' activities in the classrooms and semi-structured interviews with students. The observations were limited to what students did (discussion, listening, doing experiments). The students' interviews were aimed at gaining more information on certain issues related to their experience of learning in the classroom. For this purpose, interviews were conducted with six students, two from public and four from private *madrasah*. Examples of questions were: "How do you feel about chemistry learning in the classroom? Do teachers use a variety of instructional methods? How are experiments conducted? Do you have experience with laboratory activities? Are you satisfied with the chemistry activities? Why yes, or why not?"

To gain data for the Attained Curriculum, results of the national examination for chemistry subject were collected from all eighteen *madrasah*. In addition, items in the exam questions were collected to gain more understanding of the examination.

2.4.3 Data Analysis
The analysis of data was dependent upon the source of the data. The initial data analysis was conducted by the first author. Data from documents such as, the curriculum guideline, syllabi, lesson plans and textbooks were analyzed on the basis of the texts written in the documents. The texts were grouped according to Roberts' seven emphases, namely; Everyday Coping, Structure of Science, Science Technology and Decisions, Scientific Skill Development, Correct Explanations, Self as Explainer, and Solid Foundation (see the explanation in the previous section). Particularly for the books, we analyzed the material presented in each of the chapters or topics, and the questions for exercises presented in each of the chapters. In relation to the interviews, once an interview was finished, it was directly transcribed verbatim. The texts of the transcriptions were grouped, based on the questions as structured in the interview protocols. Having all answers grouped for each of the questions provided a complete description of emphases given in the participants' responses.

The results of the initial analysis were then discussed with the supervisors of this thesis in order to come to consensus on the formulation of the data in the matrix of the curriculum representations and curriculum emphases (Table 2.1). This discussion provided an opportunity to cross-check and to validate the data. In addition to the validation of the data, the data on the different curriculum representations were used to analyze (the coherency of) the curriculum emphases in a process of triangulation. In this process, data from different sources, i.e. documents, interviews, observations, were combined and analyzed concurrently to provide confirmed, cross-validated, and corroborated findings (Creswell & Clark, 2007).

2.5 Results
This section provides the major findings about six curriculum representations, namely, the Ideal, Formal, Perceived, Operational, Experiential, and Attained Curriculum. The overall presentation of the results is presented in Table 2.1. Within each of the representations, the results for the curriculum emphases are described.

2.5.1 The Ideal Curriculum
Since *madrasah* follow the national curriculum policy, the objectives of chemistry education of *madrasah* refer to the objectives of chemistry education as stated by the government (MONE). There are five objectives described in the book of content

standards established by the BSNP. Table 2.2 presents the five objectives and their references with respect to the seven emphases.

The analysis of these objectives showed that the objectives cover most of the emphases of Roberts where one objective could imply more than one emphasis (see Table 2.2). The objective of the first article of the content standards stresses the orientation of praising One God and gives a religious orientation, which is not included in Roberts' emphases. Since this orientation appears in the first article, this stresses its importance.

Table 2.2 *Categorization of the objectives of chemistry education, related to Roberts' emphases*

The objectives of the chemistry curriculum of KTSP	Emphasis
Article 1. To create a positive attitude towards chemistry by understanding the organization and the beauty of nature, as well as praising the greatness of One God.	Religious Orientation*
Article 2. To cultivate scientific attitudes such as honesty, objectivity, openness, diligence, critical thinking, and cooperative work with others.	Structure of Science, Scientific Skill Development
Article 3. To gain experience in implementing scientific methods through experiments, in which students are assessing their hypotheses through setting instruments, obtaining, analyzing and summarizing data, and reporting the results of the experiments orally or in a written form	Structure of Science, Scientific Skill Development
Article 4. To develop awareness of the dangers and benefits of the application of chemistry for personal, community, and environmental purposes, and of the importance of managing and preserving the environment for the community.	Science Technology and Decisions
Article 5. To understand chemical concepts, principles, laws, and theories and their relation to everyday life and technology.	Correct Explanations (the first part of the statement), Everyday Coping

*Religious orientation is appropriate to describe the objectives of the Indonesian chemistry education in this study, however it is not included in the emphases of Roberts.

Table 2.2 shows that the Ideal Curriculum for chemistry of the Indonesian *madrasah* involves most of the emphases of Roberts, except Solid Foundation and Self as Explainer. Apart from the seven emphases of Roberts a new emphasis appeared, i.e. Religious Orientation. This emphasis describes the importance of God as the creator of nature.

Articles 2 and 3 were interpreted to have two emphases. These two articles indicate both the function of science towards its development (Structure of Science) and the process of the development (Scientific Skill Development). However, the first emphasis is less apparent than the second. Article 4 implies a direction towards the emphasis of Science, Technology and Decisions, however, it is not very explicit. Article 5 was interpreted to have two statements, leading to two emphases. The first part (understanding chemical concepts, principles, laws, and theories) stresses the objects of chemical knowledge (concepts, principles, laws, and theories), indicating the emphasis of Correct Explanations. The second part, their relations to everyday life and technology, indicates Everyday Coping. Therefore, we decided article 5 was related to two emphases.

2.5.2 The Formal Curriculum
The standards of graduate competences (SKL) for chemistry education are as follows. The student is required:

1. To be able to conduct an experiment, such as problem formulation, propose and verify a hypothesis, determine variables, collect and analyze data, conclude, and communicate the result.
2. To understand basic laws and their implementation, ways of calculating and measuring, chemical reactions related with kinetics, equilibrium, mass and energy conservation.
3. To understand types of acids and bases, solutions, colloids, electrolyte and non-electrolyte solutions including their related measurement and application.
4. To understand the concept of oxidation-reduction reactions and electrochemistry in the formation of electric energy, metal corrosion and electrolysis.
5. To understand molecular structures and organic reactions including benzene, lipids, carbohydrates, proteins and polymers, and their application in daily life.

Table 2.3 shows an example of SK (competence standards) and KD (basic competences), as part of SI (content standards) of chemistry education, for the first semester of grade 11.

In the data of the SKL and SI (SK and KD), three emphases were found: Correct Explanations, Scientific Skill Development and Everyday Coping (Table 2.1). Among the three, more weight appeared to be on Correct Explanations because knowledge of scientific concepts, laws, and theories is emphasized. Nothing in the SKL and SI indicated the emphasis on religious orientation, as described in the Ideal Curriculum, nor did the SKL and SI indicate other emphases.

Table 2.1 shows the emphases of the Formal Curriculum. Comparing the emphases as found in the Ideal and Formal Curriculum, it was concluded that there is a slippage from

the Ideal to the Formal Curriculum. Table 2.1 shows in what emphases this slippage occurred.

Table 2.3 *Examples of SK (competence standards) and KD (basic competences) of chemistry for grade 11 students*

Competence standards	Basic competences
Understanding atomic structures, periodic table, chemical bonding, molecular structures and properties of molecules	Explaining Bohr theory, quantum mechanics
	Explaining theory of electron pairs and hybridizing
	Explaining inter-molecule interaction
Understanding energy, entropy, thermo chemistry	Describing energy, entropy, thermo chemistry
Understanding chemical kinetics, reaction mechanisms, reaction rate and their application in daily life and industrial settings	Describing reaction rate and factors influencing it
	Understanding chemical reaction order
	Understanding chemical equilibrium by doing experiments
	Identifying quantitative relations between reactants and products
	Application of the concepts in daily life settings

2.5.3 The Perceived Curriculum

The Perceived Curriculum was analyzed from the teachers' syllabi and lesson plans, from textbooks, and through interviews with teachers. Regarding the syllabi, it was found that the content of the syllabi had a tendency to maintain the SK and KD of the Formal Curriculum. However, throughout the content of the syllabi, it was found that the emphasis was more on Correct Explanations. Figure 2.1 gives examples of the syllabi which were analyzed.

In relation to the lesson plans, it was found that most of the core activities mentioned in the lesson plans were inviting students to discuss and study the concepts, laws, and theories. Such activities were stated as, for instance, "Discussing how to configure the electrons of the elements and to determine the electron valence", "Studying the trend in the atomic radius, the ionization energy, the electron affinity, and the electro negativity of elements in the periodic table" (The lesson plan of teacher DD). This implies that the lesson plans emphasized Correct Explanations and reduced at least the other two emphases (i.e. Scientific Skill Development and Everyday Coping) found in the Formal Curriculum.

Interviews with teachers provided a further understanding of the Perceived Curriculum. Responding to the question: "How do you develop your syllabi and lesson plans", for instance, all teachers said that their syllabi and lesson plans were "copied and pasted" from examples given in the curriculum guideline or in the textbooks (one out of three textbooks was found to have provided examples for the syllabi) and from their colleagues. However, they said that minor changes have been made, including the name of the *madrasah*, the date the topics were planned to be taught, and resources used. Interviews also revealed that the syllabi and lesson plans had to be provided mainly for the purpose of administrative matters and teachers' portfolios.

Apart from this administrative reasoning, the interviews revealed at least three reasons underpinning why the teachers developed their syllabi and lesson plans in this way. The three reasons were; insufficient knowledge, lack of support to develop the syllabi and lesson plans, and examinations. With respect to insufficient knowledge, at least three teachers had never received any training in how to develop syllabi and lesson plans. The two teachers, who had received training, explained that even though they had some understanding of the syllabi and lesson plans, they did not considerably modify or adjust the given examples of syllabi and lesson plans. According to all the teachers in the interviews, the explanation for this was insufficient or no support with respect to teaching materials and carrying out experimental work. However, they understood that the new curriculum policy expected them to develop their own syllabi and lesson plans contextually and to provide students with wider opportunities to enhance their competences.

> "*The new curriculum asked too much of us, especially in dealing with practicum and other student-centered approaches. As we do not have labs and books are very limited for students, how are we able to create the ideal syllabi and lesson plans if such support is lacking?*" (TCHR-2)

Regarding the textbooks, it was found that the content of all textbooks, as found in their tables of contents, followed exactly the sequence of the topics in the guideline (Figure 2.1). For example, considering the basic competence (KD) of "Understanding the atomic theory of Bohr and quantum mechanics", the learning topics were "Atomic theory of Bohr and quantum mechanics" and "Quantum numbers and orbital shapes". Accordingly the chapter of the textbook was titled "Atomic structure, periodical system, and chemical bonding" (Permana, 2007). Further analysis of the textbooks showed that there were attempts to integrate concepts, laws, and theories with context, such as providing pictures related to the concepts, laws or theories (calorimeter, foods containing fats, rusted cars, detergents, cosmetics, etc.), providing triggering questions (asking for examples of endothermic and exothermic reactions in daily life, finding out a fermentation process and determining the chemical reaction in it, etc.). In general, the content of the

School name : MAN X (Public *madrasah* of X)
Subject : Chemistry
Grade/Semester : XI/1
Competence standard : 1. Understanding atomic structure to predict the periodical properties of elements, molecular structure, and properties of compound **[solid foundation]**
Time allocation : 16 hours (2 hours for daily test)

Basic competence (KD)	Learning topics	Learning activities	Indicators	Assessment	Time allocation	Resource/learning materials
1.1 Understanding atomic theory of Bohr and quantum mechanics *[solid foundation]*	• Atomic theory of Bohr and quantum mechanics *[solid foundation]* • Quantum numbers and orbital shapes *[solid foundation]*	• Study about quantum theory, uncertainty principles and wave mechanics in group discussion *[solid foundation]* • Determining quantum number and orbital shapes of s, p, d and f in group discussion *[solid foundation]*	• Explaining the atomic theory of quantum mechanics *[solid foundation]* • Determining quantum number (possibility of electron states) • Drawing orbital shapes • Explaining orbital level and sub level and its relation to quantum numbers *[solid foundation]*	• Mode of assignment Individual work Quiz Daily test • Form of instrument Written test	4 hours	• Resources Chemistry textbooks Internet • Materials Workbooks, presentations materials LCD, laptop

*1 hour time allocation indicates 45 minutes of teaching time.

Figure 2.1 Example of a syllabus

books indicated that the intention of the writers was to provide content in accordance with the SK and KD of the Formal Curriculum.

All teachers indicated that the examination was another reason that influenced the development of their syllabi and lesson plans. At least two teachers explained that the examination given by MORA at the province level was held every semester. Teachers had to finish covering certain KD (basic competences), as referred in the curriculum guideline, in order for their students to be able to succeed in the exam. The teachers were hindered in their attempts to modify and develop their syllabi and lesson plans, because they felt that the KD needed to be finished at a certain moment as planned. Even though the teachers were informed by the principals not to bother about the exam, the principals were very concerned about the results of the exam. In order to correspond to this situation, the teachers kept to the examples of syllabi and lesson plans provided in the curriculum guideline.

> "*We were not supposed to be bothered by the exam but it bothers our principal so much since the results of the exam show the students' performance.*" *(TCHR-1)*

Considering these results, it was concluded that in the Perceived Curriculum more weight has been given to Correct Explanations and little emphasis given to Everyday Coping. This indicates that the emphases of the Perceived Curriculum have been reduced from those in the Formal Curriculum, noting that only one clear emphasis was found in the Perceived Curriculum. This shows more slippage of the curriculum emphases from the Ideal Curriculum to the Perceived Curriculum (Table 2.1).

2.5.4 The Operational Curriculum

The observations of teaching and learning activities in four classes showed that all teachers started their lessons by asking the students whether they understood the topics of the previous lesson. The teachers often went back to the topic of the previous lesson to ensure that students understood the previous topic. After that, the teachers started to convey the topic intended for that lesson. The teachers used most of the teaching time for explaining the topic. During the lesson, they asked the students whether they understood what had been taught. The students were also asked, individually or in groups, to solve problems posed by the teachers related to the topic, such as calculating moles, determining orbitals, balancing reactions, etc. At the end of the lesson, most often the teachers gave the students home work related to the topic of the meeting and asked the students to learn the topic of the next lesson from their workbooks. The observations of these teaching and learning activities indicated also the emphasis of Solid Foundation, noting that certain concepts were taught as preparation for students to understand other concepts. Regarding the teaching of the concepts, this Operational Curriculum indicated mainly an emphasis on Correct Explanations.

With respect to the laboratory activities, it was observed that most of the *madrasah* (15 out of 18) never conducted laboratory activities in the semester. Two *madrasah* had laboratory activities twice in a semester and one *madrasah* had them three times. Based on the observations of the activities in laboratories of two *madrasah*, it was found that students were placed in groups of six to eight students, and they were given papers with the instructions for the experiments to be conducted. They work in groups due to limited availability of substances and chemical equipments in the labs. In general, the teachers initially introduced the goal of the experiments and asked the students to follow the guidelines provided for the experiments in order to determine the results. Observing the work within the groups, it was found that one or two students of the group were working, while the other students were chatting or doing something else. The teachers hardly managed the activities but talked to the students while they were working. The results of the experiments were then presented by each of the groups and discussed with students. Prior to closing the activities, the teachers concluded the results of the experiments and asked the students to study the topic of the activities further at home. From the above activities, the use of guided experiments implied that the activities focused rather on the results of the experiments than on the development of scientific skills of the students. Therefore, while the emphasis of Scientific Skill Development was less indicated, Correct Explanations dominated the lab activities.

In the teachers' interviews, their responses in relation to the teaching activities were relatively uniform and related to students' capability to acquire knowledge and the time required for teaching. At least two teachers in the interviews explained that their students had insufficient capability to acquire knowledge by themselves and thus more attention was given to lecturing, to have them to understand the topic. These teachers considered that it was not favorable for developing students' understanding of the concepts to carry out experiments in the labs or to apply other student-centered methods of teaching. One teacher said that the students might like doing experiments but that did not mean that they understood the concepts better. Because the students needed attention to understand a topic, this teacher said that more time was needed. Another teacher argued that the experiments or student-centered teaching most often required more time which was difficult to manage. Therefore, lecturing was preferred by all the teachers in the interviews and the topics of the lecturing were found considerably consistent with their lesson plans.

Based on the above description on the Operational Curriculum, the emphasis of Scientific Skill Development was found in very few instances and in certain public *madrasah*. Thus, Scientific Skill Development was not considered an emphasis in this curriculum representation. A new emphasis of Solid Foundation appeared. However, more weight was found on Correct Explanations. This implies that in the Perceived

Curriculum, while the slippage was maintained, the emphases have changed compared to the previous curriculum representation (Table 2.1).

2.5.5 The Experiential Curriculum

Observing the teaching and learning activities in the classroom, it was found that students' activities were mainly listening to the teachers. For those who had textbooks, once in a while they looked at the books and thus confirmed what had been taught. Some students in the back seats in one of the lessons observed were found to be having their own discussions and not paying attention to teachers. In another classroom, it was observed that students who were sitting at the two rows in the center were more active and giving more attention to the teacher than the students in the other rows. In general, the students were mainly passive and gave reactions only when they were asked by the teachers.

All students in the interviews reported having experienced chemistry like the other subjects, as being taught through lecturing. At least two students, however, said that the classroom became active during discussions in which issues were related to a real-life context; e.g. the role of the basis of soap, the role of gold in gold-tint spray. However, they explained that such discussions rarely occurred. None of the students was aware of the new curriculum policy that expected them to have more contextual and active learning experiences. However, at least two students said that active learning, which was defined by them as doing experiments, was never conducted and had not been since they were in the lower grade while the other two students had experienced this only once in a year. Besides talking about their experiences during classroom activities, students described their intentions of being in the chemistry class. They said in the interviews that learning chemistry was important as part of requirements of the science program of grade 11. They further explained that as students of the science program, they had more open opportunities to choose any field of studies for further education or to get jobs directly.

The above explanation confirmed what might be expected from the Operational Curriculum, noting that the Experiential Curriculum hardly differed from the Operational Curriculum. This implied that the two emphases, Correct Explanations and Everyday Coping, were prevailing in the Experiential Curriculum, where Correct Explanations seemed to remain more dominant. It was found that the emphasis of Solid Foundation played a minor role in this curriculum representation, noting that some students had the intention of learning more about chemistry in the future. Therefore, only two obvious emphases appeared in this curriculum representation (Table 2.1).

2.5.6 The Attained Curriculum

In the results of the 2008 national examination of *madrasah* students, it was found that on average, the students scored 7.96 out of 10 for chemistry. This score was considered

satisfactory since the minimum score for chemistry to be achieved as recommended by the government is 5.5 out of 10. Further analysis of the items tested in the exam showed that most questions (around 70% or 27-30 out of 40) relied on memorization, knowledge recognition, and calculation including calculations from experimental data. Examples of such items are:

3. Where is the position of the element of Y 35.5 in the periodic table?
    A. group IV B, period 5
    B. group VIII B, period 4
    C. group IV A, period 3
    D. group VII A, period 3
    E. group VIII A, period 3

11. The pH of a solution containing 6 gram CH3COOH (Mr = 60) and 0.1 mol CH3COONa (Ka 1.0×10^{-5}) is…..
    A. 1   B. 5   C. 7   D. 9   E. 12

The remaining items (30%) required students to demonstrate understanding of the concepts and the contextual applications of the concepts. Two examples of such items are given:

15. Below are some daily examples that relate to the properties of colloids:
    1. Blood transfusion
    2. Mountain fog
    3. River delta process
    4. Sugar whitening process
    5. The work of diarrhea medicine
    The properties of the coagulation of colloids can be shown in …
    A. 1   B. 2   C. 3   D. 4   E. 5

40. Sulfuric acid can be produced with the following reactions:

$S (s) + O_2 (g) \longrightarrow SO_2 (g)$

$SO_2 (g) + O_2 (g) \underset{450^{o}C}{\overset{V_2O_5}{\rightleftharpoons}} 2SO_3 (g)$
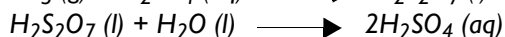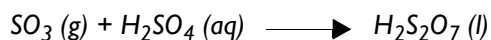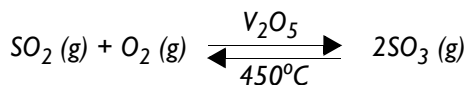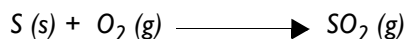
$SO_3 (g) + H_2SO_4 (aq) \longrightarrow H_2S_2O_7 (l)$
$H_2S_2O_7 (l) + H_2O (l) \longrightarrow 2H_2SO_4 (aq)$
The results of such a reaction can be used for:
A. antiseptics

B. bleaches
C. materials for electric cables
D. substances for ZA fertilizer
E. plane frame structure

According to the results of the national examinations and further analysis of the items, it was found that the examination put predominant emphasis on Correct Explanations while there were attempts to involve contextual cases (Everyday Coping) and interpretation of a lab result (Scientific Skill Development). This finding implies that in the Attained Curriculum, three emphases were given; Correct Explanations, Everyday Coping, and Scientific Skill Development. These emphases appeared to be consistent with the Formal Curriculum. The last column in Table 2.1 gives an overview of the slippage across the curriculum representations.

2.6 Discussion and Conclusion

This study aims at characterizing the chemistry education of secondary school in the context of *madrasah* in Indonesia. For this characterization, this study combines two theoretical frameworks; the curriculum representations of Goodlad (Goodlad et al., 1979) and Van den Akker (1998; 2003), and the curriculum emphases of Roberts (1982). The research question addressed was:

> *What are the characteristics of Indonesian upper secondary chemistry education in* madrasah *in terms of curriculum emphases and curriculum representations?*

The findings show that secondary chemistry education in Indonesian *madrasah* is characterized by having inconsistent curriculum emphases in the curriculum representations and showing a slippage in curriculum development. The Ideal Curriculum, for example, covered the majority of the emphases of Roberts, although the emphases Solid Foundations and Self as Explainer were not included. In addition, a new emphasis, Religious Orientation, was found and added to the original seven in Roberts' typology of emphases. Among all emphases found in the Ideal Curriculum representation, Correct Explanations and Everyday Coping remained in the other curriculum representations in which weight was put on Correct Explanations. Particularly in the Operational and Experiential Curriculum, one other emphasis was indicated: Solid Foundation. It was concluded that there was a large slippage in the curriculum emphases between the curriculum representations. The slippage appeared in three curriculum representations that were developed by the government (MONE); the Ideal Curriculum involved the overall objectives of the chemistry education, the Formal Curriculum was the curriculum guideline established by BSNP, and also the Attained Curriculum involving the national examination was developed by the government. An

overview of the extent of this slippage in the different curriculum representations is given in Table 2.1.

Considering the process and the results of this study, two aspects were found to contribute to a broader understanding, particularly with respect to the science and chemistry curriculum. These aspects are the frameworks used in this study to characterize the curriculum and the religious orientation in the science education.

The combination of the perspective of curriculum representations and that of curriculum emphases was found to be beneficial in mapping thoroughly the characteristics of a curriculum through understanding the emphases in each of the curriculum representations. These two perspectives have been widely used in the field of curriculum analysis. However, often they are not used in combination, but only one perspective is used without the other. Wei (2006), for instance, examined the change in curriculum emphases in the Chinese secondary science textbooks. However, this study only involved the Perceived Curriculum. Van Driel et al. (2008) studied the curriculum emphases from the perspective of Dutch science teachers, which also only involved the Perceived Curriculum. Roberts (1995) himself used the seven emphases to examine the purpose of learning in the Ideal and Formal Curriculum of Canadian high school science. Analyzing only one or two curriculum representations may provide a direct contribution to teaching practices; however, such a contribution does not involve the whole of the curriculum objectives. Using a complete set of perspectives provides an analysis of the coherency in the development of the curriculum. Comparing all curriculum representations and emphases can determine the problems more clearly, e.g. slippage in the curriculum development from what was intended by the government (policy makers) and attained by students. Such understanding of the problems may help all educational actors, from the policy makers to the teachers and researchers, to contribute to efforts to improve education.

Religious Orientation was found only in the Ideal Curriculum representation and it is hardly developed in the other curriculum representations. This situation is similar to other countries where believing in God is part of the Constitution, regardless of the variety of cultures and ethnic background of the citizens, such as in Malaysia and Egypt. One explanation for this can be that the religious orientation involves the attitude of teaching and learning rather than integration in the content of science. The integration of this orientation in the science content, as Mansour described in a study in Egypt, is highly dependent on the personal religious beliefs of teachers about science, and teachers' willingness to integrate their beliefs in the science content (Mansour, 2008). Mansour found that controversial issues, such as cloning and the theory of evolution, dominate the discussion among teachers and the way these issues are taught. For example, teachers present Qur'anic verses regarding these issues or avoid teaching

detailed information about these issues from the Western perspectives. It is therefore possible that the religious orientation exists in Perceived and Operational Curriculum representations where teachers play important roles. Another example of such orientation might be found in the Confucian culture. As reported in many studies in the field of science education, this culture influences the attitude of teaching and learning rather than the content of science (Gao, 1998; Nguyen et al., 2006). The perspective of the teachers as a model of good conduct and learning, for instance, determines the role of teachers as the source of knowledge and thus worthy of respect (Gao, 1998). As a consequence of this, teaching is teacher-centered rather than student-centered. A cultural orientation is reported to influence not only the attitude of teaching and learning but in some cases also the content of science. For example, aboriginal culture in Canada has its own way to describe and explain nature that often is different from the explanation of modern science. This makes modern science "a foreign, forbidding world" (Aikenhead, 2002, p. 290) to most of the aboriginal students. Nature strongly influences the way of life of the aboriginal people. Thus, teaching modern science needs to take the aboriginal concepts of science into serious consideration if students are expected to accept the knowledge of modern science (Aikenhead, 1997; 2002). Considerations of how to adjust science curricula needs a specific Cultural Emphasis which is suitable for aboriginal students, not only in the Ideal Curriculum, but also throughout the other curriculum representations.

This study of characterizing the chemistry curriculum of *madrasah* is particularly important for the context of *madrasah* with the complications in their status and their difficulties in applying the curriculum policy. Despite these complications, the nature of the problems in the *madrasah* education has been found to be relatively similar to other cases where a decentralized system is implemented, such as the problems of teachers in developing their own syllabi or "the dynamic of content" in British Columbia, Canada (Karlsen, 2000, p. 525). Since the initiative for the decentralized educational system came from the central authorities, decentralization led to a new type of central regulation that can be considered as a more standardized content of the Operational Curriculum (Cohen & Spillane, 1992). Within such decentralized educational systems, characterizing the curriculum, as in this study, provides a better understanding of the coherency in the curriculum development from Ideal to Attained Curriculum. While the degree of the problems may vary among the countries, the similarity in the decentralization policy is expected to enable that from the current study lessons can be learned to be applied to other countries.

The slippage of the curriculum that is found in this study asks for a further study on how to improve the educational practice, in either all or some curriculum representations. With respect to the current situation of *madrasah* in Indonesia, serious measures are

required to support the chemistry teachers. Prior to taking action, an in-depth analysis is needed to understand the conditions in which the teachers give shape to their teaching practice, the Operational Curriculum, in the situation of the newly established decentralization policy for education.

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CHAPTER 1 Introduction and overview of the research

Main Research Question In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?

Sub-Research Question 1 What are the characteristics of chemistry education and the conditions during the curriculum change?

CHAPTER 2 Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah* **Research Question** What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	**CHAPTER 3** The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia **Research Question** What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?

Sub-Research Question 2 In what way can professional development activities of chemistry *madrasah* teachers be facilitated?

CHAPTER 4 Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah* **Research Questions** 1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers? 2. What indicators of favorable conditions are formulated from the actors' shared agreements?

CHAPTER 5 Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah* **Research Question** To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?

CHAPTER 6 Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system **Research Questions** 1. What changes did the teachers perceive after their professional development activities? 2. What PD activities did the teachers perceive to be meaningful for their practices? 3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?

CHAPTER 7 Conclusions and Reflection

Chapter 3

The Operational Curriculum of *madrasah* chemistry teachers

An analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia

Abstract

In order to determine the extent to which teachers comply with the goals of a curriculum change, it is essential to analyze the teachers' instructional process in the classroom. The aim of this study is to examine the conditions teachers have to work in when they give shape to a new Operational Curriculum during a curriculum change in a decentralized educational system. To analyze these conditions, the model of Infrastructure, Authority and Consensus (the IAC model) is used. This study was conducted in the setting of chemistry education in *madrasah* (Islamic schools) in Indonesia. It was found that the current conditions are rather unfavorable for the teachers to develop their own Operational Curriculum. The low level of Authority of the educational actors in the *madrasah* education led to a low level of Consensus of the actors in providing the necessary Infrastructure for teachers' tasks. As a consequence of these conditions the teachers lack opportunities to conduct professional development activities. The IAC model stresses the importance of the condition Consensus, which in this study appeared to be an important factor. Consensus among all the actors, including policy makers and principals, is necessary to allow teachers to act in accordance with the intentions of the new policy. Therefore, facilitating teachers' professional development activities should become the concern of further study. It is suggested that this facilitation should consider giving ownership to all educational actors to participate in providing favorable conditions for the teachers.

3.1 Introduction

In the context of curriculum change, it is essential to evaluate teachers' instructional process in the classroom, the Operational Curriculum, in order to determine to what extent the teachers act coherently with the goals of the change (Fullan, 2007). Such coherency is particularly relevant in a decentralized educational system where educational matters have been transferred to local authorities and to schools, i.e. a school-based curriculum policy. In such a school-based curriculum policy, teachers have more autonomy to work on their educational practices (Cohen, 2004). When implementing this curriculum change, the work of the teachers is influenced by many conditions, such as the availability of support (Marsh, 1992) and the commitment of local authorities (Marsh, Day, Hannay, & McCutcheon, 1990; Prideaux, 1993). Therefore, it is important to analyze the conditions in which teachers give shape to the curriculum change.

A policy of decentralization of education has been recently applied in Indonesia, where decision making has been transferred from the Ministry of National Education (MONE) to the schools. Consequently, a school-based curriculum (*Kurikulum Tingkat Satuan Pendidikan* - KTSP) policy has been issued by MONE, which expects all schools, including the Islamic schools (*madrasah*) to implement this policy. As a complication, *madrasah* schools are regulated under the Ministry of Religious Affairs (MORA) which applies a central management system. As a result, the management of the *madrasah* schools is still centrally governed. However, as part of the national educational system, these *madrasah* need to follow the decentralized KTSP policy. This situation influences the curriculum development of *madrasah* schools, resulting in incongruence, i.e. slippage, between the initial vision, the objectives of education issued by the government (MONE), the Operational Curriculum, and the (affective and cognitive) outcomes of *madrasah* students (Chapter 2). Therefore, it is specifically relevant to examine the conditions *madrasah* teachers work in when they give shape to their Operational Curriculum, because teachers play an important role in the innovation process between the government's goals and the students' outcomes.

Many studies have emphasized the importance of favorable conditions when teachers give shape to the Operational Curriculum (Fullan, 2007; Rogan & Grayson, 2003). However, few studies have been conducted that analyze and understand the influence of the different conditions within the national and regional educational system on the teachers. Most of the studies on curriculum change deal with the development of classroom instructions, i.e. lesson plans and syllabi (the Perceived Curriculum), the execution of these instructions in the classrooms (the Operational Curriculum) (Farrell & Meyer, 1997), and the impact of the Operational Curriculum on students'

performances (Brady, 1987; Sussman, 1996). It is therefore relevant to understand the full set of favorable and unfavorable conditions within the entire educational system when teachers give shape to the Operational Curriculum during curriculum change in order to determine what measures might improve unfavorable conditions.

Many frameworks have been used to analyze the conditions teachers work in during the process of educational change (Fullan, 2007; Rogan & Grayson, 2003). These frameworks ensure the importance of assessing at least two important factors, i.e. the authority of the educational actors who are involved in the change, and the availability of infrastructure. However, most of the frameworks do not clearly involve the extent of consensus among authorities when providing the necessary infrastructure. Consensus has been found to be an essential element in any educational change, particularly when many actors are involved (Hubbard, Stein, & Menhan, 2006).

Based on these considerations, this study will use a framework which integrates an analysis of the conditions of Infrastructure, Authority and Consensus to provide a full understanding of these conditions for educational change. This framework, introduced by Havelock and Huberman (1978), connects the conditions; Infrastructure, Authority and Consensus (the IAC model). This study has been conducted in the case of the *madrasah* schools in Indonesia to analyze the conditions teachers work in when they give shape to the Operational Curriculum within a new school-based curriculum policy in a decentralized educational system. It is important to understand these conditions, among other reasons, to determine which measures facilitate teachers to improve their educational practice during the process of curriculum change and to contribute to the reduction of slippage during curriculum development (as described in Chapter 2).

3.2 Theoretical Framework

3.2.1 School-based curriculum policy

In the analysis of the development of the curriculum, six curriculum representations (Goodlad, Klein, & Thye, 1979; Van den Akker, 2003) are used to distinguish between the vision, the Formal Curriculum design, teachers' instructional processes, and the students' affective and cognitive outcomes. These curriculum representations enable a better understanding of curriculum development (see Chapter 2). The six curriculum representations are:
1. The Ideal Curriculum, describing the goals of the curriculum,
2. The Formal Curriculum, describing the written elaboration of the goals,
3. The Perceived Curriculum, describing the interpretation by teachers of the previous representations,
4. The Operational Curriculum, describing the instructional process in the classroom,

5. The Experiential Curriculum, describing students' experiences with the instructional processes, and
6. The Attained Curriculum, describing the outcomes of students' learning processes.

In a school-based curriculum policy, the Ideal Curriculum offers some degree of autonomy for the teachers in the development of the instructional process (related to the Operational Curriculum). In a school-based policy which can to a certain extent be based on the school context, students' needs, and the school's own objectives of education have a strong influence on the Operational Curriculum. Skilbeck (1984) defines the school-based curriculum as "the planning, design, implementation and evaluation of students' learning by the educational institution of which those students are members" (p.2). Many studies have acknowledged the important roles of the teacher in the development of the Operational Curriculum within a school-based curriculum policy (Chun, 1999; Gopinathan & Deng, 2006; Howells, 2003; Jennings, 1993; Keiny, 1993; Punch & Bayona, 1990; Shawer, 2010; Shoham, 1995). These studies report that all actors in the educational situation within which teachers work, such as principals and local authorities, need to provide favorable conditions to allow teachers to act in accordance with the Ideal Curriculum.

At least four aspects are central in relation to the autonomy of teachers.
1. Curriculum policy that involves the Ideal and Formal Curriculum (Gopinathan & Deng, 2006; Stevenson & Baker, 1991) and includes the policy on examination (Kwakman, 2003). This aspect determines the degree of autonomy of teachers, implying that the more government controls the curriculum, the lower the autonomy of the teachers will be.
2. Facilities, including books and laboratories (Garret, 1990; Law, 2011; Marsh, 1992; Punch & Bayona, 1990). The facilities determine the success of the Operational Curriculum. Insufficient facilities may lead to unfavorable instructional practices of teachers.
3. Financial support, including teachers' incentives (Garret, 1990; Marsh, 1992). Particularly for the incentives of teachers, Garret reported that insufficient incentives lead to teachers being discouraged from working on the development of their Operational Curriculum (1990).
4. Monitoring and evaluation of the implementation (Morgado & Sousa, 2010). Skilbeck (2005) suggests that in a cyclical process of planning, enacting and evaluation, the monitoring and evaluation of the Operational Curriculum will lead to improvement of the Operational Curriculum.

The roles of educational actors at different levels must be clearly defined in the decentralized school-based curriculum policy. Stevenson and Barker (1991), for instance,

mention that the government at the national level defines the Ideal and Formal Curriculum, which are used by teachers to develop the Operational Curriculum. If the government gives teachers autonomy, the Ideal and Formal Curriculum should allow enough room and limited restrictions for teachers to give shape to the Operational Curriculum. The principal is the educational actor who has a direct effect on the Operational Curriculum (Marsh, 1992). The school policy established by the principal influences the environment of teachers' educational work and the Operational Curriculum. Teachers are very important actors, particularly regarding their expertise, understanding and skills concerning the curriculum policy and their knowledge on subject content and pedagogy related to the Ideal and Formal Curriculum. Marsh (1992), Gopinathan and Deng (2006), and Garret (1990) found that teachers who lack this expertise, this understanding, and these skills are reluctant to be involved in curriculum development, and therefore do not take up their roles in the Perceived and Operational Curriculum. Considering the different roles of the educational actors, a clear description of responsibility of the role of each actor may help to ensure the understanding and the commitments of the actors to achieve the goals of the curriculum change.

To summarize, in a school-based curriculum policy, particularly within a decentralized educational system, teachers' autonomy and the role of the different educational actors are important aspects. The autonomy of the teachers is dependent on all educational actors. Therefore, in order to implement this policy successfully, both teachers' autonomy and the roles of the educational actors should be clearly determined, particularly at the level of Operational Curriculum.

3.2.2 The model of Infrastructure, Authority and Consensus (IAC) for educational change

In a process of educational change certain conditions are related to meeting the objectives (Cohen & Spillane, 1992; Fullan, 2007; Simon, 1992). To analyze the conditions pertaining during the change, the model of conditions of Infrastructure, Authority, and Consensus (IAC) will be used in this study. This model was introduced by Havelock and Huberman (1978) after analyzing the implementation of educational changes in many developing countries. For the purpose of this study, the IAC model is elaborated with indicators for each of the conditions, based on the nature of the change that applies to the school-based curriculum policy in a decentralized educational system. Details of each of the conditions and indicators are given below.

Infrastructure (*I*) is a "procedural configuration" (Havelock & Huberman, 1978, p. 76) that refers to "the efficiency of the entire problem-solving mechanism, the manner in which the system processes its needs, defines the problem in operational terms, elaborates solutions for the problem and, in particular, implements those solutions" (p. 76).

Infrastructure (I) is indicated by the availability of either material or non-material support that influences the teachers to develop and execute their curriculum, i.e., the Perceived and Operational Curriculum respectively. Included in the material support is the availability of facilities (Havelock & Huberman, 1978) which may include textbooks, teaching materials and laboratory equipment. The provision of time is also considered an important facility for teachers (Havelock & Huberman, 1978; Marsh, 1992). Infrastructure also includes resources (Havelock & Huberman, 1978), such as financial support and experts (Marsh, 1992). Apart from this material support, non-material support can be identified from policies established by the government. Rado (2010) indicates that policies about teachers, such as teachers' qualifications standards and training, about the system of educational evaluation, and about the Formal Curriculum (curriculum guideline) have a direct influence on teachers' practices. Within such policies, support for teachers with respect to their professional development is particularly important. Many studies have reported that the professional development of teachers in a school-based curriculum setting is essential for a successful implementation of the initial vision within the Operational Curriculum (Gopinathan & Deng, 2006; Punch & Bayona, 1990; Soon Nam, 2005). The availability of effective professional development becomes an important indicator for Infrastructure.

Authority (A) is determined by the "authority" or control that gives direction to the problem-solving cycle. Authority is the first element of an "optimal political condition" (Havelock & Huberman, 1978). A high level of Authority means "there are people (not always the same) who are making certain that a need is recognized, the problem treated, some solutions found and that there is follow-through in the course of implementation" (p. 76). In respect to this study, Authority implies the mechanism of control that ensures all educational actors involved to perform in line with the school-based curriculum change and the decentralized educational system. This is indicated by the clarity of roles, tasks and responsibilities of the educational actors. The actors at the national level, for example, the government, may establish policies to control educational actors at a lower level, such as the local or district authorities and the principals of schools. The principals are responsible for providing an environment which is supportive for the educational practice. As the key actors, teachers have a role in controlling their instructional practices for students' learning. Considering the different tasks each of the educational actors have, Authority is indicated by the extent to which the actors accomplish their tasks.

Consensus (C) is determined by agreement and commitment among the educational actors involved in the implementation of change. As a second element of "optimal political condition" (Havelock & Huberman, 1978), Consensus is signaled by the motivation and interest of every actor (Marsh, 1990). A high level of Consensus means

"people involved in a large-scale innovation […] agree with its objectives and with the way it is being carried out". For example, if actors are motivated and interested in a change, it is likely that serious measures will be initiated to make the change successful. Consensus is a key for an educational change, for it builds the responsibility, ownership, and commitment among the actors (Carver & Neuman, 1999; Havelock & Huberman, 1978; Marsh et al., 1990). With respect to the purpose of this study, Consensus is indicated by the degree of commitment of all educational actors to provide the needed Infrastructure and to the accomplishment of the actors' tasks.

The description of the conditions of Infrastructure, Authority, and Consensus in the IAC model provides the basis for analyzing the conditions for educational change in a comprehensive way. The indicators for each of the conditions are used to assess to what extent the conditions for the educational change are as favorable as intended.

3.3 Setting of the study and research question

This study was conducted within the setting of chemistry education in senior secondary *madrasah*. The senior secondary *madrasah*, as well as the senior secondary school, is relatively independent compared with elementary and junior secondary *madrasah*. This is because both elementary and junior secondary are defined as basic education and thus they receive considerable support for their development from the government. In addition, science teaching (i.e. chemistry, biology, and physics) starts at the first grade of senior secondary *madrasah* (grade 10). For *madrasah*, science is a particularly challenging subject considering their historical background of teaching only in the domain of Islamic studies, i.e. Arabic language, *Qur'anic* lessons (the history and interpretation of the Koran), rituals (*Ibadah*), and ethics (*Akhlak*). Chemistry was chosen as the domain of study in this study because of the expertise of the authors, and because chemistry is widely considered to be a complex subject (Gilbert, 2006). The complexity and dynamic development of chemistry has strong implications for the teaching of the subject (Gabel, 1999).

The challenge for *madrasah* to cope with science has increased since a decentralization policy was introduced to some ministries in 2004, including the Ministry of National Education (MONE) which has issued the school-based KTSP policy accordingly. With respect to MONE, this policy brings about the consequence that the educational system of Indonesia is also decentralized, indicating a transfer of responsibilities of educational matters from MONE to the local authorities and to the schools. However, unlike MONE, the Ministry of Religious Affairs (MORA) is not decentralized. The management of all matters under MORA, including *madrasah*, remained centralized.

The KTSP policy is a response to the decentralized educational system in Indonesia and was established together with the regulation of district autonomy in 2004. Within the new system, the government, i.e. the Ministry of National Education (MONE), has transferred educational matters to local authorities and to schools. Through the national body for educational standards (*Badan Standarisasi Nasional Pendidikan* - BSNP) MONE has established the Ideal and Formal Curriculum for KTSP in the form of a curriculum guideline. This guideline describes the objectives of education and the minimum standards of schools, and forms the starting point for the *madrasah* schools and their teachers for conducting the teaching and learning process. The standards for the content and competences that teachers should cover in their teaching and that students should attain at the end of their study are important and highly influence the Operational Curriculum. Besides, the guideline also covers some regulations as to how the schools, i.e. principals, should support teachers to implement the policy (the Operational Curriculum). Included in this regulation is a cyclical process to ensure that the Operational Curriculum of the KTSP policy is coherent with the Ideal and Formal Curriculum. This cyclical process, which contains pre-analysis, planning, developing, implementing and evaluating, is conducted based on the needs and the characteristics of the school.

Considering this setting, this study aims to analyze the conditions in which chemistry *madrasah* teachers give shape to the Operational Curriculum during the school-based KTSP policy in a decentralized educational system. In order to meet this aim, the framework for analysis should be synthesized with respect to the setting of this study. The synthesis provides for indicators for each of the conditions that are relevant to be examined in this study.

Table 3.1 *The IAC model of analysis used in this study including the indicators for each of the conditions*

Condition	Indicators
Infrastructure	1. Curriculum guideline
	2. Facilities (textbooks, teaching materials and working time)
	3. Financial incentives for teachers
	4. Evaluation of the Operational Curriculum
	5. Professional development of teachers
Authority	1. MORA at the national level
	2. MORA at the district level
	3. Principals
	4. Teachers
Consensus	1. On the provision of infrastructure and accomplishment of tasks of the actors

Infrastructure was found to have five indicators that, according to the KTSP policy, are important for teachers' involvement in the change of the Operational Curriculum: (1) the curriculum guideline; (2) the facilities, i.e., textbooks, teaching materials and working time; (3) teachers' incentives; (4) the cyclical process of the Operational Curriculum, particularly with respect to evaluation; and (5) the professional development of the teachers. *Authority* was found to include four indicators that involve four different groups of educational actors, namely, MORA at the national and at the district level, principals, and chemistry teachers. *Consensus* involves one indicator – the commitment of all actors on the provision of Infrastructure and on their tasks. Table 3.1 provides a matrix of the IAC model used to analyze the conditions for educational change in this study.

With respect to the aim of this study, i.e. to analyze the conditions teachers work in to give shape to the Operational Curriculum in a school-based KTSP policy in the decentralized educational system in Indonesia, the research question addressed in this chapter is:

> *What are the conditions for chemistry teachers of* madrasah *when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?*

3.4 Method

Considering the complexity of the situation for *madrasah* science education in Indonesia, a mixed-method research approach with triangulation was applied in this study. This method allows for a concurrent triangulation strategy implying the "concurrent, but separate, collection and analysis of qualitative and quantitative data so that the researcher may best understand the research problem" (Creswell & Clark, 2007, p. 64). This method should provide confirmed, cross-validated, and corroborated findings from different people and data sources.

3.4.1 Participants

The *madrasah* involved in this study were drawn from two sites, namely Cirebon district (Kabupaten) and Cirebon municipality (Kotamadya) in the Province of West Java, Indonesia. These sites were purposely chosen because of the great number of Islamic institutions that might influence the *madrasah*. Only *madrasah* that provide a science program were selected, yielding six public *madrasah* and twelve private *madrasah*. While public *madrasah* mainly receive their support from the government (in this case MORA), private *madrasah* are established and managed by non-profit foundations.

The participants of this study came from different groups of educational actors and were purposely chosen. With respect to the teachers, 18 chemistry teachers, one from each

madrasah, along with their respective principals, participated in this study. In addition, two officers of MORA took part in the study; one was the head of the division of curriculum of upper secondary *madrasah* from the Directorate of *Madrasah* Education of MORA at the national level and the other was the head of *Madrasah* Education from MORA at the district level.

3.4.2 Data Collection

Data were collected from September to December 2008 when the KTSP policy had been in operation for nearly two years. Data were gathered from questionnaires (quantitative), interviews, discussions, document analysis, and observations (qualitative). The qualitative data were used as primary sources of data in this study. Variation in data sources was chosen to provide in-depth and detailed information, and to allow for comparing one data source with others (triangulation) (Creswell & Clark, 2007).

The questionnaires involved questions about the educational background, conditions in *madrasah*, attitudes to the current curriculum, support given to chemistry teachers, and professional development of the teachers. These questionnaires were used to gather information on these issues from the teachers and the principals. Examples of questions are presented in Table 3.2.

Table 3.2 *Examples of items in the questionnaire*

Teachers' questionnaire				
How much control do you actually have at this madrasah *over the following areas in your classroom planning and teaching?*				
	No control	Minor control	Moderate control	Great deal of control
a. Selecting textbooks	☐	☐	☐	☐
b. Selecting other instructional materials	☐	☐	☐	☐
c. Selecting content, topics, and skills to be taught	☐	☐	☐	☐
d. Selecting teaching techniques	☐	☐	☐	☐
e. Evaluating and grading students	☐	☐	☐	☐
Have you participated in any professional development activities?				
☐ Yes ☐ No If *yes*, please mention:				
☐ Month ☐ Year				
☐ Month ☐ Year				
☐ Month ☐ Year				
Others, please mention…				

Principals' questionnaire					
Does this school provide teachers with time for professional development during regular contract hours					
☐ Yes ☐ No					
How much ACTUAL influence do you think each group or person has on decisions concerning the following activities?					
a. Setting performance standards for students of this school					
b. Establishing curriculum at this school					
c. Determining the content of in-service professional development programs for teachers of this school					
d. Evaluating teachers of this school					
e. Hiring new full-time teachers for this school					
f. Deciding how your school budget will be spent					
(each of the above activity will be given the below choices of answers)					
	No influence	Minor influence	Moderate influence	Major influence	Not applicable
1 Governing board	☐	☐	☐	☐	☐
2 Principal or school head	☐	☐	☐	☐	☐
3 Teachers	☐	☐	☐	☐	☐
4 Curriculum specialists	☐	☐	☐	☐	☐
5 Parent association	☐	☐	☐	☐	☐
6 College and university partners	☐	☐	☐	☐	☐

Concurrently with the questionnaire, semi-structured interviews were conducted with MORA officers, four teachers (two from public and indicated as TCHR-1, TCHR-2, and two from private, i.e. TCHR-3, and TCHR-4) and four principals (two from public *madrasah*, i.e. PRNCPL-1 and PRNCPL-2 and two from private *madrasah*, i.e. PRNCPL-3 and PRNCPL-4). These persons representing different groups of actors were chosen to provide more detailed information about the issues in the questionnaires. The questions in the interviews were structured similarly to those in the questionnaire except for the educational background. Each interview lasted for about 45 to 60 minutes and was structured in the same manner, starting with the introduction by the researcher on the purpose of the study, and the questions to be asked. All interviews were recorded and transcribed verbatim right after the interview. Examples of questions in the interviews are presented in Table 3.3.

Table 3.3 *Examples of interview protocols*

Teachers' interview
1. During the curriculum reform (KTSP), what changes have happened to you as teachers, to your students, and to the school in general? (*incentives, professional development, learning style, facilities, policy, students learning, school networking etc.*)
2. Do you generally use the syllabi and lesson plan as directed by the teacher's guide in the KTSP module or books or do you generally modify?   *If not modified*: Why do not you modify the syllabi and lesson plan? How do you connect the gap between what is prescribed in the teachers' guide and books and your current school conditions? If *modified*: How and why do you modify?
Principals' interview
1. During the curriculum reform (KTSP), what changes have happened to you as principal, to your students, and to your school in general? (*incentives, professional development, facilities, policy, students learning, school networking etc.*)
2. Has the school undertaken any new initiatives recently that seem likely to have an effect on science as a result of the change of curriculum? (*Probe for details on status of, changes in, and reasons for any initiatives*)
MORA officers' interview
1. During the curriculum reform (KTSP), what changes have happened to the policies of *madrasah*, in relation to science (the *madrasah*, the curriculum, the teachers etc.)
2. What support is given for the development of science teachers of *madrasah*? (*Probe for details on type of support, who gain the support, the regularity of the support etc.*)

Document analysis involved the following documents; the curriculum guidelines, the decree on national education, the decree on teachers, and the regulations on the function of MORA from the national to the district level with respect to *madrasah* education. Regarding the curriculum guidelines, data on two issues were collected; the objectives of chemistry education and the content standards that were used by teachers to develop their syllabi and lesson plans.

Observations were conducted in *madrasah* to examine the availability of facilities for teachers' instructional practices. The observations involved the availability of collections of books related to chemistry in the library, teaching materials, and facilities in the chemistry laboratory (Table 3.1). Such observations were needed to provide information additional to what has been reported by principals and teachers in relation to Infrastructure.

The last data source involved a discussion that was conducted after the data were gathered from the other sources. This discussion took place in two meetings with teachers and aimed to gain more information about what was concluded from the analysis of the data from the other sources. This discussion included a further understanding on certain issues that might not be clear from the other sources. The

discussion was recorded and notes were taken regarding important issues related to Infrastructure, i.e. the curriculum guideline, facilities, incentives, evaluation, and professional development of teachers (Table 3.1).

3.4.3 Data Analysis

This exploratory study aimed at characterizing the conditions of Infrastructure (I), Authority (A) and Consensus (C) during the implementation of the curriculum. In the data analysis a concurrent triangulation procedure was applied, referring to an approach in which all data, collected with the different instruments, were combined and analyzed concurrently (Creswell & Clark, 2007). This procedure was chosen to provide a rich analysis of the information and to allow for an in-depth analysis.

Both quantitative and qualitative data were concurrently analyzed and compared. Prior to comparing and analyzing the combined data, the quantitative data were descriptively analyzed using SPSS in order to obtain frequencies and means for each item in the questionnaires. Once a general tendency of the participants on certain issues has been found, it was brought in to the main analysis. The process of the main analysis is summarized in the steps below.

Step 1. The indicators in Table 3.1 were used to structure the data. The recurring information from all sources was grouped according to the indicators of the conditions (Table 3.1). Examples of how the information from different sources was related to each of the indicators are shown in Table 3.4.

Step 2. Verification that the information was connected to the correct aspect was conducted through a discussion with both supervisors. They were provided with the necessary information about the data and the indicators. Whenever different views existed regarding the categorization, the three researchers consulted together to reach agreement. Such verification provided both validation and reliability of the triangulation process in which separate findings were brought together in the interpretation (Creswell & Clark, 2007). By doing so, a process of cross-checking the data was carried out to control for bias and to establish valid propositions.

Step 3. A general conclusion was made in the discussion between the author and the supervisors to provide the findings about all indicators of the conditions of Infrastructure, Authority and Consensus. This step also provided a validation process to control for bias of the data through cross-checking (Creswell & Clark, 2007).

Table 3.4 *Examples of excerpts from various data sources grouped according to indicators of Infrastructure*

Infrastructure Data sources	Curriculum	Facilities
The regulation of the implementation of content and graduate standards	Development and decisions regarding the KTSP curriculum should consider the curriculum development guideline established by the National Body of Education Standard (BSNP)	
Interview with the first public teacher (PB-TCHR-1)	*"For me, the curriculum provided a prescription of content that should be taught. It was difficult for me to involve a contextual topic since the current content of the curriculum has given all what we needed."*	*"We can easily find a collection of religious books in the library, but very rarely a collection of chemistry textbooks. Only the books from MORA of 2004, and our students were not enthusiastic to use these."*
Interview with the second public principal (PB-PRNCPL-2)	*"What needed to be changed? Of course we expected teachers to make some changes in their practice as recommended by the curriculum and we supported them with anything we could."*	*"We have to take into account the need of other subjects in this madrasah. Providing chemical materials was very expensive and different from materials for physics. Materials for chemistry were on a one-shoot basis, they do not last long"*
MORA at national level	*"In relation to chemistry, we follow the MONE curriculum and structure."*	*"We certainly supported* madrasah *for their science development. Many projects have been carried out, but of course we have to admit that we have not covered all* madrasah *in the nation yet. You know, 90% of our* madrasah *are private and certainly we need more funds to support them."*

3.5 Results

In this section, the results of the study are presented according to the indicators of the conditions of Infrastructure (I), Authority (A) and Consensus (C), as described in Table 3.1.

3.5.1 Infrastructure (I)

3.5.1.1 Curriculum guideline

The curriculum guidelines, i.e., the Formal Curriculum, were taken for granted by teachers when preparing for and conducting teaching, the Perceived and the Operational Curriculum respectively. Regarding the interviews with the teachers, the content

standards, which were presented in the curriculum guideline for each semester of each grade, were used by the teachers to schedule their teaching practices. The schedule was also strictly interpreted because this presentation of the content standards was strongly related to the students' examination after each semester. For example, in the guideline the atomic structure, periodic table, chemical bonding, chemistry laws and stoichiometry are the topics recommended for the first semester of grade 11. These topics should be taught by the teachers prior to the exam of the first semester for students in grade 11. If teachers could not finish teaching the topics, the students could fail in the exam. Particularly important was the national exam for students of grade 12. Failing the exam will damage students' opportunities to continue their study at a higher level. Considering this, teachers reported in the interviews that the curriculum guideline did shape the Operational Curriculum to a large extent.

3.5.1.2 *Facilities*
<u>Textbooks and Teaching Materials</u>
Each teacher had a minimum of two and a maximum of four different textbooks for their references, supported by their principals (questionnaire data and confirmed by observations). The teachers could only provide a limited number of the textbooks to their students compared with the situation in 2004, before the establishment of the KTSP policy, when MORA provided funding for new textbooks. However, the teachers still encouraged the students to use these books as their learning sources, although these were old versions of the textbooks. In addition, according to the observations, none of the libraries of *madrasah* could provide a sufficient number of these science textbooks for all students of one class. The textbooks were thus found to be outdated and only available in limited numbers that were insufficient to cover all students, although the policy clearly recommended that students should be supported with sufficient sources of learning. Most of the books in the libraries were related to Islamic studies. According to at least two teachers in the interviews, the availability of the books in the library was strongly influenced by the principals. They argued that since their principals had Islamic studies as their educational background, the principals' interest in Islamic studies was greater than in science.

> "*If you visit our library, you would notice that there is a very limited collection of books of science compared to the books for religious studies. We know it.*" (TCHR-3)

> "*The new curriculum policy recommended us to be able to provide students with sufficient books in order for them to develop their thinking. But our* madrasah *could not afford to provide these books. However, the government policy did not allow us to ask students to buy their own books as was previously done.*" (TCHR-2)

The teaching materials were mostly limited to a (white or black) board, as was found from classroom observations, and confirmed in the discussion. However, in the public

madrasah there were more learning materials, laptops and LCD projectors than in private *madrasah* (10 out of 12). At least three teachers in the interviews reported that the use of these materials should be arranged carefully since the availability of laptops and LCD projectors was limited, and other teachers within the *madrasah* used them as well. One teacher stated in the interview that, even though these materials were available, she had no knowledge about how to use them, and thus these materials were not helpful for giving shape to her Operational Curriculum.

Regarding lab experiments, each public *madrasah* and only two private *madrasah* (out of 12) had a lab for carrying out chemistry experiments (observations). However, these labs had limited facilities; lack of chemical substances, equipment, desk and tables, and lab safety management.

Apart from the insufficient facilities, teachers reported that the greatest problem with lab experiments was the absence of a lab assistant. This was particularly the case in the public *madrasah*. One teacher in a public *madrasah* explained in the interview that a lab assistant was important for supporting works of the lab, such as preparing chemical substances and equipment, and managing the lab. However, it was difficult for principals to provide teachers with lab assistants. During the group discussion, it became apparent that the reason for this was that the principals did not have the funds required.

> *"Doing experiments in the laboratory requires a lot of work and definitely we needed a lab assistant. I could not do the lab work alone, i.e. preparing substances, setting the lab, etc."* (TCHR-1)

Working time

According to the curriculum guideline, every teacher was assigned to have a minimum of 24 teaching hours and a maximum of 40 teaching hours per week (45 minutes/hour). This minimum of teaching hours should be fulfilled by every teacher who wanted to be certified by MORA. In the interviews all teachers reported that getting the minimum of teaching hours was hard to attain because a *madrasah* had a limited number of classrooms for their teaching. To cope with this, teachers were allocated to teach at all levels of grades. In addition, teachers were often asked to teach at other schools or *madrasah*. This practice particularly took place for teachers of private *madrasah*: the observations showed that fewer classrooms were available than in the public *madrasah*. As a consequence, teachers reported that they had limited time to plan their instructional practices.

Teachers in the group discussion reported that the current hours of teaching were insufficient considering the learning skills of the students of the *madrasah*. According to

the teachers, their students had difficulties in acquiring knowledge during the teaching and learning process in the classroom. At least one teacher said that students were low performing, especially when dealing with basic concepts. Therefore, teachers most often needed more time to teach the concept a first time or to repeat it when this was needed for the students' understanding of the more complex concepts. Besides the minimum of teaching hours, the issue of time is related to the time spent for one hour of teaching.

"*I do not want to underestimate my students. But the fact was that they could not intuitively follow my teaching and thus their understanding of certain concepts was poor. When the concepts were needed for further exploration, we need time for repeat some lessons. This is unavoidable, otherwise we cannot move on with other lessons.*" (TCHR-3)

3.5.1.3 Financial incentives for teachers

According to the interviews with the principals, all teachers in public *madrasah* were hired by the government through an admission process managed by the government. These teachers were then assigned to work in a particular *madrasah* according to the need of the *madrasah* and their salaries were paid by the government. In private *madrasah*, teachers most often were appointed by either the principals or the head of the *madrasah* foundation. These teachers were paid by the principal according to the *madrasah* policy established by the principal and the head of the foundation. The salaries of these teachers were determined based on the financial conditions of the *madrasah*, which were often unpredictable; consequently the salaries were below those of teachers in public *madrasah*. The teachers in the interviews and in the group discussion reported that the salaries of the teachers in private *madrasah* were less than in the public ones. In addition, the salaries were sometimes below the minimum salary determined by the government.

"*It depends on the income of our madrasah. Sometimes when there are quite a lot of students who could not afford to pay their tuition fees, then we lowered the salaries for the teachers. In other times, the head of the foundation might help our financial status so that we could give the teachers affordable salaries. Most of the time, however, we tried to keep the salaries at least on the average level of the salaries for unskilled workers as stated by the district policy.*" (PRNCPL-4)

3.5.1.4 Evaluation of the Operational Curriculum

Despite the importance of the evaluation, it was reported by the teachers in the interviews that only principals of public *madrasah* visited the classrooms for the monitoring and evaluation. In contrast, the principals of private *madrasah* reported that they visited the classrooms, however not on a regular basis. These principals argued that their *madrasah* taught at least fourteen subjects and this made it difficult for them to manage the entire process of regular monitoring and evaluation. However, all teachers reported that there was an external superintendent who monitored and evaluated the

teachers. This superintendent was assigned by MORA at district level. Further in the discussion, teachers explained that the assigned superintendent was responsible to monitor and evaluate the Operational Curriculum of teachers of all subjects in the *madrasah*. According to the teachers, this practice was different from the one conducted in the general schools of MONE. The superintendent assigned by MONE worked according to his or her educational and academic background. Consequently, the MONE superintendent for chemistry had a chemistry-related educational background. The teachers, however, did not consider the monitoring by the MORA superintendent as useful, since this superintendent has to carry out the monitoring of teachers for all subjects instead of for chemistry only.

3.5.1.5 Professional development of teachers

According to the result of the teachers' questionnaire, six of the eighteen teachers had spent 9 to 16 hours on professional development during the last twelve months. Only three had spent less than 16 hours and the other three spent less than 8 hours. This result was not in accordance with the findings in the interviews with teachers. These interviews revealed that only two public *madrasah* teachers had participated regularly in the district professional development of chemistry teachers (Musyawarah Guru Mata Pelajaran (MGMP) Kimia), which was established by MONE. These teachers argued that they were involved in the MGMP Kimia, because they taught at schools governed by MONE. The other teachers stated in the interviews that they had no experience with professional development or even had never been invited by the MGMP Kimia. The observation that teachers had very little experience in professional development activities was strengthened during the group discussion. In the discussion teachers strongly pointed out that there had been no professional development program during the last three years at the very least. The interviews with the principals also confirmed the lack of professional development activities supported by MORA at the provincial level, to which this issue should be addressed to. However, the principals reported that the necessary support was already given to chemistry teachers to participate in professional development activities that were imposed by MORA at national or provincial level.

> *"Last time, we supported the teachers to go for professional development activities held in another city. We gave financial assistance to them. Of course, it was not enough to cover all costs. We should also think of teachers of other subjects, to have the same opportunity. It was hard, but we tried to support them."* (PB-PRNCPL-1)

3.5.2 Authority (A)

According to the decree on the national educational system and the regulation of district autonomy, the role of MONE has been to provide the necessary guidelines for teachers in order to give shape to the Operational Curriculum. These guidelines describe eight

standards of education; content standards, graduate standards, process standards, facilities standards, standards of teachers and administrators, financial standards, management standards, and evaluation standards.

Despite the centralized management of *madrasah*, it was implied that MORA at the national level had transferred the responsibilities of the senior secondary *madrasah* to MORA at provincial level. Such responsibility included giving services and supervision to the Operational Curriculum, students and employment, facilities, and organization and management. With respect to the chemistry curriculum, MORA at the national level required *madrasah* to follow the policy from MONE. Therefore, according to the interview with the head of *madrasah* of MORA at the national level, there was no particular policy regarding chemistry education. MORA at the district level had a strong relationship with educational matters of the senior high *madrasah*. However, it had no responsibility for the educational practices of the senior high *madrasah*.

According to the government's regulation on the decentralization policy, the principals had three responsibilities, namely, managerial, supervision, and entrepreneurship. The first and the last concern the effectiveness of the educational practice in the *madrasah*, such as providing financial support and facilities for development. Included in such responsibilities is the support of the teachers' professional development. The second responsibility, i.e. supervision, has a direct impact on teachers' practices. A principal was obliged to plan, carry out, and follow-up supervision of the teaching and learning process in order to develop professionalism of the teachers.

In addition, the teachers' responsibilities have been determined in the curriculum guideline. As the actors responsible for developing syllabi and lesson plans (the Operational Curriculum) and enacting the syllabi and lesson plans in the classroom (the Perceived Curriculum), teachers were recommended to develop the content and graduate competencies beyond what was stated in the Formal Curriculum. The development of the Operational Curriculum should consider the context of the *madrasah* where the teachers work, the students, the available resources, and the need of the community. Based on these considerations, it was expected that in the Operational Curriculum students were at the center for learning and given more opportunity to do practical work. In relation to the intended development of the Perceived and Operational Curriculum, teachers had also a responsibility for their own continuous professional development.

3.5.3 Consensus (C)

The level of Consensus was determined by the degree commitment of all educational actors to provide the favorable conditions of Infrastructure to support teachers. Most non-teaching actors involved in the process of curriculum implementation had a low

level of ownership for chemistry education in *madrasah*. In addition they were not fully committed to their responsibilities. For example, according to teachers both in the interviews and the group discussion, MONE, which provided the curriculum guidelines, did not allow much space for teachers to develop their own description of standards and competencies. The standards of content and competencies established in the Formal Curriculum acted as a prescriptive guideline for the Perceived and Operational Curriculum. In addition, the regulations on examinations has also contributed to the teachers' dependency on the Formal Curriculum when giving shape to the development of their own Operational Curriculum.

Moreover, the centralized system of education under MORA has been recognized to be inconsistent with the school-based curriculum policy. However, MORA did not prepare the necessary support to ensure that the work of the *madrasah* teachers would become more consistent regarding the objectives of education. Neither of the ministries prepared the support that was needed. This resulted in a lack of both material and non-material support for the teachers from both MORA or MONE at the national, provincial and district level. This lack of support has created confusion among the teachers when searching for support from institutions under MONE and MORA.

The poor understanding and the lack of support from MORA has also influenced the principals. At least two principals said in the interview that there was no new policy of *madrasah* in relation to the new school-based chemistry education although the role of supervision was assigned to the principals. However, this supervision only took place in the public *madrasah*, indicating that MORA put a greater pressure on public *madrasah* than on private *madrasah*. This lack of preparation by MORA explains the lack of availability of textbooks, facilities and opportunities for professional development of teachers. It was also evident that teachers had insufficient support to participate in professional development activities.

The described findings, and the lack of clarity and understanding of the tasks of the educational actors failed to provide for a clear Consensus. This situation strongly influenced the teachers when giving shape to the Operational Curriculum. As a consequence, it was found that the way teachers gave shape to the Operational Curriculum was strongly influenced by the low level of concern among the other educational actors.

3.6 Discussion and Conclusions

The aim of this study is to analyze the conditions chemistry teachers work in when they give shape to the Operational Curriculum. The setting of this study was the senior

chemistry education in the new school-based curriculum policy in a decentralized educational system in Indonesia. This study used the IAC model to analyze the conditions of Infrastructure, Authority and Consensus,. This study sought to answer the research question:

> *What are the conditions for chemistry teachers of* madrasah *when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?*

It was found that the educational actors involved in chemistry education in *madrasah* had a low level of understanding and ownership (a low level of Consensus). This lack of understanding and ownership was due to a lack of clarity and commitment to the roles of each of the educational actors, i.e. MONE, MORA, principals, and teachers (Authority). For instance, MONE developed curriculum guidelines which restricted the teachers' autonomy to give shape to the Operational Curriculum. While the centralized policy of education under MORA was not coherent with the policy of the school-based KTSP policy, MORA did not prepare itself to respond to this situation. This resulted in uncertainty about the roles of the educational actors at lower level, such as MORA at the provincial and district level, the principals, and the teachers. This also resulted in a lack of support, i.e. textbooks, facilities, time, incentives, evaluation, and professional development of teachers (Infrastructure). The overall current conditions of Infrastructure, Authority and Consensus were not favorable for chemistry teachers of *madrasah* to give shape to the Operational Curriculum during this curriculum change.

This study on the conditions for change provides an understanding of two important factors, thereby contributing to this field of education. These factors are the IAC model for analysis and the importance of professional development of teachers.

Reflecting on the IAC model of the conditions of Infrastructure, Authority and Consensus, this model was found to be a worthwhile tool for analyzing this educational change. This model supports the findings of Petrie (1995) who demonstrated the importance of being clear about the influence of each of the educational actors as determined in Authority, and potential contributions of the actors to the change, as presented in Infrastructure. Consensus is particularly important in this model, according to Hubbard et al. (2006). Consensus is essential in any program of educational change. Having Consensus as one of the conditions to be assessed, the IAC model provides a full overview in the analysis of conditions. This is rarely found in models for analyzing educational change; the condition of Consensus does not occur in the models of Rogan and Grayson (2003) and Fullan (2007). Both studies describe the roles of the different educational actors in providing the Infrastructure needed for change. However, they do not explicitly mention the importance of Consensus. This IAC model was developed

long ago; however, it appeared to be very useful in this study, resulting in a thorough analysis of the conditions and a successful understanding of the educational change in the context of decentralized educational system. This study contributes by emphasizing the condition of consensus and the importance of all educational actors being owner of this educational change. How consensus was determined in this study can be relevant for future studies.

This study confirms the importance of professional development of teachers to help them to shape their instructional practices, particularly in the setting of a school-based curriculum policy (Avery, Colebourne, James, & Florek, 2004; Chun, 1999; Keiny, 1993; Morgado & Sousa, 2010). Keiny (1993) argues that a policy of decentralization in fact is an opportunity for professional development, since a policy of decentralization provides autonomy for teachers to develop a curriculum based on their preferences and interests. However, individual teachers usually do not organize their professional development activities in self-organized communities. As mentioned by Darling-Hammond and McLaughlin (1995), support from the other educational actors, such as principals, administrators, and other authorities, is needed to develop favorable conditions for the teachers' professional development activities. Collaboration of all educational actors is essential within a policy of a decentralized educational system. So far, few research studies have described how this collaboration can facilitate the professional development of teachers.

To summarize, it is important to analyze favorable conditions for teachers to give shape to the Operational Curriculum, particularly in a process of curriculum change. This is particularly relevant in a decentralized educational system where favorable conditions are expected to be supported by local educational actors to whom responsibilities have been transferred by the regional or national actors. When the conditions are not favorable, it is very likely that teachers will be hindered in giving shape to this new Operational Curriculum. That can lead to problems in curriculum development as was shown by the incoherency between the learning objectives of the Operational Curriculum and the objectives of the Ideal Curriculum (Chapter 2). The IAC model was found to be very relevant in this study to analyze the conditions for change. Based on the conclusions of this study, it is recommended that educational change in which local educational actors are involved should be undertaken by first providing favorable conditions for teachers. If local educational actors are to be partners in the change process, it appears to be important that they have opportunities to participate and be involved in the process of change, and to have ownership of the change. This study showed that professional development of the *madrasah* teachers is currently lacking, implying that the change can be facilitated by first developing the conditions for teachers' professional development activities. This local change is particularly relevant because of

the nature of a decentralized educational system in which empowerment of local actors is encouraged.

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CHAPTER 1 Introduction and overview of the research

Main Research Question
In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?

Sub-Research Question 1
What are the characteristics of chemistry education and the conditions during the curriculum change?

CHAPTER 2	**CHAPTER 3**
Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah*	The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia
Research Question	**Research Question**
What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?

Sub-Research Question 2
In what way can professional development activities of chemistry *madrasah* teachers be facilitated?

CHAPTER 4
Establishing a community of teachers during educational change: A case study of participatory design approach in Indonesian *madrasah*
Research Questions
1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers?
2. What indicators of favorable conditions are formulated from the actors' shared agreements?

CHAPTER 5
Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah*
Research Question
To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?

CHAPTER 6
Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system
Research Questions
1. What changes did the teachers perceive after their professional development activities?
2. What PD activities did the teachers perceive to be meaningful for their practices?
3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?

CHAPTER 7 Conclusions and Reflection

Chapter 4

Establishing a community of teachers in a decentralized educational policy
A case study of participatory design approach in Indonesian *madrasah*

Abstract

This study focuses on the establishment of a community of teachers as a means of providing favorable conditions for teachers' professional development activities in a policy of decentralization of education. The research took place in *madrasah* (Islamic schools) in a district of Indonesia. The Participatory Design Approach (PDA) was used as a research approach. The actors involved in this study, i.e. the ministry at the district level, principals, and teachers, together determined agreements on establishing a community of teachers. To structure the agreements of the actors, this study used a model that visualized Strategies (S) and arguments to fulfil Intended Conditions (IC) of the community to enable teachers' professional development activities, the SIC model. Using this SIC model for qualitative analysis of the data, five strategies were found that the actors agreed upon for establishing a community to provide the intended conditions for teachers' professional development activities. The work of the actors was considered a major achievement in the setting of this study. Details of the activities of the actors and the strategies are described. A further study is needed on the implementation of the strategies and to what extent the intended conditions are fulfilled.

4.1 Introduction

Educational change challenges teachers to continuously develop their professionalism (Fullan & Hargreaves, 1992). Particularly in a decentralized educational system, the nature of the educational system allows the development of teachers to be supported by local actors (Behrman, et al., 2002; Hannaway & Carnoy, 1993). This includes local authorities and principals, and it might involve the establishment of communities of practice for teachers. Using their decentralized responsibilities, these local educational actors should provide their local capacities in order to improve the educational practice in which teachers play an important role.

Within a decentralized educational system support for teachers in their professional development is related to the activities of the local actors, e.g. establishing a community of learning for teachers. Many communities, like the ones studied by Ausbusson, Steele, Dinham and Brady (2007) and Grossman, Wineburg and Woolworth, (2001), were established in relation to long lasting, funded and facilitated activities of a group of teachers. In both studies creating favorable conditions for teachers' activities in the community played an important role, e.g. by providing financial grants and experts for professional development (PD) activities. However, in these studies little attention was paid to the capacity of the local educational actors to support favorable conditions for the PD activities of the teachers. Understanding this capacity is important because it appears to be difficult to maintain the previous conditions and to sustain the community when the support is diminishing or ending.

As in other countries, in Indonesia the teachers' professional development is an important issue on the agenda of the new decentralized educational system. Within this system, teachers are recommended to participate in professional development activities conducted in communities of teachers in each district. Such communities are called "communities of subject matter teachers" (*Musyawarah Guru Mata Pelajaran* – MGMP). In accordance with the policy of decentralization of education, these communities are supposed to be supported by local educational actors since the government, i.e. the Ministry of National Education (MONE), gives only limited support. Studies have shown that these communities are lacking support in many aspects, such as support from the local government and the principals, operational funds (USAID, 2006), time for teachers to conduct activities, and experts (Thair & Treagust, 2003). Problems with MGMP are even greater for teachers in *madrasah* (Islamic schools). Although the *madrasah* is part of the national educational system, these schools are managed by the Ministry of Religious Affairs (MORA), which still uses a centralized system of governance. Since MGMP was established by MONE, *madrasah* teachers feel excluded from it and thus they are often under-represented in the activities of the MGMP (USAID, 2006). In response

to this, recently MORA has decided to provide support for teachers to develop their own communities to conduct their professional development activities with the help of other educational actors. However, teachers and other actors lack experience in establishing communities, and designing and conducting professional development activities.

Establishing a new community of teachers is not an easy task (Aubusson et al., 2007; Grossman et al., 2001). It involves many participants and this takes a lot of time, effort and commitment. However, little research has been done about how communities of teachers are developed, particularly within a decentralized system involving local educational actors. These studies recommend inviting all educational actors, i.e. principals, schools administrators and teachers, to participate in the planning process of the development of the community (Fullan & Hargreaves, 1992; Loucks-Horsley, et al., 2003). These actors are important in supporting and providing favorable conditions for teachers' learning in the community: giving sufficient time, making skilled people available (experts, mentors or facilitators), and providing adequate financial compensation for teachers. However, few studies focus on how the actors should participate to provide these favorable conditions.

This study is a response to the challenge of establishing a community of teachers and inviting educational actors to participate in the establishment of the community to provide favorable conditions for teachers' PD activities in a decentralized educational system. The setting of this community is a curriculum change in a decentralized educational system, in which educational actors can determine strategies for teachers' professional development activities. The results of this study may contribute to the knowledge of communities of teachers and teachers' PD activities.

4.2 Theoretical framework

This study uses the perspective of the participatory design approach (PDA) that emphasizes the role of participatory work of different actors (Spinuzzi, 2005) in the development of the community. In this approach the concept of design strategies is used in which these strategies are based on theoretical arguments to result in certain intended effects (Prins, Bulte & Pilot, 2011; Van den Akker, 1999). In addition to this approach, theories on communities of teachers and conditions for professional development activities of teachers are used as a framework. Borko (2004) found that the involvement of many educational actors determines the context of the community which strongly influences teachers' activities in the community. The relations to the conditions of change are described with the theory of educational change of Havelock and Huberman (1978), in which a model of three necessary conditions for change is used,

namely, Infrastructure, Authority and Consensus, the IAC model. For this study a model for establishing a community of teachers is developed in a synthesis of the concept of design strategies and the model of conditions of change. This combined model puts emphasis on the relation between the strategies, as determined by the actors in their participatory work, and the fulfilling of favorable conditions for teachers' professional activities. Emphasizing the Strategies and the Intended Conditions, this model is called the SIC model. The SIC model may help to understand and assist the participatory work of educational actors towards establishing communities of teachers and fulfilling favorable conditions for teachers' professional development activities. Based on this arrangement, this study aims at investigating an approach to establish a community of teachers. These perspectives are described in the next sections.

4.2.1 The community of teachers

The term community in relation to professional development (PD) of teachers is used in variety of formulations, such as community of practice (Wenger, 1998) and professional learning community (DuFour, 2004). In this paper, the term "community of teachers" will be used. Adapted from Borko (2004), the community of teachers is defined as a system for PD of teachers that is established by a group of teachers together with other educational actors through shared decision making. According to Borko, there are four key elements in a system for PD, namely, the context in which the professional development occurs, the professional development activities, the teachers who are the learners in the system, and the facilitator who guides teachers as they construct new knowledge and they develop new practices (Borko, 2004). Considering these four elements, the community of teachers is divided into an outer layer and an inner one. For the purpose of this study, the outer layer will be described in more detail.

The outer layer of the community determines the context of the PD activities and consists of educational actors who influence and thus are involved in the community (Borko, 2004; Guskey & Sparks, 1996). This context is essential in building the community and determining conditions in which teachers conduct their PD activities (Borko, 2004; Loucks-Horsley et al., 2003). The larger the context of the community is, the more actors are involved, which means involving more participants from a school, district, region or nation. Because the context influences the development and sustainability of the community (Borko, 2004; Guskey & Sparks, 1996), lack of support from the context may hinder the professional development activities (Guskey, 2002). Loucks-Horsley et al. (2003) mention that the context in which professional development activities will be implemented specifically shapes the selection, combination, and sequence of the learning opportunities provided.

4.2.2 The IAC model for the analysis of conditions

As described in the previous section, the intention is to establish a community of teachers to provide favorable conditions for the teachers' professional development activities. The IAC model is used to analyze and influence the conditions and to assess whether these are favorable. Developed by Havelock and Huberman (1978), the IAC model proposes a comprehensive look at three interconnected conditions for educational change. The conditions are Infrastructure (I), Authority (A) and Consensus (C). The IAC model has been used in a previous study (Chapter 3) to analyze the conditions in which the teachers were working in during the recent curricular change. To study the designing and establishment of the community of teachers, the IAC model is used to understand the conditions for change and to formulate indicators for each of the conditions, particularly for teachers' PD in the community. These conditions will be described now in detail.

Infrastructure (*I*) is a "procedural configuration" (Havelock & Huberman, 1978, p. 76) that refers to "the efficiency of the entire problem-solving mechanism, the manner in which the system processes its needs, defines the problem in operational terms, elaborates solutions for the problem and, in particular, implements those solutions" (Havelock & Huberman, 1978). Infrastructure indicates the availability of either material or non-material support to allow teachers' activities in the community. Supportive policy, availability of facilities and provision of time are among the indicators for Infrastructure. Included in Infrastructure are resources which indicate the availability of trained people, a good technical and communication infrastructure, and financial support (Havelock & Huberman, 1978). For Infrastructure, according to Havelock and Huberman, it is particularly important that the implementation is rapid and reliable, e.g. funding is delivered on time and in sufficient amounts, facilities are available when needed, meetings are organized, and trained people are available to assist.

Authority (*A*) involves persons or organizations that give direction to the problem-solving cycle. Authority is the first element of "optimal political condition" (Havelock & Huberman, 1978). A high level of Authority means "there are people (not always the same) who are making certain that a need is recognized, the problem treated, some solutions found and that there is follow-through in the course of implementation" (p. 76). Regarding this study, Authority implies the mechanism of control that ensures the actors perform in line with the activities of the community. The mechanism of control can be determined from the roles of the different actors involved in the community. The roles of the actors vary according to their status in an educational system. Those who are at a higher hierarchical level, for example, are likely to have more power and control than actors at a lower hierarchical level. They use policies to determine their own role and the roles of actors at a lower hierarchical level. An instance of the different roles played

by the actors is the role of principals. Principals are key persons in facilitating teachers' participation in the community. This participation can be facilitated through allowing teachers to convey their community activities and to provide substitutions of teachers. To understand these different roles of actors, Authority therefore is indicated by the roles of each group of actors involved in the community.

Consensus (*C*) is determined by agreement and commitment among the actors involved. As a second element of "optimal political condition" (Havelock & Huberman, 1978), Consensus can be a signal of motivation and interest of every actor (Marsh, 1990). A high level of Consensus means that "people involved in a large-scale innovation […] agree with its objectives and with the way it is being carried out". If actors are motivated and interested in a change, for example, it is likely that serious actions will be initiated to make the change successful. Consensus is a key for any educational change, for it builds the responsibility, ownership, and commitment among the actors (Carver & Neuman, 1999; Havelock & Huberman, 1978; Marsh, Day, Hannay, & McCutcheon, 1990). In a locally initiated change, as in this study, Authority becomes more dependent on Consensus (Havelock & Huberman, 1978). For example, teachers are physically and administratively close to their principals. They know more about what to do and how their learning activities will be conducted in the community, but, unlike the principals, they do not have the power to schedule their teaching in order to conduct activities in the community. Taking this as an example, Havelock and Huberman (1978) predict that at a local level, a high rate of Consensus is a critical component in order both to *initiate* and to *implement* an innovation. It is expected that when Consensus is determined and committed, Infrastructure and Authority are more likely to accompany it.

4.2.3 Participatory Design Approach

Participatory Design Approach (PDA) is mainly discussed in the field of human-computer interaction and computer-supported cooperative work (Penuel, Roschelle, & Shechtmann, 2007; Spinuzzi, 2005). Within these fields, four aspects of PDA are important; the designers-researchers, the users, the process, and the designed system. The designers-researchers most of the time have the accountability and responsibilities of decision making in the design (Penuel & Gallagher, 2009). The users are a source of knowledge on which a system is built. The involvement of these users is critical in PDA since the designed system will be used by them and thus should be beneficial for them. With respect to the process, an iterative process is applied in PDA: exploring the current situation where problems or opportunities occur, designing a system, implementing it and evaluating the application of the system (Penuel et al., 2007; Spinuzzi, 2005). The designed system is the product of PDA that can be presented in the form of artifacts, systems, organization of work, or practical and tacit knowledge (Spinuzzi, 2005). This designed system is constructed with the knowledge developed. The characteristics and

use can be explored and understood through the practices and interactions of the users (Spinuzzi, 2005).

The participatory design approach as applied in this study is inspired by the given description. The design in this PDA means the design of a model for the establishment of a community of teachers that can fulfill the conditions for teachers' professional development activities. The components of the model are the products of the agreements of the actors involved. The four aspects described are adapted for the purpose of designing and establishing a community of teachers and providing conditions for teachers' professional development activities. With respect to the designer-researcher, in the PDA in this study this person is also described as a facilitator. As in the original PDA this person facilitates the PDA activities but does not have the responsibility of decision making. The users are the local educational actors involved in the community. Regarding the nature of the decentralized educational system previously described, these actors have their own responsibilities for any of their attempts at establishing the community. Particularly important in this group of actors are the teachers as the most targeted beneficiaries of the community. The voice of the teachers therefore needs to be taken very seriously (Chapter 3). In relation to the iterative process, PDA in this study involves three stages, namely, planning, implementing and evaluation.

The model for designing the community of teachers is adapted from the work of Prins, Bulte and Pilot (2011) and Meijer (2011). Prins, Meijer and their co-authors were inspired by Van den Akker, Gravemeijer, McKenney and Nieveen (2006) when developing their design-based research method. In their design studies on curriculum units three components were used, namely, strategies, arguments and intended effects on the students' affective outcomes. Their design model describes strategies (actions, tasks, etc.), based on analysis of the literature, empirical studies, and direct experiences, that are claimed to have the intended effects when the unit is implemented. These three components are adapted and used in this study. Particularly important in the adaptation is the component of intended effects. For the purpose of this study, the intended effects are described as the intended favorable conditions that enable teachers' professional development activities. Since this model emphasizes the Strategies and Intended Conditions, it is called the SIC model (Figure 4.1). The model is used to systematically analyze and structure the shared decisions of the actors on strategies that they think are needed to establish a community and to fulfill (improved) conditions for teachers' professional development activities.

The *strategies* for the development of a community focus on organizational support strategies. They imply actions that the educational actors involved agree to take in order to establish the community and fulfill the conditions for teachers' professional

development activities. The agreed strategies are based on the actors' own considerations. Some strategies, however, have also been found in the literature to be important, such as providing facilities and resources (Loucks-Horsley et al., 2003), establishing a policy that supports teachers' development (Fullan & Hargreaves, 1992; Loucks-Horsley et al., 2003; Richmond & Manokore, 2010), giving teachers incentives (stipends) (Luft, 2001), providing rewards for teachers (Darling-Hammond & McLaughlin, 1995; Guskey, 2000), and giving adequate time for professional activities (Guskey, 2000; Loucks-Horsley et al., 2003; Thair & Treagust, 2003).

The *arguments* describe the reasons that underpin the actors' agreed strategies which are believed to result in the intended conditions for teachers' PD activities. The arguments are related to collaborative considerations of the actors involved in the community. They can be drawn from the actors' own experiences and their knowledge on particular strategies. These arguments are highly influenced by the educational setting in which the community is developed. They may be limited to the ability, capacity and competency of the actors involved. However they are supposed to respect the importance of strategies to create the intended conditions.

The *intended conditions* characterize the conditions that, according to the actors, especially the teachers, are supportive of teachers' PD activities. Indicators of the intended conditions are formulated in relation to the IAC model previously described.
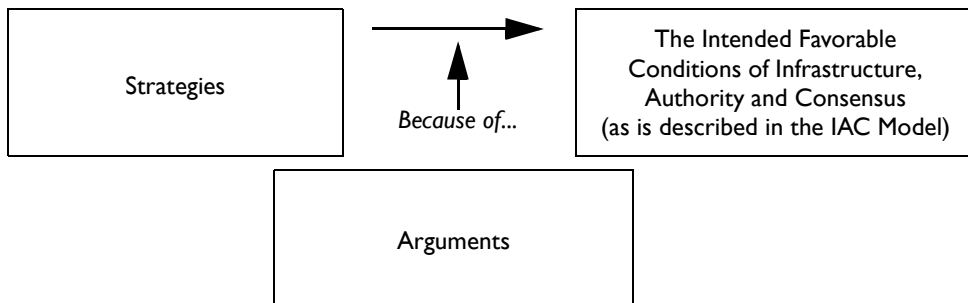
Figure 4.1 The SIC model for strategies and favorable conditions

With the three components, i.e. the Strategies, Arguments, and the Intended Conditions, the SIC model describes the results of structuring the actors' agreements in the establishment of the community and the fulfillment of conditions for teachers' PD activities (Figure 4.1). This model offers a way to develop and analyze the participation of the local educational actors and to establish a community in a decentralized educational system. Considering the participatory design approach and the SIC model, this study aims at understanding an approach to establish a community of teachers in a

local setting where local educational actors determine strategies that result in favorable conditions for teachers' PD activities. Having this aim, two research questions are addressed in this study.

1. *What strategies and arguments do the educational actors agree upon in establishing a community of teachers?*
2. *What indicators of favorable conditions are formulated from the actors' shared agreements?*

4.3 Method

This section describes how the participatory design approach (PDA) was used in this study through the setting, participants involved, data collection, and data analysis.

4.3.1 Setting of the study

The study was conducted during the implementation of a policy to decentralize the educational system. It was carried out in senior secondary *madrasah* in the Cirebon district, West Java Province, Indonesia. The establishment of the community was a response to MORA's efforts to encourage *madrasah* teachers to build their own community of teachers in their district.

4.3.2 Participants

Different groups of educational actors in the district participated in this study, i.e. the head of *madrasah* affairs of MORA, two officers of MORA at district level, the principals, and the teachers. The two first groups of actors were determined by the teachers (five public and four private *madrasah* teachers) who initiated the establishment of the community. These actors, according to the teachers, have influential roles in the community and therefore they were invited to be involved in the community. Eleven principals (five public and six private *madrasah*) participated. Three of the principals of public *madrasah* involved their vice-principals of curriculum affairs into the process. All *madrasah* chemistry teachers in the district were invited. However, only nine teachers were regularly involved, indicated as TCHR-3 to TCHR-11.

The teachers thought that it was important to have a facilitator and an expert in the field of communities of teachers and professional development. The teachers argued that the researcher of this study was able to facilitate their meetings and the discussions among them and the other actors. In this socio-cultural context, teachers have the lowest hierarchical level of power among all actors. They are reluctant to talk directly to the principals or MORA officials, the actors at a higher hierarchical level. Therefore, a facilitator was needed for the communication between them and the other actors. The expert was expected to provide the teachers with a broader knowledge about the

development of a community. Especially important was that the expert could also mediate and support the teachers in the meetings with the other actors.

4.3.3 Data collection

The data for this study were collected in three meetings and two interviews, one with a principal and one with a teacher. The data were primarily verbal, consisting of meeting notes, interview notes, and recorded discussions of the meetings and conversations in the interviews. The meeting notes were written by a team consisting of the researcher and one of the teachers in the process. The notes were used to keep track of the agreements reached by the actors involved in the different meetings. Different actors participated in the three meetings. Each meeting lasted effectively for four to five hours. The results (agreements) from the previous meetings were always brought to the next meeting.

The first meeting. Nine teachers (five from public *madrasah* and four from private *madrasah*) gathered, facilitated by the researcher. The teachers discussed the current conditions in relation to their professional development, such as policies, support from MORA and the principals, and the development of the communities of subject teachers (Musyawarah Guru Mata Pelajaran - MGMP) of general schools in the district. To enrich their discussion, the researcher presented some related information from the results of her previous studies (Chapters 2 and 3). In the discussion, the teachers listed actors who might influence the community and for that reason should be involved in the development of the community. They also discussed strategies to fulfill the conditions for professional development activities in the community. At the end of the meeting, they formulated a list of the actors and the strategies for their community. To strengthen their list, the teachers asked the researcher to invite an expert who could discuss this list with them before delivering it to the other actors. This expert should have experience, particularly in dealing with *madrasah*, communities of teachers, and chemistry education.

The second meeting. Invitations for this meeting were distributed by the teachers to all *madrasah* chemistry teachers in the district. However, only the nine teachers from the previous meeting attended. Facilitated by the researcher, an expert in professional development of teachers was invited. In this meeting, the teachers introduced their plan to establish a community to the expert and presented the list of actors and strategies formulated by the teachers in the first meeting. Some questions were asked by the teachers in order to gain more insight on the expert's view about the planned community, such as what needed to be taken into account in the community, what should be done by the other actors towards the community, and what was needed to make the community sustainable. The teachers and the expert were engaged in the discussion. The expert had the opinion that the teachers' plan to establish the

community was reasonable considering the teachers' current conditions. In addition, she thought that the choice of actors and the determination of the strategies presented by the teachers were considerably fundamental for the professional development activities of the teachers in the community. Supported by the expert, the teachers planned to deliver this list to the principals and the MORA official. At the end of the meeting, there was planning for the next meeting. The teachers asked the facilitator to approach the head of *madrasah* of MORA at the district level to invite all principals of the *madrasah* in the district to the next meeting. The teachers were of the opinion that invitations signed and delivered by MORA would attract more principals to come.

The third meeting. This meeting was attended by principals, MORA official, teachers, the expert, and the researcher. From the 32 principals invited in the meeting, only eleven principals (five from public and six from private *madrasah*) attended. The same nine teachers also joined this meeting. It was intended that the principals and the MORA official would respond to the teachers' plan to develop a community and the list of actors and strategies. In this third meeting, the teachers expected the expert to be a "push-factor" that supported the teachers to convince the principals and the MORA official. The MORA official opened the meeting. A representative of the teachers was then asked to present the teachers' intention to establish a community. She delivered the list of the actors and strategies as a result of the teachers' discussions in the previous two meetings. Next, the expert delivered her general opinion about the planned community and the teachers' expectations presented in the list. The principals and the MORA official were invited for a discussion with the teachers and the expert about the teachers' plan for the establishment of the community and about the strategies. In this discussion, the MORA official and the principals agreed to implement the strategies proposed by the teachers and thus to fulfill the teachers' intended conditions. In order to realize the implementation of the strategies, the principals and the MORA officer asked the teachers to do some tasks. Therefore, at the end of this meeting, the discussion resulted in a completed list of strategies and intended conditions.

4.3.4 Data analysis
The data were analyzed in two steps with two different aims: on-site data analysis to provide direct confirmation of the agreed decisions from the actors, and off-site data analysis to formulate the strategies, arguments and intended conditions, related to the SIC model.

On-site data analysis was used for immediate assessment of how the actors involved in the meetings progressed towards agreements achieved at the end of the meetings. The on-site data analysis was conducted by two persons, the researcher and a representative of the teachers. According to Duffy (1987) in Thurmond (2001), "the use of more than

one investigator with different and complementary skills decreased potential bias and prevented the occurrence of a holistic fallacy" (p. 255). This team made notes during each meeting and analyzed them after the meeting. The analysis was focused on agreement on the decided strategies and the tasks of actors. Once agreement between the two was achieved, it was presented to the actors who attended the meeting. This allowed the actors to check the notes, thereby increasing the reliability of the findings.

Off-site data analysis was conducted in order to gain more conceptual understanding and interpretation of the agreements resulting from the on-site analysis and from the discussions and interviews. The off-site analysis was done by the researcher and her research team (consisting of the supervisors of this study). The analysis was conducted from an interpretative perspective as described by Smith and Osborn (2008) which allows for exploration of the meanings of particular points of view of the actors involved. The aim of the analysis was to cluster the data into strategies, arguments and intended conditions in the perspective of the SIC model (Figure 4.1). The researcher, who had been involved in the on-site analysis, and the two other team members categorized the data into three themes; strategies, arguments and intended conditions. Because the strategies had been previously agreed and confirmed by the actors, discussion was only needed to ascertain the strategies found in the meeting notes. For arguments about the strategies, the excerpts of the interviews and discussions were categorized. Intended conditions were determined from the meeting notes, interviews, and discussions. Indicators of the Infrastructure, Authority and Consensus were formulated as follows.

1. Indicators of Infrastructure were formulated from the theoretical framework of the IAC model and the discussions on the strategies. For example, if the participants of the discussion agreed to provide for giving the community legal status, the list of indicators for favorable conditions mentioned: there is a legal document for the community of the teachers (Figure 4.2).
2. Indicators of Authority were delineated mainly from the meeting notes. They were drawn from the tasks of each of the actors involved in the community that have been agreed by the actors in the third meeting. For example, it was agreed that the MORA official should issue the legal document for the community. Only MORA has the political capacity to sign such documents. Similar indicators were delineated from the tasks of the teachers. For example, in order to issue a legal document of the community, the MORA official needed to have an organizational structure of the community, which was to be delivered by the teachers. Therefore, the task of the teachers was to develop this organizational structure and deliver it to the MORA official, which then is derived as an indicator for Authority.
3. Indicators for Consensus were delineated from the agreements and commitments of the actors towards the objectives of the community and the way the community

should be conducted. Therefore, an indicator for Consensus is the realization of the agreements of the actors.

Even though the off-site analysis was synthesized from the actors' agreed decisions, it might be subjective. To prevent subjectivity, a validation of the results of the analysis was conducted by asking for confirmation from representatives of each of the group of actors. The confirmation was done by providing the SIC diagram (Figure 4.1) and explaining its meaning to the representatives. The representatives confirmed that this analysis was indeed consistent with the results of the decision making in which they participated.

4.4 Results

This section describes the results of this study as follows. First, the strategies and the arguments are presented in order to answer the first research question. Second, indicators of the intended conditions are clustered according to Infrastructure, Authority and Consensus to address the second research question. Figure 4.2 shows the resulting formulation of the designed SIC-model.

4.4.1 The strategies and arguments

Five strategies were delineated from the meetings. Initially, these strategies were formulated by the teachers in the first meeting. After discussing the strategies in the third meeting, the principals and MORA eventually agreed upon these strategies. The strategies were (1) providing a legal status for the community, (2) providing recognition for teachers' participation, (3) providing accommodation (a meeting place and its facilities) for conducting the professional activities, (4) providing incentives for teachers and experts, and (5) providing time for teachers' activities. Each of these strategies is elaborated below, including the arguments.

(1) Providing a legal status to the community
Regarding the legal status of the community, the principals argued that such a legal status of the community was essential for their commitment to allocate a budget for future activities of teachers. The teachers, on the other hand, thought that this legal status would serve as an acknowledgement of the existence of the community. The teachers considered that this was necessary for them to get funding from other institutions. In addition, having a legal status, the teachers' activities would then be recognized by both the principals and the MORA official.

Strategies

1. Giving a legal status to the community (strategy: legalization)
2. Providing recognition for teachers' participation (strategy: recognition)
3. Providing accommodation for teachers' activities (strategy: accommodation)
4. Providing incentives for teachers and the experts (strategy: incentives)
5. Providing time for teachers' activities (strategy: time)

Result in ...

Because ...

Intended favorable conditions (cf. the IAC model)
Infrastructure (I)
Indicators:
I.1 A legal document of the community of chemistry teachers is available
I.2 A certificate of teachers' participation is provided
I.3 Accommodation for regular teachers' activities is available
I.4 There are enough incentives for the teachers and invited experts
Authority (A)
Indicators:
A.1 The principals are responsible for managing teachers' teaching schedules, budgeting for incentives for teachers and experts, and providing a place and facilities for teachers' activities
A.2 The MORA officer is responsible for issuing the legal document for the community of chemistry teachers and provide teachers' certificates of participation
A.3 The teachers are responsible for helping the MORA officer and the principals to accomplish their tasks: providing the structure of the community, schedule of activities, and report of activities (including list of attendance).
Consensus (C)
Indicators:
C.1 The realization of the strategies and the actors' tasks.

Arguments
1. A legal document serves as an acknowledgement of the existence of the community. The legalization could allow the teachers to search for other sources of funding. For the principals, the legal status of the community helps them to allocate their budget for teachers' activities.
2. The certificates of teachers' participations are required for the certification of teachers and accreditation of *madrasah*.
3. The certainty of a place with necessary facilities, such as black board, projector, screen and other stationeries is important for the regular learning activities in the community.
4. Financial assistance is important to compensate for teachers' participation and to allow more teachers to participate in the community. Financial assistance is also needed to pay the invited experts.
5. Due to long distances between the *madrasah* in the district, the activities of professional development cannot be done within teachers' teaching time.

Figure 4.2 The strategies, arguments, and intended favorable conditions as structured in the SIC model.

> *"Our financial administration works on the basis of legal documents. If you expect us to allocate some funds for the community, we hope that a legal document can be issued. By so doing, next year, it is very much possible that we will propose for additional money to fund our teachers."* (PRNCPL-2)

(2) Providing recognition for teachers' participation
The teachers were concerned about the certificate of recognition of their participation.

They argued that this certificate was important for the process of the teachers' certification and *madrasah* accreditation, especially because the certificate is necessary as evidence that the teachers has undertaken PD activities. Certification has two consequences for the teachers, namely, increasing salary and obtaining additional tasks (more hours of teaching). The former consequence seemed to attract the teachers more than the latter. In relation to *madrasah* accreditation, the teachers said that their participation in professional activities became one of the important items for assessment during this accreditation. Considering these arguments, the teachers thought the certificate of recognition was critical.

> "*To be honest, a certificate of participation is important for us. We need it for our madrasah accreditation and for our own certification. It would be great if the certificate can be signed by the head of MORA at the district level because it will increase the grade gathered for certification.*" (TCHR-5)

(3) Providing accommodation for teachers' activities
Accommodation, a meeting place and appropriate facilities, was needed by the teachers. According to the teachers, the certainty of having a meeting place was important for their activities. Even though different arguments were used among the principals in relation to the choice of the location of the meeting place, the teachers preferred to choose a place that can easily be reached by all teachers. Furthermore, it was important that the place was equipped with necessary facilities, such as white board and pens, LCD and laptop. Having the certainty of this accommodation, the teachers expected that they could focus better on their professional development activities.

> "*I agree that it is better to have a center for teachers learning.*" (PRNCPL-1)

> "*Certainly we are scattered in many areas. We need a meeting place to enable all our colleagues to come.*" (TCHR-3)

(4) Providing incentives for teachers and experts
It was noted that the teachers gave very serious consideration to the incentives. According to at least one-third of the teachers in the discussion at the first meeting, the absence of incentives could discourage teachers from participating in professional development activities. They reported that in many other professional development activities, teachers were not sufficiently compensated, and therefore were reluctant to participate further in such activities. This especially happened with teachers from private *madrasah*. They argued that these teachers could not afford to spend their salary on traveling costs, because of their lower salary. Incentives were also important for inviting experts. The experts, according to the teachers, were needed to help teachers' learning activities in the community.

> "*Our colleagues from private madrasah certainly needed financial assistance to*

participate in the community. Their honorarium for one class meeting in the madrasah was probably less than the price of the ticket from their madrasah to the location of professional activities. If we cannot get financial support, I bet that only very few private teachers will come." (TCHR-1)

(5) Providing time for teachers' activities
According to the teachers, the lack of time available for PD activities is problematic. When PD activities were conducted, teachers would have to take time away from lessons in their *madrasah*. This is because the locations of *madrasah* in the district are scattered, implying that traveling from one *madrasah* to another would take considerable time. In addition, the principals were not able to provide substitute teachers to take over their lessons. It was then required that these lessons should be taught at another time, which was difficult for the teachers themselves to arrange. Therefore, the teachers needed a "day-off" from teaching to be able to participate in PD activities on the days the PD activities were conducted.

> *"My madrasah is in the south and the activities will be held somewhere else. Probably it will take more time to travel to the location of the activities than to conduct the activities themselves."* (TCHR--3)

The above five strategies were determined by the teachers and considered as important strategies to establish the community of teachers. Teachers expected that favorable conditions could be fulfilled with these strategies to enable them to conduct their PD activities.

4.4.2 The intended conditions
The intended conditions were formulated in terms of the Infrastructure, Authority and Consensus conditions of the IAC model. Indicators for each condition were elaborated as follows.

4.4.2.1 Infrastructure
Five indicators of the condition Infrastructure were determined and related to the five strategies formulated in the previous section. The indicators for the condition Infrastructure (I in Figure 4.2) are: (I.1) there is a legal document for the community of chemistry teachers, (I.2) certificates are awarded for teachers' participation, (I.3) accommodation for PD activities is regularly available, (I.4) there are enough incentives for teachers and invited experts, and (I.5) teachers are given a "day-off" on all Saturdays for PD activities. Each of the indicators is presented below in more detail.

(I.1) <u>There is a legal document for the community of chemistry teachers</u>
The issue of legalization of the community was understood in relation to the need of the teachers and the principals for a legal status of the community. Because the legal status is given in the form of a legal document, this document is an indicator of the legalization

of the community.

(I.2) <u>There is certification of teachers' participation</u>
The availability of a certificate for teachers' participation is the indicator related to the strategy of recognition of teachers' participation. It was agreed that the certificate would be given on the basis of completion of one semester of activities in the community.

(I.3) <u>The availability of accommodation for the regular activities of the teachers</u>
The availability of accommodation (a meeting place and its facilities) for teachers' PD activities is an indicator related to the third strategy. In the third meeting, it was agreed that a classroom in *madrasah* A with a white board, an LCD and a laptop would be provided for teachers' regular activities.

(I.4) <u>There are enough incentives for teachers and experts</u>
Providing incentives for participating teachers and invited experts are indicated by the availability of enough financial assistance for both. In the third meeting, it was agreed that all teachers who participate in the activities of the community would be provided with snack, lunch, and reimbursement of transport costs by the principals. Experts would be given an additional honorarium.

(I.5) <u>The teachers are given a regular day-off on Saturday for PD activities</u>
Educational activities in *madrasah* were conducted from Saturday to Thursday every week. This was different from the general schools that had their activities from Monday to Saturday. It was agreed that all chemistry teachers would be asked to participate in PD activities in the community and they would be given a regular day-off every Saturday for such activities. This regular day-off on all Saturdays, therefore, was one of the indicators for the conditions of Infrastructure that was related to the fifth strategy.

4.4.2.2 *Authority*
The data of the discussions show that the implementation of the five strategies was the responsibility of either the principals or the MORA official. These assignments define the roles of the principals and the official as indicators for the condition Authority (Figure 4.2). Besides these actors, the teachers were assigned some tasks that would help the principals and the MORA official to accomplish their tasks.

(A.1) <u>Principals</u>
It was agreed in the third meeting that the principals were responsible for providing time, accommodation, and incentives for teachers to conduct their PD activities. These three tasks were therefore the indicators to be accomplished by the principals. Regarding the time, the principals discussed this directly with their vice principals for curriculum affairs. They agreed to allocate Saturday as a day-off from teaching in *madrasah*. As a

consequence, the teachers were required to participate in the PD activities in the community. To allow this, the principals would sensure that their vice principals rearrange the teaching schedules as agreed.

> "*Because the principals asked for it, I think we can easily rearrange the teaching schedule. That would be no problem at all.*" (VC-PRNCPL-3)

For the indicator of accommodation, the principal of MAN Cirebon-1 took an initiative to allow the teachers to use one of the classrooms in his *madrasah* for their activities. He would also provide the necessary learning facilities. All the principals were in fact open to the teachers using their classrooms for the activities. The principal whose classroom will be used should receive notice at least one week prior to the activities.

> "*I agree that it is better to have a center for teacher learning, a place for them to conduct their activities. Our madrasah has a classroom, a lab for vocational study, that is always free on Saturday, so we can devote that room for the teachers' activities. For learning facilities, I think we have sufficient facilities there, LCD, white board, and even in near future I have planned to add an air conditioning system. So, I think the place for the teachers' activities is fixed.*" (PRNCPL-1)

In relation to incentives for teachers and experts, the principals decided to provide some amount from their budget to be used for teachers' incentives. The principals, however, agreed to cover only the basic needs of the teachers' activities (transportation and meals), at least for one year. They also guaranteed to provide a financial contribution for any invited experts during the teachers' activities in the community.

(A.2) <u>MORA</u>
It was found in this study that the MORA official was responsible for two tasks: issuing a legal document about the community and providing certificates of participation for teachers. In terms of the first task, the official said:

> "*I would ask the teachers to discuss about their organizational structure, such as, who will be the leader, the secretary, etc. and give the report to me so that I can directly ask my staff to issue a letter in relation to the community. We will refer to the government decree regarding the community.*" (MORA)

In response to the latter task, the official took the responsibility for helping the teachers to obtain certificates of participation. These certificates would be signed by the head of MORA at the district level. Because the certificates would be given on the basis of one semester activities, the official needed a report of participants' participation in one semester.

(A.3) <u>Teachers</u>

The teachers' roles were to help the other actors to accomplish their tasks. It was agreed in the third meeting that the teachers had at least four tasks to help the principals and the MORA official to accomplish their tasks:

1. Determining an organizational structure of the community. The structure will be used by the MORA official to issue the legal letter of the community;
2. Providing a schedule of activities. The schedule was important to determine the amount of financial assistance the principals should give to the teachers;
3. Reporting their activities to the MORA official and to the principals. The report would be used by the official to issue certificates of participation. It would also be used by the principals to ensure that their teachers did participate in the community and for considering further support;
4. Coordinating their activities with the principal of *madrasah* in which the activities would be conducted. In giving notice of the activities, according to the principals, they might give an approximation of facilities required to be provided by the principals, such as laptop, LCD, or other teaching materials.

4.4.2.3 Consensus

Consensus was reached by all actors in the third meeting in relation to two important agreements. First, the actors agreed upon the necessity of a community for teachers' professional development and that some strategies needed to be implemented for teachers' learning activities. Second, the actors agreed on their tasks for the strategies to be fulfilled. Considering these two arguments, Consensus (Figure 4.2) was therefore indicated by the realization of the strategies and the actors' roles in the implementation process (C.1).

4.5 Discussion and conclusions

In general the conditions for chemistry teachers of *madrasah* were unfavorable, i.e. lack of support from educational actors for carrying out professional development activities (Chapter 3). This study aimed at investigating an approach to establish a community of teachers in a local setting where local educational actors determined strategies that should result in favorable conditions for teachers' PD activities. It provided an elaboration of the planning process of the participatory work of the educational actors to establish a community of teachers in a local setting. This participatory work was conducted following the principles of the participatory design approach (PDA) in which the model of Strategies for Intended Conditions, the SIC model, is used. This model provided a systematic way of structuring the decisions, shared among all actors upon the strategies for establishing the community and for fulfilling the intended favorable conditions for professional development of teachers. Two research questions were addressed in this study:

1. *What strategies and arguments do the actors agree upon in designing a community of teachers* and
2. *What indicators for intended conditions are formulated from the actors' shared agreement?*

The answers to both the questions are summarized in the SIC model in Figure 4.2. While the strategies and indicators of favorable conditions were generated by the teachers, the accomplishment of the strategies was found to be depending on the principals and MORA official whom teachers considered as key educational actors in their community.

In the process and the findings of this study, four important issues emerged that contribute to the field of education. These are (i) the sequential planning of the process of the establishment of the community, (ii) the teachers as initiators, (iii) the SIC model, and (iv) the role of the expert and the facilitator.

(i) <u>The sequential planning of the process</u>
The sequential process of planning reflected a bottom-up process where teachers, as the most important beneficiaries of the community and the actors in the lowest hierarchical level, took part in the process. This practice was at least different from the top-down establishment of the community of teachers of general schools (MGMP), where MONE provides a supportive policy, resources and material support for conditions favorable to teachers' professional development activities (Hadi, 2002; Thair & Treagust, 2003). The bottom-up process demonstrates an ability of *madrasah* to develop local educational changes that are consistent with the decentralization of the national educational system. This process has a potential to be further disseminated in the nation. Such bottom-up process is in fact in line with many theoretical notions in the literature that recognize the importance of a bottom-up process for improving educational change (Darling-Hammond, 1990; Hallinger, 2003).

In addition, the planning provided a sequential process of involving teachers' voices, i.e. their interests and needs in relation to their community should be taken into consideration by educational actors who have a higher hierarchical status than the teachers. The first meeting, in which only the teachers were involved, was a self-reflection process for the teachers on their current conditions of professional development and the local educational actors that may potentially influence their community. This self-reflection process allowed the teachers to consider what would be favorable conditions. The second meeting involved the process of developing the strategies that would result in the favorable conditions. This developmental process was assisted by an expert who gave the teachers her considerations based on her experiences in dealing with communities, particularly with respect to the strategies and conditions teachers proposed. The third meeting was the process of presenting the

strategies and conditions decided in the second meeting to the other educational actors. This process was facilitated and mediated by a facilitator and the expert who delivered the teachers' proposal on strategies and intended conditions. The three meetings in this sequential process gave a description of gaining consensus by different educational actors which was found to be critical in an educational change process (Hubbard et al., 2006). Havelock and Huberman (1978) indeed emphasize that in a local educational change consensus likely provides the availability of Infrastructure and Authority. The work of different educational actors in a local educational change has often been demonstrated in the field of economic and community health development, particularly in the context of Indonesia (see Beard, 2007; Mitchell, 1994). However, such description of the work of the actors is new for the field of education and is thus relevant for dissemination in other contexts.

(ii) <u>The teachers as initiators of the establishment of the community</u>
This study confirms the findings of studies that stress the importance of a small group of motivated teachers in the establishment of a community and at the start of professional development activities (Lee, 2004; 2005; Thair & Treagust, 2003; Triggs & John, 2004). Both Lee (2004; 2005) and Triggs and John (2004) found that such a group of teachers, called a nucleus of teachers, creates a state of organization and nurtures the community. Thair and Treagust (2003) mentioned this group of teachers as the key teachers (guru inti) in their study of PD programs in Indonesia and found these teachers to be important for the successful dissemination of the community of teachers and development of the PD programs. The key teachers are often selected by the PD developers based on certain characteristics, such as having better competencies or being involved in collaborative research with a university. In contrast to this, the teachers in this study were self-selected, based on the teachers' own motivation. This motivation may develop teachers' responsibilities that, according to Lasley (1989), are a potential factor to increase teachers' professional efficacy. The work of the teachers in this study therefore enhances an understanding of the role of the nuclei teachers in the establishment of a community of teachers.

(iii) <u>The SIC model</u>
The strategies, the arguments, and the IAC model combined in the SIC model are the theoretical yield of this study. The SIC model developed in this study not only offers a model for planning to establish a community but also for the evaluation of the intended conditions. An analogous model has been used in the study of Prins et al. (2011) and Meijer (2011) for the development of a unit of a curriculum. The use of the SIC model in this study for the planning of a community of teachers is novel in the field of education. In addition, this model was shown to bring the results of the participatory work of educational actors into a structured planning that was beneficial in the establishment of

the community. The model can be used by other researchers and developers in other contexts wishing to establish and study a community of teachers with the participation of educational actors.

The tasks of the expert and the facilitator proved to be important for the success of the planning process, being a resource person and a mediator respectively. As a resource person, the expert was found to help the teachers to present what they considered favorable conditions to the other actors, which it was unlikely the teachers could do by themselves. The expert provided information and shared her experiences and knowledge about communities of teachers with the actors. In this respect, she supported the approach and convinced the other actors of the importance of favorable conditions. The facilitator, on the other hand, had a role as mediator who was able to stimulate the communication between the teachers and the other actors. The importance of such role in a local educational change with many actors involved has been found in other studies (cf. Park, 1993).

In conclusion, this study has shown an approach to the establishment of a community of teachers as a way to improve the unfavorable conditions teachers perceived during an educational change (Chapter 3). This study demonstrated that the participatory design approach with many educational actors is feasible and productive in designing the essential support of teachers' educational practice in a decentralized educational system (Behrman, et al., 2002; Hannaway & Carnoy, 1993). Although this study is specific to *madrasah* in Indonesia, the findings revealed that the educational actors were able to choose important strategies. They aimed at favorable conditions for change that were found in other studies on communities of teachers, such as the need for facilities, time and accommodation (Lee, 2004; 2005; Loucks-Horsley et al., 2003; Thair & Treagust, 2003; Timperley et al., 2007). While these favorable conditions are important for teachers' professional development activities (inner layer), the fulfillment of these conditions is highly determined by the educational actors (outer layer) (Borko, 2004). As this study focuses only on the planning stage of the establishment of the community, these findings pave the way for a further study on the extent of the implementation of the strategies and the fulfillment of the intended conditions as well as the extent of teachers' professional development activities.

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CHAPTER 1 Introduction and overview of the research	
Main Research Question In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?	
Sub-Research Question 1 What are the characteristics of chemistry education and the conditions during the curriculum change?	
CHAPTER 2 Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah* **Research Question** What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	**CHAPTER 3** The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia **Research Question** What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?
Sub-Research Question 2 In what way can professional development activities of chemistry *madrasah* teachers be facilitated?	
CHAPTER 4 Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah* **Research Questions** 1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers? 2. What indicators of favorable conditions are formulated from the actors' shared agreements?	
CHAPTER 5 Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah* **Research Question** To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?	
CHAPTER 6 Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system **Research Questions** 1. What changes did the teachers perceive after their professional development activities? 2. What PD activities did the teachers perceive to be meaningful for their practices? 3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?	
CHAPTER 7 Conclusions and Reflection	

Chapter 5

Facilitating a community of teachers
A case study of participatory design approach in Indonesian *madrasah*

Abstract

Many studies have acknowledged the importance of a community of teachers for their PD activities. However, little research has been done to establish a community in a decentralized educational system and to fulfill the conditions which allow teachers to conduct their PD activities. This study presents an approach of participatory work of local educational actors in the outer layer of such a community. The participatory design approach (PDA), the perspectives of the teachers and the IAC model were used for the analysis of conditions to develop a model that structures Strategies agreed by the actors to fulfill the Intended Conditions for teachers' activities, the SIC model. Using this model, it was found that when the community was established, the intended conditions were not completely fulfilled. This was due to incomplete accomplishment of the strategies by the actors. Despite the incompletely fulfilled conditions, it was found that the SIC model was helpful for both enabling the participatory work of the educational actors and analyzing conditions for PD activities. A further study is needed to analyze the inner layer of the community, where teachers' PD activities are conducted when the conditions are fulfilled.

5.1 Introduction

In many studies on educational change, the teacher is described as a corner stone (Fullan & Hargreaves, 1992). A community of teachers, therefore, is considered important in educational change because it can serve to increase teachers' professional development (PD) (Good & Weaver, 2003; Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003; Talbert, 2010). In a decentralized educational policy the participation of local actors in educational change is emphasized (Cohen, 2004; UNESCO, 2005). When communities of teachers are involved, this participation of local actors should provide support for enabling teachers to conduct their PD activities within their community (Borko, 2004; Loucks-Horsley et al., 2003).

However, many studies have found that decentralization of education does not necessarily bring different educational actors together to work collaboratively on educational change (Chapman, Barcikowski, Sowah, Gyamera & Woode, 2002). Chapman et al. (2002) and Bjork (2003; 2004; 2005) report that lack of clarity of the actors' tasks can create confusion among the educational actors at the local level. This confusion makes them reluctant to work on the change process (Bjork, 2005). Developing the conditions that enable teachers to conduct PD activities and to achieve support for educational improvement from all actors is found to be critical (Borko, 2004; Guskey, 2000; Vegas & Umansky, 2005).

In the process of executing the policy of decentralization of the educational system in Indonesia, teachers have struggled with conditions that are unfavorable for educational change. This is particularly the case for teachers of Islamic schools (*madrasah*) (Chapter 3). *Madrasah* are under the responsibility of the centralized Ministry of Religious Affairs (MORA) while at the same time they are required to follow the decentralized educational policy under the Ministry of National Education (MONE). This system of dualism, i.e. decentralized and centralized, has made support for PD complex for local educational actors concerned with *madrasah* (Asian Development Bank, 2005; Duncan, Cattleya, Emzita, & Reppellin-Hill, 2004). Studies have reported that the teachers of *madrasah* do not have sufficient opportunities to participate in the communities of teachers which are established in the districts by MONE (Asian Development Bank, 2005; and see Chapter 3). One of the reasons is that these communities are established and funded by MONE for teachers under MONE's responsibility. Recently, MORA has encouraged educational actors of *madrasah* to develop and support communities of teachers in their districts, similar to those of MONE. However, the educational actors of *madrasah* do not have experience of organizing such communities. Consequently, providing and assessing the conditions for teachers' activities are novel experiences for these actors.

In many studies, it is reported that it can be difficult to establish and sustain a community of teachers (Aubusson, Steele, Dinham, & Brady, 2007; Grossman, Wineburg, & Woolworth, 2001). While participation of educational actors in a community is encouraged (Fullan & Hargreaves, 1992; Loucks-Horsley et al., 2003), few studies have been conducted about how such communities should be developed and what conditions are favorable to enable teachers to conduct their PD activities. Teachers and other local educational actors therefore need strategies for establishing their communities.

Considering their needs, this study aims to understand, define and implement strategies to facilitate a community of teachers and the participatory work of educational actors to define and implement strategies in fulfilling favorable conditions for teachers' PD activities. The participatory design approach should enhance the participation of the educational actors. This study focuses on the case of chemistry teachers in *madrasah* in Indonesia. As a foundation for this study, two perspectives are used: (1) the characteristics of a community of teachers including the potential actors involved, and (2) the conditions and the framework of Infrastructure, Authority and Consensus (IAC) to analyze the conditions for educational change. The participatory design approach and the two perspectives were used to define the model for Strategies and Intended Conditions, the SIC model. Structuring and implementing these strategies should result in the participatory work of the actors to fulfill favorable conditions for change.

5.2 Theoretical framework

5.2.1 Community of teachers

Inspired by Borko (2004), a community of teachers is defined in this study as an organizational system for the PD of teachers that is established by a group of teachers together with other educational actors. In this system, four key elements should be considered (Borko, 2004), namely, the context in which the PD occurs, the PD activities, the teachers who are the learners in the system, and the facilitator who guides teachers as they construct new knowledge and practices (Figure 5.1). Considering these key elements, a community can be determined to have two layers, namely, the outer layer and the inner layer. The outer layer describes the first element, that is, the context of the community. The inner layer describes the other three elements which can be categorized as content and process. For the purpose of this study, the outer layer will be described in more detail.

The outer layer determines the context of the community which defines educational actors who influence and thus are involved in the community (Borko, 2004; Guskey & Sparks, 1996). This context is essential in building a community and determining the conditions in which teachers conduct their activities (Borko, 2004; Loucks-Horsley et

al., 2003). With respect to the actors involved, the larger the community, i.e. school, district, regional or national, the more actors are involved. Because the context influences the development and maintenance of the community (Borko, 2004; Guskey & Sparks, 1996), lack of support within the context may hinder any efforts at PD activities (Guskey, 2002). Loucks-Horsley et al. (2003) mention that the context within which PD activities will be implemented shapes the selection, combination, and sequence of the learning opportunities provided.

Inner layer

Facilitators

Activities ←→ Teachers

Outer layer/Context
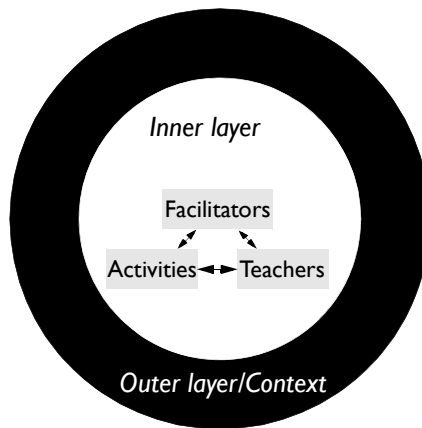
Figure 5.3 The outer and the inner layer of community as an organizational development (adapted from Borko, 2004)

5.2.2 Analysis of conditions
For the establishment of the community of teachers as a change in the educational system, it is important to ensure that conditions are fulfilled by all educational actors to enable teachers in their PD activities. Therefore these conditions need to be analyzed. In this study the IAC model developed by Havelock and Huberman (1978) is used as a means to analyze whether the conditions are fulfilled. This model can provide a comprehensive look at three interrelated conditions for building a system for an educational change. The conditions are clustered in Infrastructure (I), Authority (A) and Consensus (C). For the purpose of this study, indicators are formulated for these conditions to enable teachers to conduct their professional activities in their community.

Infrastructure (*I*) is a "procedural configuration" (Havelock & Huberman, 1978, p. 76) that refers to "the efficiency of the entire problem-solving mechanism, the manner in which the system processes its needs, defines the problem in operational terms, elaborates solutions for the problem and, in particular, implements those solutions" (Havelock & Huberman, 1978). Understanding this definition, in this study two indicators of

Infrastructure are related to the availability of material and non-material support to allow teachers to conduct their PD activities in the community. Supportive policy, availability of facilities, and provision of time are among indicators of Infrastructure that have been widely acknowledged to support such activities (Loucks-Horsley, Stiles, & Hewson, 1996; Loucks-Horsley et al., 2003; Yager, 2005). Included in Infrastructure is resources, which includes the availability of trained people, a good technical and communications infrastructure, and financial support (Havelock & Huberman, 1978). Particularly important for indicating Infrastructure, according to Havelock and Huberman, is whether the implementation of the change is rapid and reliable; e.g. funding is delivered on time and in sufficient amount, facilities are available when needed, meetings are organized, trained people are available to assist (Havelock & Huberman, 1978).

Authority (*A*) is determined by "authority" or control that gives direction to the problem-solving cycle. Authority is the first element of "optimal political condition" (Havelock & Huberman, 1978). A high level of authority means "there are people (not always the same) who are making certain that a need is recognized, the problem treated, some solutions found and that there is follow-through in the course of implementation" (p. 76). In respect to this study, Authority implies the mechanism of control that ensures people perform in line with the activities of the community. The mechanism of control can be determined from roles or tasks of different groups of actors involved in the community. These roles or tasks are closely related to the infrastructure needed. The roles can vary and are determined by all actors involved in the community. Indicators of conditions of Authority, therefore, are shown by clear roles and by the accomplishment of tasks, as initially defined for each group actors involved in the community.

Consensus (*C*) is determined by agreement and commitment among the actors involved. As a second element of "optimal political condition" (Havelock & Huberman, 1978), Consensus is a signal of motivation and interest of every actor (Marsh, 1990). A high level of Consensus means "people involved in a large-scale innovation [...] agree on its objectives and with the way it is being carried out". If actors are motivated and interested in a change, for example, it is likely that serious measures will be initiated to make the change successful. Consensus is important, for it builds responsibility, ownership and commitment among the actors (Carver & Neuman, 1999; Havelock & Huberman, 1978; Marsh, Day, Hannay, & McCutcheon, 1990).

The conditions of Infrastructure, Authority and Consensus are necessary for a change to meet its objectives. By analyzing these three conditions, it is expected to have a comprehensive analysis of the conditions for creating a continuous improvement that in the end leads to the objectives.

5.3 Research approach

The participatory design approach (PDA) is often discussed in the field of human-computer interaction and computer-supported cooperative work (Penuel et al., 2007; Spinuzzi, 2005). Within these fields, four aspects of participatory design are determined; the designers-researchers, the users, the process, and the designed system. The designers-researchers most of the time hold the accountability and responsibilities for decision making on a design (Penuel & Gallagher, 2009). The users are an important source of the knowledge with which a designed system is built. The involvement of these users is critical in the participatory design since the designed system will be used by them and thus should be beneficial for the users. An iterative process is applied in the PDA: exploring the current situation where problems occur or opportunities are identified, designing a system, implementing and evaluating the application of the system (Penuel, Roschelle & Shechtmann, 2007; Spinuzzi, 2005). The designed system is the product of the PDA that can be presented in the form of artifacts, systems, work organizations, and practical and tacit knowledge (Spinuzzi, 2005). This designed system is constructed from the knowledge developed and used by the participants that can be explored and understood through the practices and interactions of the users (Spinuzzi, 2005).

The participatory design approach (PDA) in this study is inspired by the above description of this approach. The four aspects described above are adapted for the purpose of establishing a community of teachers and fulfilling conditions for teachers' PD activities. In this study the designer-researcher is considered a facilitator. As in the participatory action on which PDA is based, this person facilitates the PDA and thus does not hold the responsibility for decision making. In this study the users in the PDA are the local educational actors involved in the community. Regarding the nature of the decentralized educational system, these actors have their own responsibilities for any of their attempts at development, including establishing the community. Within this group of actors, teachers are particularly important as they are the targeted beneficiaries of the community. The voice of the teachers therefore needs to be taken into serious consideration. The iterative process in this study is defined to have three stages; planning, implementing, and evaluation. All actors are involved in this process which is to be facilitated. The design in this particular PDA concerns the design of a model for the establishment of a community of teachers that can fulfill the conditions for teachers' PD activities. The components of the model are the product of agreements of the actors involved.

The structure of the design, resulting from the PDA, is inspired by the work of Prins and co-workers (Prins, 2010; Prins et al., 2011), Meijer (2011) and Van den Akker, Gravemeijer, McKenney and Nieveen (2006). Prins, Meijer and co-workers use a structure with three components in their design, namely; strategies, effects (in this study

the intended improved conditions), and arguments, as shown in Figure 5.2. The three components in Figure 5.2 describe a design model in a nutshell in which strategies and arguments are used to establish the intended favorable conditions that enable the teachers, as the most targeted beneficiaries, to conduct their PD activities. Since this design model is focusing on the strategies and the intended conditions, it is defined as a model combining Strategies (S) and Intended Conditions (IC), in short the SIC model (see Figure 5.2).
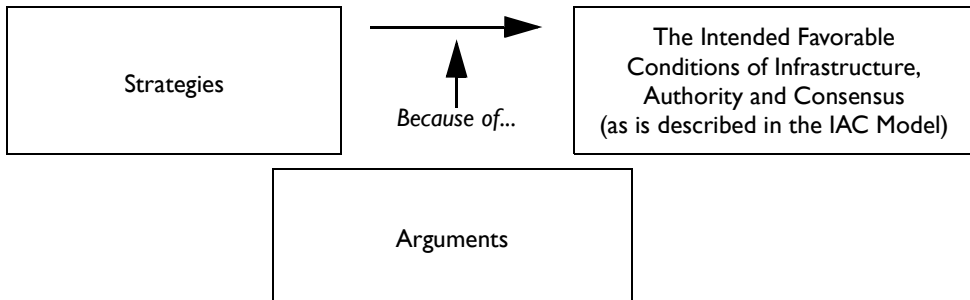
Figure 5.4 The model with Strategies (S) and Intended Conditions (IC): the SIC model

Within the process of the PDA, the design of a concrete specification of the SIC model is the product of the planning stage. In the implementation stage, strategies formulated in the specification of the SIC model are expected to be implemented. The evaluation stage involves the analysis to what extent the intended conditions are fulfilled. The results of this analysis will be considered in the decision making about adapting the specification of the SIC model for the next cycle. Therefore, in addition to analyzing the conditions, the evaluation stage is also meant to provide input for the planning stage of a next cycle. This iterative process of PDA is expected to lead to improved functioning of the community and to the intended favorable conditions.

5.4 Scope and Research Questions

This research study is situated within a newly established community of chemistry teachers of *madrasah* in a district in Indonesia. This community was built by a group of chemistry teachers in response to a call by the central Ministry of Religious Affairs (MORA). Three groups of educational actors participated in the development of this community, namely, the MORA official at the district office, the principals, and the chemistry teachers of (senior secondary) *madrasah* in the district. The teachers decided to involve the MORA official and the principals within the community as being important educational actors.

The participatory work of the educational actors was conducted in a first cycle and a second cycle. Each cycle consisted of three phases: planning, implementing, and evaluation. The planning stage of the PDA in the first cycle was conducted and is reported in Chapter 4. In this planning phase, the SIC model was fulfilled with agreements of the actors in relation to the strategies, their arguments, and the intended conditions (Figure 5.3). The current study will present the results of the implementation of the strategies and the evaluation of conditions in the first cycle, and the results of the planning, implementing, and evaluation in the second cycle (Figure 5.3). The planning stage of the second cycle has resulted in adapting the strategies and accordingly adding additional indicators as shown in the SIC model for the second cycle (in Figure 5.4 marked with "*"). Considering the two cycles and the specific SIC models of the two cycles, the aim of this study is to investigate the facilitation of a community of teachers that was established through participatory work of the educational actors. They worked on defining and implementing strategies in order to provide favorable conditions for teachers' PD activities. Thus, the research question addressed in this study is:

To what extent were the intended favorable conditions fulfilled, what strategies were implemented, and in what way?

Figure 5.5 The gray area presents stages of PDA conducted and studied in this paper.

Strategies

1. Giving a legal status to the community (strategy: legalization)
2. Providing recognition for teachers' participation (strategy: recognition)
3. Providing accommodation for teachers' activities (strategy: accommodation)
4. Providing incentives for teachers and the experts (strategy: incentives)
5. Providing time for teachers' activities (strategy: time)
6. Facilitating boundary crossing among the actors (strategy: facilitating)*

Result in ...

Because ...

Intended favorable conditions (cf. the IAC model)
Infrastructure (I)
Indicators:
I.1 A legal document of the community of chemistry teachers is available
I.2 A certificate of teachers' participation is provided
I.3 (Accessible*) accommodation for regular teachers' activities is available.
I.4 There are enough incentives for the teachers and invited experts
I.5 The teachers are given a regular day off on Saturdays

Authority (A)
Indicators:
A.1 The principals are responsible for managing teachers' teaching schedules, budgeting for incentives for teachers and experts, and providing a place and facilities for teachers' activities
A.2 The MORA officer is responsible for issuing the legal document for the community of chemistry teachers and provide teachers' certificates of participation
A.3 The teachers are responsible for helping the MORA officer and the principals to accomplish their tasks: providing the structure of the community, schedule of activities, and report of activities (including list of attendance).

Consensus (C)
Indicators:
C.1 The realization of the strategies and the actors' tasks.

Arguments
1. A legal document serves as an acknowledgement of the existence of the community. The legalization could allow the teachers to search for other sources of funding. For the principals, the legal status of the community helps them to allocate their budget for teachers' activities.
2. The certificates of teachers' participations are required for the certification of teachers and accreditation of *madrasah*.
3. The certainty of a place with necessary facilities, such as black board, projector, screen and other stationeries is important for the regular learning activities in the community.
4. Financial assistance is important to compensate for teachers' participation and to allow more teachers to participate in the community. Financial assistance is also needed to pay the invited experts.
5. Due to long distances between the *madrasah* in the district, the activities of professional development cannot be done within teachers' teaching time.
6. Since the actors involved had different hierarchical status, facilitating boundary crossing among the actors would blur the boundary and thus allow the actors to implement the strategies better.

The "*" appears in cycle 2

Figure 5.6 The specification of the SIC model of organizational support for the first and the second cycle as a result of participatory design work of all educational actors involved.

5.5 Method

5.5.1 Participants

All essential groups of educational actors in the district participated: the ministry (MORA) official of the district, the principals of both public and private senior secondary *madrasah*, and the chemistry teachers of the *madrasah* in the district. Data were collected from one ministry official, five principals, and eleven teachers involved in this study.

5.5.2 Data collection and analysis

The data collection and analysis were focused on the strategies and intended conditions as presented in the specific SIC model of each cycle (Figure 5.3). Given the aim of this study, mainly qualitative data were collected in each cycle: observations, interviews, report of a group discussion, and written responses. The data from the observations were collected during and at the end of each cycle. The observation data were compiled from notes on the strategies that were implemented by actors and the extent to which the conditions were fulfilled. The semi-structured interviews were conducted at the end of each cycle. Such interviews were chosen to gain in-depth and structured responses of actors. A MORA official, three principals (two public, i.e. PRNCPL-1 and PRNCPL-2, and one private, i.e. PRNCPL 3), and three teachers (two public, i.e. TCHR-3 and TCHR-4, and one private, i.e. TCHR-7) were interviewed in the first cycle; the same official and the two principals of public *madrasah* were interviewed in the second cycle. Information from the teachers in the second cycle was gathered through a group discussion, conducted in a group of eight teachers in order to grasp more open and representative views of the teachers. Figure 5.5 provides examples of questions of the semi-structured interviews and the discussion. Each interview lasted for about 30 to 45 minutes and was managed in the same manner: starting with the introduction by the researcher, the purpose of the interview, and general remarks about questions to be asked. The discussion lasted for 90 minutes. In addition to the above data, written responses of the teachers about the facilitator were also collected. This method of data gathering was considered appropriate to explore free responses of the teachers as the facilitator was also the researcher of this study.

To analyze the data, this study uses an interpretative analysis as described by Smith and Osborne (2008). Aiming at making sense of the world being studied, such analysis attempts to explore personal perception of the participants in relation to their experiences of an event. This analysis is underpinned by theoretical notions describing that there is a connection between what people say and their way of thinking and acting. Therefore, the researcher's involvement in the world of the participants combined with closer interaction with them (interviews) may help to interpret the world being studied and the participants' perceptions about it.

Infrastructure
Was the **accommodation** sufficient?
   If Yes, to what extent?
   If No, why not? How to make it better?
Were you given time off teaching (in the *madrasah* schedule) on Saturday?
   If Yes, did you go for professional activities? How frequent? Why?
   If No, why not? Did you talk to your principal?
Authority
What do you think about **the principals**? Did they accomplish their tasks?
   If Yes, are you satisfied?
   If No, why not? How to make it better?

Figure 5.7   Sample of questions in the interviews and discussion

With respect to the conditions, the procedure of analysis involved three major steps. In the first step, all recorded interviews and the discussion were transcribed verbatim by the researcher. She also typed the data from the observation notes and the written responses of the teachers and transcribed the interviews to make an electronic version of the data in Microsoft Word. Next, the researcher and one critical friend separately read and coded the data. This critical friend was a PhD student who was well acquainted with data analysis in the educational field. In principle, the data were grouped in nine and eleven themes for the first and second cycle respectively. Five and six themes were related to conditions of Infrastructure, three and four themes to Authority and one to Consensus (see Figure 5.3). While reading for the first time, texts in the data were coded by highlighting them with different colors representing different themes. Themes for coding were based on the intended conditions of each of the cycles; nine themes of coding for the first cycle (legal document, certificate, accommodation, incentive, time, principal, official, teacher, and commitment) and two additional themes of coding for the second cycle (communication and facilitator). Once the coding has been finished, a second reading was conducted, aimed at verifying that there were no missing texts that should be highlighted and the highlighting was done correctly. The highlighted texts were then grouped in a chart according to the each of the themes. This grouping chart was made in the same file as the transcript or note. This allowed a back-up result of the grouped texts from the respective source of data. The texts in each of the themes as presented in the chart were copied and pasted onto a recapitulation table of themes located in a different file (see Figure 5.6). In this way, it was possible to view all the participants' responses within a particular theme. The recapitulation tables of both the researcher and the critical friend were then compared. The agreement of the content of the table was measured by calculating the percentage of similar content statements of both coding. This was above the lower limit for a substantial level of agreement (80%; Miles & Huberman, 1994).

Recorded interview with TCHR--3 in cycle1
Was the accommodation sufficient?
Well, yes, it (the accommodation) was fair enough. The principal was supportive. Whenever he had time, he ensured whether we had what we wanted. There was a laptop offered by the principal. Even in the first meeting, he was busy helping us with an extension cable for the laptop outside the classroom, because the plug in the classroom did not work. However, the classroom was so hot, even though the door and the windows were open. We were always busy fanning ourselves and to be honest I myself could not fully concentrate. But I heard the principal said that he planned to install air-conditioned apparatus here, because this classroom was planned to be reactivated again for an engineering lab. I think if it was possible, we could ask to the principal whether we could have the room for our regular meeting.
...
----------------------------- END OF TRANSCRIPT - TCHR-3 cycle1---------------------
Grouping Highlighted Texts

Accommodation
It (the accommodation) was fair enough
There was a laptop
The classroom was so hot
We were always busy fanning ourselves, and to be honest I myself could not fully concentrate.

Principals
The principal was supportive (for accommodation)
The principal offered a laptop
He ensured whether we had what (accommodation) we wanted

Grouping to themes, cycle-1

Participant's code	Theme: **Accommodation**
TCHR-3	*It (the accommodation) was fair enough*
	There was a laptop
	The classroom was so hot
	We were always busy fanning ourselves, and to be honest I myself could not fully concentrate.
TCHR-4	
TCHR-7	
....	

Participant's code	Theme: **Principals**
TCHR-3	*The principal was supportive (for accommodation)*
	The principal offered a laptop
	He ensured whether we had what (for accommodation) we wanted
TCHR-4	
TCHR-7	
....	

Figure 5.8   An example of highlighting and grouping interview texts from a transcript

The second step in the analysis was the interpretation and judgement of the data on the intended conditions. This analysis was carried out by the researcher and one of her supervisors, who was well acquainted with chemistry education and innovation processes. The judgements were scored as completely fulfilled (+), incompletely fulfilled (±), and not fulfilled (-). These judgments were based mostly on the extent of the teachers' perspectives on the availability and usefulness of the conditions involved. The completely fulfilled conditions (+) were determined by teachers' expressions such as "very happy", "very satisfied". In addition, teachers also mentioned the fulfilled conditions, such as, the presence of certificates for teachers. Incompletely fulfilled conditions (±) were determined when teachers expressed disappointment when only parts of the conditions were perceived to be fulfilled, e.g., the accommodation was available, but uncomfortable due to insufficient air circulation. Another instance was that only some principals gave Saturday off for teachers, while it was expected that all principals did that. An example of the non-fulfilled conditions was that certificates were not available. In this judging, both researchers used an interpretative perspective adapted from Smith and Osborn (2008). The initial interpretation and judgment was determined by the first researcher. This interpretation and judgment was then reviewed by the second researcher together with the first researcher for final decision.

The third step in the analysis involved the strategies. The first researcher did the analysis with a second and third researcher. Similar to the analysis of conditions, the analysis of strategies was also conducted from an interpretative perspective adapted from Smith and Osborn (2008). The researchers first discussed the texts for each theme to reach agreement on a thorough understanding of the data. Then the researchers further interpreted the data to assess the extent to which the strategies were implemented and did influence the teachers' learning activities. The result of these interpretations was then used to answer the research question.

5.6 Results

This section is structured as follows. First, the extent to which the conditions were fulfilled in the first cycle will be described. This is followed by a reflection on the strategies implemented by the actors in the first cycle and an elaboration of the need to have new strategies for the second cycle. Next is the description to what extent the conditions were fulfilled in the second cycle. Finally, a reflection on the strategies as implemented in the second cycle is given. Table 5.1 provides a summary of the extent to which the intended conditions were fulfilled in both the first and the second cycle.

5.6.1 Conditions and strategies in the first cycle

None of the conditions was completely fulfilled as intended in the SIC model for the first cycle (Table 5.1 and Figure 5.4). Most of the conditions were incompletely fulfilled. Of the

five conditions of Infrastructure, three were incompletely fulfilled, namely, availability of accommodation for the activities, sufficient incentive for teachers and invited experts, and time-off from teaching on Saturday. The teachers preferred accommodation for their activities in a *madrasah* located at the center of the district. It was argued that more teachers would have attended the activities if they were conducted in an easily accessible location.

Even though the incentives were relatively sufficient, in the interview all teachers said that their incentives were still below their expectation from what had been agreed with the principals, and that that this contributed to the decreasing number of teachers participating (Figure 5.7). The requirement to provide time was also incompletely fulfilled. Only the teachers of public *madrasah* were given time off from teaching on Saturday (interviews). Therefore, throughout this cycle, it was observed that the participation of teachers of private *madrasah* decreased while teachers of public *madrasah* relatively regularly attended the activities (Figure 5.7). Two conditions of Infrastructure were not fulfilled, i.e., the availability of the legal document and the certificates of participation for the teachers. The first one was in fact fulfilled at the end of the first cycle. Because the legal document became available so late, the community could not make a budget proposal to the principals, which in turn led to insufficient incentives from the principals (teacher interviews). Because there was no report of the activities, which was needed for issuing certificates of participation, a second condition for Infrastructure was not fulfilled.
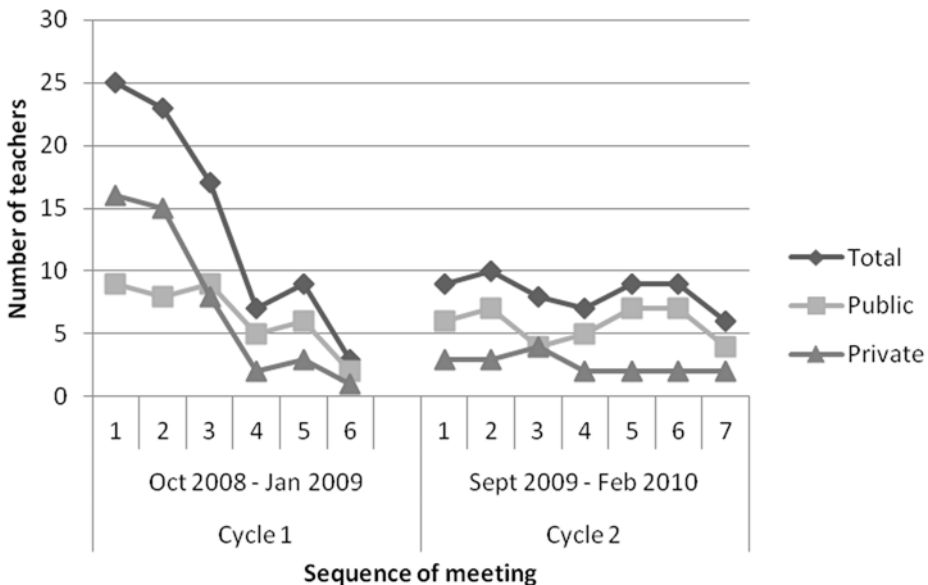
Figure 5.9 Numbers of teachers attending the activities in the first and second cycles

Some excerpts from the interviews illustrate the teachers' insights described in the conditions of Infrastructure.

"*Except for the chemistry experiments, I think it is better to have activities in madrasah [B]. Since madrasah are spread from east to west, I think madrasah [B] is more accessible for most of our teachers.*" *(TCHR-4)*

"*I think the incentive was quite a sensitive issue. It was not clear why the principals could not provide us sufficient financial assistance but for me it is clear that because of lack of incentives, teachers were reluctant to come.*" *(TCHR-4)*

"*I already told my principal about the agreements we made in the planning [the designed SIC model of the first cycle, Chapter 4], particularly in relation to the teaching schedule for chemistry teachers. My principal agreed to consider the scheduling but she could not promise to provide it for me. And in fact, I was still assigned to teach on Saturdays. (TCHR-7)*

Table 5.1 *The extent to which the intended conditions were fulfilled in cycle 1 and cycle 2*

Intended conditions	Cycle 1	Cycle 2
	Achievement	Achievement
Infrastructure		
1. A legal document of the community of chemistry teachers. is available; using this document more financial assistance* is provided	**-** The legal document was established at nearly the end of the first cycle. The budget proposal for teachers' activities could not be sent to the principals.	**±** The legal document was available and attached to the budget proposal. This was sent to the principals and to MORA at the beginning of the cycle. The principals through MK2MA responded to the proposal by determining budget for teachers' activities. No grant was given from MORA at the national level.
2. A certificate of teachers' participation is provided	**-** Certificates of teachers' participation were not yet provided because reports of the teachers' activities were not yet available.	**+** The certificates were issued for ten teachers who regularly participated in the activities (80% of attendances). These certificates have been used for completing teachers' portfolios for the purpose of certification and accreditation process.

Intended conditions	Cycle 1	Cycle 2
	Achievement	**Achievement**
3. (Accessible*) accommodation for regular teachers' activities is available	**±** Accommodation was sufficiently provided for the activities. The activities were conducted in two *madrasah*. *Madrasah* A; located in the center of the district, the facilities were completed (screen and laptop), but the classroom was hot. *Madrasah* B; the location was quite far from the district center, the facilities were complete with chemical equipments and substances. Each teacher was given two free books as sources for further learning.	**+** The activities were conducted in *Madrasah* A, located in the center of the district. An air-conditioned classroom. The laptop and screen were available but used only during the meetings when the experts were invited. The invited teachers came regularly.
4. There are enough incentives for the teachers and invited experts	**±** The incentives for the teachers were sufficient. These incentives came at every meeting from two sources; the principals through the MK2MA gave snacks, lunches and incentive for the experts; the facilitator gave money for traveling costs.	**±** The incentives for the teachers were insufficient. A limited semester budget for teachers' activities was avaliable. The rest of the budget, also needed to invite experts, was provided by the facilitator. Due to insufficient budget, only a limited number of teachers could be invited to the activities.
5. The teachers are disengaged from teaching on Saturday	**±** All teachers of public *madrasah* were released from teaching on Saturday. Yet, not all the teachers participated in the activities. No private teachers were released from teaching on Saturday. The activities were scheduled and realized according to the schedule.	**±** The teachers of public *madrasah* were released from teaching on Saturday. No fixed schedule of activities developed by the teachers at the beginning of this cycle. A lower frequency of teachers' activities took place despite the release from teaching on Saturdays

Intended conditions	Cycle 1	Cycle 2
	Achievement	**Achievement**
Authority		
1. The principals/the MK2MA	**±** Only the principals of public *madrasah* released their chemistry teachers from teaching on Saturdays. The principals whose *madrasah* were used for activities provided necessary facilities for the teachers. The principals through MK2MA provided teachers with snacks and lunches and paid the expert's additional travel cost. The MK2MA facilitated the teachers to send invitations for the activities to each of the principals in the district. The MK2MA sent the structure of organization of the community to the MORA official.	**±** Only the principals of public *madrasah* participated is supporting the teachers' activities in this cycle. The principals had to be reminded to release their teachers from teaching on Saturday. MK2MA sent invitations to each of the principals regarding Saturday as chemistry day. The principal of the madrasah in which the activities were conducted gave a better classroom for the activities, i.e., air conditioned room with screen and laptop. MK2MA who represented the principals responded to the teachers' proposal and decided to provide a budget for all teachers' activities at the beginning of the cycle. The head of the MK2MA signed the teachers' reports of activities as recognition for teachers' activities.
2. The MORA official	**-** It took quite a long time for the MORA official to establish the legal document for the community of teachers. The certificates of participation were not issued by the official because no reports of activities by the teachers were available at the end of this cycle.	**+** The MORA official issued certificates of participation to the teachers based on the report of activities given by the teachers.

Intended conditions	Cycle 1	Cycle 2
	Achievement	**Achievement**
3. The teachers	±	±
	The teachers formulated the structure of organization of the community right after the first meeting (as expected) and sent it to the MORA official through the MK2MA and the facilitator.	The teachers gave the MORA official the report of activities.
		The teachers invited their colleagues to attend the activities.
	The teachers developed a schedule of activities at the beginning of the cycle and carried on the activities as scheduled.	The teachers managed their budget for this cycle and tried to gain more financial assistance.
		The teachers worked to ensure the availability of accommodation.
	The teachers did not make a report of their activities at the end of this cycle because they wanted to report on two cycles instead of one.	The teachers reduced the frequency of the activities.
4. The facilitator	<u>Not planned</u>	±
	The facilitator facilitated communications between the teachers and the principals; facilitated meetings with representatives of the teachers regarding the availability of accommodation (classrooms and facilities) for activities in both madrasah and incentives for the teachers and the expert.	The facilitator facilitated communication between the teachers and MK2MA as a representation of the principals in relation to the incentives and accommodation.
		The facilitator discussed the budget proposal of the teachers with three principals.
	The facilitator helped the teachers with minimum travel costs in addition to snack and lunches given by MK2MA.	The facilitator called individual principals to remind them about the chemistry schedule on Saturday at the beginning of the semester in which teaching schedule was developed.
		The facilitator provided additional financial assistance.
Consensus		
1. The realization of the strategies and the actors' tasks	±	±
	The actors tried to be committed to what had been agreed; yet the efforts taken were not sufficient to fulfill all the intended conditions.	The actors tried to be committed to what had been agreed. Even though there were conditions remained unfulfilled, the actors tried to maintain the existence of the community.

+ Completely achieved, ± incompletely achieved, - not achieved

The "*" appeared in cycle 2

Note: MK2MA is a district-based working group of principals of secondary *madrasah* in which all the principals of *madrasah* in the district automatically became members of the group.

The conditions of Authority were incompletely fulfilled. It was observed that none of the actors fully completed their tasks. In the interviews the teachers reported that it was a major achievement that the principles rescheduled the teaching schedule to provide one day off duty (Figure 5.6, strategy 5: time). However, this strategy was not implemented for the teachers of private *madrasah*. The principal of a private *madrasah* reported that re-scheduling and enforcing teachers to participate in the community was rather difficult since these teachers were non-permanent employees and often worked at one or more other places (interview). Regarding the principals' task of providing accommodation, two classrooms in two different *madrasah* were provided. The accommodation became available after the facilitator asked the principals for it (interview; Figure 5.6, strategy 3: accommodation). Prior to the start of the meetings, a representative of the teachers and the facilitator approached the principals of *madrasah* whose classrooms would be used for activities, to ensure that the accommodation and necessary facilities would be available (observation). Issuing a document for the legalization of the community took quite some time (task of the MORA official). The official said that it was difficult to provide the legal document (Figure 5.6, strategy 1: legalization) due to a complicated procedure involving organizational structures of the other communities of teachers within the *madrasah* in the district. The certificates of recognition for the teachers' participation did not become available. The MORA official argued that there was no report of the activities from the teachers for which the certificates could be issued (observation; Figure 5.6, strategy 2: recognition). The teachers carried out the majority of their agreed tasks, except for reporting the activities to the MORA official. However, they did take initiatives to accelerate and ensure the other actors' works on their tasks (observation).

Some excerpts of the interviews illustrate the results on the conditions of Authority:

> "*We just noticed that we had to include the structure of teachers' communities of all subject matters in the legal document. However, the other communities have not been established yet. It took time for us to ensure that all communities were covered in the document.*" (MORA)

> "*To be honest we were not ready to finance the teachers' activities. Yes we do have some budget for PD, but we need to consider other teachers as well. So, we could not really count how much funding we should provide for these chemistry teachers.*" (PRNCPL-1)

> "*We have given the MORA official our organizational structure. However, the legal document was not ready when we expected it.*" (TCHR-4)

Regarding the condition of Consensus, it can be inferred from the extent of fulfilling the conditions of Infrastructure and Authority that the actors did not fully commit to the agreements they had decided. However, they made an effort to implement the strategies in order to fulfill the conditions. For example, since the principals were not ready to fund the activities (Figure 5.6 strategy 4: incentives), they released some of their shared funds for the working group of *madrasah* of the district (*Musyawarah Kelompok Kerja* Madrasah *Aliyah*, MK2MA) to support the activities financially. All principals of senior secondary *madrasah* were members of this working group. Another example was the activity of the teachers when they had difficulty in communicating with the principals regarding the availability of incentives and accommodation. The teachers then asked the facilitator to help them to approach and ask the principals to confirm the availability of the incentives and accommodation. Since the incentives were not sufficient, the teachers asked the facilitator for any possible funding source. One teacher said in the interview that without the help of the facilitator, their activities might not have been successfully implemented.

5.6.2 Reflection on the strategies in the first cycle

The results of the evaluation of the first cycle (Table 5.1) show that the strategies have not completely been implemented. These strategies were related to the conditions of Infrastructure, specifically the incentives and accommodation. Different considerations should be taken into account to improve the conditions in the second cycle. It was considered that to provide the incentives and to acquire the accommodation and facilities from the principals, teachers needed some help in their communication with the principals. The facilitator should support them in this communication, particularly, as the teachers explained in the interview, about a timely response from the principals on the incentives (how much funding the teachers would get) (teacher interview). The teachers were hesitant to ask the principals directly for support. Since the facilitator had been shown to be able to cross the boundary between the actors, this facilitating was used explicitly by the actors as a new strategy to improve the conditions in the second cycle (Figure 5.6, the sixth strategy). The explicit implementation of this strategy took place in the second cycle.

Two indicators for the conditions were described more precisely to analyze the achievements in the second cycle. The first indicator regarded the legal document, to be used to raise more financial assistance from the principals and from MORA at the national level. The second indicator regarded the accommodation: the teachers expected the activities to take place in an accessible location. With the additional strategy and the more precise description of two indicators, a new specification of the SIC model for the second cycle was generated. Figure 5.6 presents this model, in which the * sign indicates additional considerations for the second cycle.

5.6.3 Conditions and strategies in the second cycle

Table 5.1 shows that in the second cycle the IAC conditions were to a large extent fulfilled. Three conditions were completely fulfilled but others remained incompletely fulfilled. The availability of certificates for teachers' participation and the availability of accommodation, both regarding the conditions of Infrastructure, were now completely fulfilled. In the group discussion the teachers said that they added the certificates to their portfolios for their certification and the *madrasah* accreditation process. The teachers hoped that these certificates would add to their credits points in both certification and accreditation. In the group discussion the teachers also explained that the location and the accommodation for their activities were much better for them in terms of accessibility. They stated that the air conditioning installed in the classroom made it much better for their activities than previously.

The conditions of Infrastructure that were incompletely fulfilled were related to the incentives: the budget proposal, the certainty about the amount of the incentives, and the incentive-related communication of the actors. The teachers received less incentives than in the first cycle. This situation created a problem for the teachers. Because of the limited incentives, it was decided to invite a limited number of teachers to participate in the activities (see Figure 5.7). The condition concerning the teachers' release from teaching on Saturdays was not completely fulfilled. Although the teachers of public *madrasah* were released from teaching on Saturday, more (seven) activities were carried out in this second cycle than in the first cycle (six) because the second cycle lasted longer (six months) than the first (three months), and so in a lower frequency (Figure 5.7). The teachers of public *madrasah* argued that it was difficult to find a time that was suitable for everyone. However, one teacher explained that lack of activities was also because the teachers were hesitant to conduct more activities due to insufficient incentives. This also explained why there was no exact schedule of activities in the second cycle.

The following excerpts from the discussion illustrate the views of the teachers.

"We had the legal document, but we still could not get the financial assistance we expected." (TCHR-7)

"I know that we conducted fewer activities in this cycle [at a lower frequency]. But you have to understand that allowing these activities to run was already a great effort from us. With the limited amount of money we were still able to conduct some activities. The principals should see our serious attempts to make this community meaningful for us." (TCHR-3)

Regarding the conditions of Authority, only the MORA official fully accomplished his tasks, according to the teachers. Once the teachers gave a report of activities to the

MORA official, their certificates were made available (observation). The official stated that this was not difficult, because the teachers delivered their report and the draft of the certificates. This made the work of the official easier (Figure 5.6, strategy 2: recognition). The use of the legal document did not provide the expected result: gaining more financial assistance (Figure 5.6, strategy 1: legalization). The proposal was sent to MORA at the national level, with the legal document attached, but the teachers did not get any response. In addition the proposal sent to the principals did not get a satisfactory outcome either.

The other actors partially accomplished their tasks and this resulted in an incomplete fulfillment of the conditions (observations). The principals did not automatically accomplish their agreed tasks. In scheduling the lessons of the teachers, for example, the principals were reminded by the head of the working group of principals (the MK2MA), and the facilitator through telephone communication and the invitation letter about the teachers' participation (Figure 5.6, strategy 5: time). The principals were reminded so that they would release the teachers from Saturday teaching. Direct telephone communication with the facilitator (Figure 5.6 strategy 6: facilitating) in particular, significantly influenced the principals in maintaining the teachers' schedules with Saturdays free (interviews with two teachers). One teacher in the group discussion mentioned that his principal had already scheduled him for teaching on Saturdays before the invitation letter came.

The principals' task related to the availability of incentives was taken very seriously by the teachers. Just before the second meeting of the activities, the principals had not yet decided as to how much money they would provide to the teachers (observation). The facilitator was asked by the teachers to communicate this incentive issue to the principals (Figure 5.6, strategy 6: facilitating). After talking to the facilitator, the principals, through the head of MK2MA, decided to give the teachers a budget for their activities for the whole cycle (Figure 5.6, strategy 4: incentives). This financial arrangement was different from the one during the first cycle: in the second cycle less money was provided, even when the teachers had one more meeting in the second cycle. In three meetings experts were invited (Table 5.1). The teachers carefully managed their money, because the resources were limited. For example, in order to allow the activities as they wanted, they decided not to have the travel cost. As a result, during the activities, the teachers were only provided with snacks and lunches. In addition, this limited budget forced the teachers to limit the number of teachers participating in the community. Only teachers who had regularly participated in the previous activities (approximately nine teachers) were invited to the activities of the second cycle. Only two of these teachers were from private *madrasah*. To finance the experts, the teachers sought additional funding together with the facilitator. The teachers decided that the expenses for the experts should be shared with the facilitator: the teachers provided

snacks and lunches and the facilitator provided the other incentives for the experts.

Excerpts of the interviews illustrate the actors' insight about these conditions.

> "*For the time being, we could only afford to give this amount of money to the teachers. During the activities, it was still possible that they would receive more. The principals have not decided clearly how much they should give to the teachers. Most of them think of other [non-chemistry] teachers since so far they have supported only the chemistry teachers.*" (PRNCPL-1)

> "*I doubt that the principals would not schedule us [to teach] on Saturday if you did not remind them.*" (TCHR-4)

> "*We needed to work with this limited money. It was difficult but it was possible.*" (TCHR-3)

Regarding the condition of Consensus in relation to the conditions Infrastructure and Authority, the actors, particularly the principals, did not completely commit to their agreed tasks, let alone provide incentives (observations). This resulted in some restrictions on teachers' tasks, such as limiting the number of teachers invited and a hesitance to ask the facilitator to help them remind the principals to do the principals' tasks. As a consequence, not only did the teachers have less frequent activities, they also had to limit their expenses.

5.6.4 Reflection on the strategies in the second cycle

Regarding the second cycle, the strategies were not fully implemented by the actors. Relatively similar problems as in the first cycle occurred in this second cycle. For example, for the strategy of incentives and time (Figure 5.6, the strategies 4 and 5) the principals needed to be reminded to give the teachers certainty in providing incentives and time. Particularly for the incentives, late decisions on the financial assistance from the principals and the fact that the assistance had to be limited made the teachers think harder how to manage the money. The new strategy of facilitating boundary crossing among the actors in this cycle (Figure 5.6, strategy 6) helped to fulfill the intended conditions. This was the case in at least in two cases where teachers faced difficulty in dealing with the principals' tasks related to incentives and accommodation.

The extent to which the strategies were implemented in the second cycle needs some additional reflections. The first is related to the incentive. As previously described the principals did not provide sufficient incentives for all chemistry teachers in the district. This made it necessary to think of rescaling the community. This involved the downsizing of the number of teachers participating in the community and keeping only those teachers in the community who had attended the activities in the first cycle relatively

frequently. At least two aims were used in the arguments for rescaling: to optimize the use of the available financial assistance for the teachers' activities, and to build a core group of teachers. The limited funds would only support the activities of a limited number of teachers. And when the activities were carried out by a limited group of the teachers, these teachers could become more of a resource center for their peers.

The second reflection concerned the presence of new actors, e.g., the head of the MK2MA appeared to be important as an actor in the process of the implementation of the strategies. The MK2MA as a body of organized principals was not taken into account in the planning stage of the first cycle. Acknowledging and empowering this MK2MA for the tasks of the principals did help to increase the extent to which the conditions were fulfilled.

5.7 Conclusions and discussion

This study aimed at investigating the facilitation of a community of teachers that was established through the participatory work of educational actors in defining and implementing strategies in order to provide favorable conditions for teachers' PD activities. Using the participatory design approach (PDA) and the clear perspectives of the community and the IAC model for analyzing conditions, this study has developed the SIC model as a tool to structure and implement the strategies and to fulfill the intended conditions as agreed to by the educational actors involved. Considering this, this study answered the question:

> To what extent were the intended favorable conditions fulfilled, what strategies were implemented, and in what way?

In both cycles none of the conditions were fully fulfilled as intended in the specific SIC model for each cycle (Table 5.1). Partially implemented strategies were found to result in incomplete fulfillment of the intended conditions. However, the fulfillment of the conditions was improved in the second cycle, when three indicators of conditions were completely fulfilled. Of the other conditions that were incompletely fulfilled, the incentives and the tasks of the principals as parts of the conditions of Infrastructure and Authority respectively did become the issues of most concern to the teachers. According to the teachers, the lack of commitment of the principals resulted in insufficient incentives provided for teachers to participate in PD activities. This condition influenced the teachers' participation in the community. Availability of time was another indicator that was very important for the teachers. While the teachers appreciated the time given for their activities and considered it as the major achievement for the community, a facilitator was needed to help the teachers to acquire this concession from the principals. From this experience, providing a facilitator has been added in the second

cycle. In the second cycle, the strategies implemented through the involvement of the facilitator resulted in satisfactory fulfillment of the favorable conditions, such as availability of accessible accommodation, certainty of budget given by the principals, and teachers not being scheduled to teach on Saturdays.

The process and the findings of this study involve four important issues that provide considerable contributions to the field of education. The issues are related to the participatory design approach (PDA), the educational actors and the boundary crosser, the IAC model, and the SIC model.

The PDA appeared to be helpful to organize the work of different educational actors involved in a local educational change. It has been widely rcognized that the PDA is used in the field of education where human-computer relations occur, such as, the design of an online community (Carroll, Chin, Rosson, & Neala, 2001), assessment software (Joyes & Chen, 2007; Penuel et al., 2007), and a teaching model (Silva & Breuleux, 1994). The nature of the PDA had both the features of an approach of participatory action and design research which is commonly used in the studies on education, as in the studies of Eilks and co-workers for participatory action research (Eilks & Ralle, 2002; Marks & Eilks, 2010) and Prins and co-workers for a design-based research approach (Prins et al., 2011). Both studies used the approaches, i.e. the participatory action and design based research, especially for collaborative work with teachers to develop a unit of curriculum. The PDA in this study is different in three aspects from both commonly used PDA and participatory action and design based research. First, the PDA is used as a process approach in which human-to-human relations occur. Second, the PDA in this study is applied in the field of a community of teachers where educational actors with different hierarchical status are involved. Third, the PDA strengthens the helpful features of the participatory action and the design research. Considering this argument, the PDA makes a contribution to the field of education, especially when a community of teachers with different educational actors is involved.

The role of each of the key actors including the facilitator as boundary crosser appeared to be important in this study. Regarding these key actors, the results of this study confirm studies that recognized the empowering of these key actors for organizing the PD of teachers. For example, Elmore and Burney (1997), as reported by Loucks-Horsley and Matsumoto (1999), found that giving much attention to the key actors who can influence the PD activities, such as the principals, resulted in an exemplary PD of teachers in a New York Community School in which support was given to sustain the community. They even consider the emphasis on the key actors as "a general principle of action" in the PD of teachers (Loucks-Horsley & Matsumoto, 1999, p. 266).

The findings in this study on the boundary crosser support the study of Lauffer and Lauffer (2009) who consider the boundary crosser as a "key aspect" of a partnership-based professional learning that determines the success of a community of learning in which different organizations are involved. Lauffer and Lauffer (2009) present four organizational attributes, as developed by Clifford and Millar (2007), as essential for the role of the boundary crosser. These attributes are: being able to reach actors of a higher hierarchical status (decision makers); having a network of supportive educational actors; having a capacity to focus the efforts of educational actors on the intended results; and being given an authority to ensure the work of the actors. This study on the establishment of a community of *madrasah* teachers in Indonesia shows the exemplification of these attributes, which resulted in a satisfactory fulfillment of the intended conditions for this community of teachers.

The model for conditions of Infrastructure, Authority, and Consensus (IAC) of Havelock and Huberman (1978) has been shown to be useful for the systematic structuring of the indicators for the fulfillment of the intended favorable conditions. Accordingly, the IAC model becomes a helpful tool for analysis by looking at each of the conditions of Infrastructure, Authority, and Consensus. The model allows us to review each of the conditions for educational change in a complete picture; this model provides a comprehensive overview of the conditions. Particularly, the role of Consensus is an essential element of any program of educational change (Hubbard et al., 2006), which is a component that is not part of the common models introduced by Rogan and Grayson (2003) and Fullan (2007). This IAC model has not been widely used although it has already been developed in 1978; it appeared to be very useful in this case of a local educational change. Therefore, the experiences with the use of this model contribute to the research field of educational change in a local context.

The developed model for Strategies and Intended Conditions, the SIC model, is a systematic tool to plan and analyze conditions that enable teachers' PD activities in their community in which different educational actors were involved. The visualization of the relation between the strategies, the arguments of the strategies, and the intended conditions were beneficial to systematically structure the results of the participatory work of the actors. Such visualization has previously been used in the field of curriculum development and instructional design (Gravemeijer & Cobb, 2006; McKenney, Nieveen & van den Akker, 2006; Prins et al., 2011; Reeves, 2006). The use of this model in this study and its visualization is new in the field of a community of teachers. It therefore provides a noteworthy contribution for studying communities of teachers, particularly for the planning of the establishment of communities, and in the analysis whether the intended favorable conditions are fulfilled.

This study involved the difficult process of establishing a community of teachers in a decentralized educational system in which local educational actors were encouraged to participate. In addition, fulfilling the conditions to enable teachers to conduct professional activities in the community was a major challenge for both the teachers and the local educational actors who were used to working in a centralized system. The participatory design approach (PDA) was useful to facilitate teachers and local educational actors to establish the community and to fulfill the conditions for the teachers' activities The IAC model and the SIC model proved to be valuable as tools to manage the participatory work of the teachers and the other actors in analyzing and improving the community and the conditions This study was conducted in the setting of Indonesia. However, the PDA and both models are expected to be applicable to other settings. Furthermore, another study is needed on the effectiveness and meaningfulness of the PD activities of the teachers in the described conditions. Following Borko (2004), both the outer layer and the inner layer of PD activities is of essential importance.

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CHAPTER 1 Introduction and overview of the research		
Main Research Question In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?		
Sub-Research Question 1 What are the characteristics of chemistry education and the conditions during the curriculum change?		
CHAPTER 2 Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah* **Research Question** What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?		**CHAPTER 3** The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia **Research Question** What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?
Sub-Research Question 2 In what way can professional development activities of chemistry *madrasah* teachers be facilitated?		
CHAPTER 4 Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah* **Research Questions** 1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers? 2. What indicators of favorable conditions are formulated from the actors' shared agreements?		
CHAPTER 5 Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah* **Research Question** To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?		
CHAPTER 6 Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system **Research Questions** 1. What changes did the teachers perceive after their professional development activities? 2. What PD activities did the teachers perceive to be meaningful for their practices? 3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?		
CHAPTER 7 Conclusions and Reflection		

Chapter 6

Facilitating a community of teachers
A case study of teachers' professional development activities in a decentralized educational system

Abstract

A decentralized educational system provides teachers with flexibility and responsiveness for their professional development activities. This study investigates the professional development activities of teachers that are facilitated in the community through giving the teachers ownership to arrange, enact, and reflect on their activities in order to gain ownership of the activities. In this study, conducted in the context of chemistry teachers of Indonesian Islamic schools (*madrasah*), the teachers reported that such activities resulted in personal, interpersonal, institutional and professional change. The teachers identified specific activities as meaningful for their practices; learning to teach experiments through microteaching and practicing, and learning to develop syllabi through practicing and collaborating. The meaningfulness of these activities was related to the structure of the activities, the help of an expert, and a clear schedule of activities. Three factors were found relevant to sustain the meaningful activities in teachers' practices. These were the role of the curriculum guidelines, the support of the working environment by the principals and colleagues, and the involvement of students. The results are discussed and related to findings both in other studies in this thesis and in other settings.

6.1 Introduction

Decentralization of education has been widely recognized as a relevant effort to boost the quality of education (UNESCO, 2005). A decentralized educational system can provide teachers with flexibility and responsiveness to their own needs for their professional development (PD) activities (Hayes, 2000). The research literature on communities of teachers shows that a community of teachers is an appropriate context for teachers to conduct PD activities (Caine & Caine, 2010; Grossman, Wineburg, & Woolworth, 2001). The PD activities might be directed to an improvement in teachers' understanding of the curriculum policy. In this way, it is more likely that teachers will act in accordance with the policy as expressed by the designers in the Ideal Curriculum. Given this critical role of a community of teachers and the importance of PD activities, it is therefore important to study how a community of teachers and PD activities of teachers are facilitated within an educational system with a decentralized educational policy.

Most PD activities still neglect teachers' interests, inputs and ownership for developing such activities (Fullan, 2007; Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003). This particularly happens in top-down initiated activities of PD or a "bureaucratic approach" (Talbert, 2010, p. 561). As a consequence, often teachers perceive the knowledge or skills gained from these activities as inapplicable for their own practices (Wilson & Berne, 1999). Such activities are considered not to be meaningful by teachers. In addition, such activities often ignore the nature of transformation of the necessary knowledge and skills, which require time and support (Cochran-Smith & Lytle, 1999). Teachers participating in such activities will frequently show "compliance, resistance, and anxiety" (Talbert, 2010, p. 563). However, teachers are expected to perform deliberate actions towards positive changes in and after the PD activities.

Having been a centralized educational system for a long period, the newly decentralized system in Indonesia has brought the government a new challenge of PD when building communities of teachers. Communities of teachers and meaningful PD activities have become a concern of the Indonesian government (Monk & Dillon, 1995; Thair & Treagust, 2003). An ambitious centralized program established in the 1990s has provided a valuable lesson learned for teachers of Indonesia. Even though fully supported by the government, the top-down organized PD activities conducted in the program have gained unsatisfactory results for the teachers. Teaching practices remained the same even though teachers had participated in the programs (Hadi, 2002; Thair & Treagust, 2003). In addition, studies reported that the PD activities were not sustained when the support was withdrawn (Hadi, 2002; Thair & Treagust, 2003; Wahyudi & Treagust, 2004).

Studies in the area of PD show the importance of teachers being the owners of their PD activities, regardless within the sort of educational system the PD activities occur. Such activities owned by the teachers have positive characteristics, such as, ensuring collaboration among teachers within their own community (Burbank & Kauchak, 2003; Erickson, Brandes, Mitchell, & Mitchell, 2005; Gallagher, Griffin, Parker, Kitchen, & Figg, 2011; Little, 1993), active learning (Ingvarson, Meiers, & Beavis, 2005), taking into account teachers' needs and building further on teachers' ownership of their activities (Fullan, 2007; Lee, 2004 & 2005; Loucks-Horsley et al., 2003), and empowering teachers (Stolk, Bulte, de Jong, & Pilot, 2009). Researchers report that these types of activities contribute to the development of knowledge and skills that teachers can apply in practice and perceive as meaningful. In this paper, the term "meaningful PD activities" is used when teachers perceive that their new knowledge and skills are directly applicable to their teaching practice. While the characteristics of such activities have been acknowledged, few studies have investigated how such characteristics are put into practice. In addition, research on incorporating those characteristics (for example, Burbank & Kauchak, 2003; Erickson et al., 2005), is lacking detail on how the teachers are facilitated to carry on their activities.

Having studied the conditions for change in the outer layer of the PD activities (Borko, 2004; Chapter 5) as a response to unfavorable conditions for teachers in the curriculum change (Chapter 3), the challenge of the study in the present chapter is to investigate PD activities in the inner layer to facilitate a community of teachers in which teachers are given ownership to arrange, enact, and reflect on their PD activities. It is considered important to support teachers to give shape to the Operational Curriculum in their new school-based curriculum policy. This may reduce the slippage between the objectives of education as intended by the curriculum designers and what the teachers implement in their practice (Chapter 2). The study in the present chapter should therefore provide new knowledge on PD activities in which teachers' collaborative work and management of their own activities is in a context of decentralization of education.

6.2 Theoretical framework

Communities of teachers for PD activities
The term community in relation to PD of teachers is used in a variety of ways depending on how people describe the community, such as teachers' learning community (MacLaughlin and Talbert as cited by Nelson (2006)), community of practice (Wenger, 1998), and professional learning community (DuFour, 2004). In this paper, the term 'community of teachers' will be used. Adapted from Borko (Borko, 2004), a community of teachers is defined as a system for PD of teachers that is established by a group of teachers together with other educational actors through shared decision making. As a

system for PD, four key elements should be available (Borko, 2004): the PD activities, the teachers who are the learners in the system, the facilitator who guides teachers as they construct new knowledge and practices, and the context in which the PD occurs. Considering the key elements, a community can be determined to have two layers (see Figure 6.1): outer layer and inner layer.
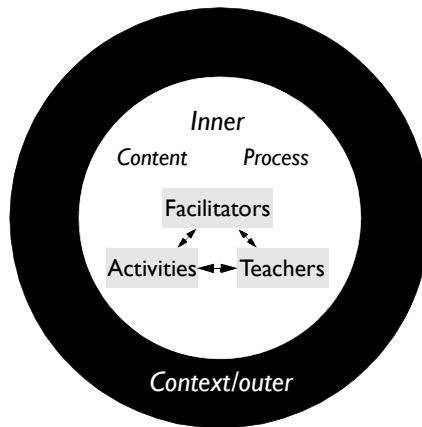
Figure 6.1 The outer and the inner layer of community as an organizational development (adapted from Borko, 2004)

The context or the outer layer is defined as the organizational structure that supports and influences the development and sustaining of the community (Guskey & Sparks 1996); Smith & Gillespie 2007). Actors in the outer layer are those who may stimulate and influence the community, such as policy makers, principals, parents, students, colleagues or other third parties (i.e., external funding agencies). The need for support from the outer layer has been acknowledged in any community of teachers (Avalos, 1998; Singh & Shifflette, 1996; Darling-Hammond & McLaughlin, 1995; Singh & Shifflette, 1996; Loucks-Horsley et al., 2003; Guskey, 2002; Chapters 3 and 5 in this thesis). The inner layer is the focus of this study. It is the core of the community and the most important layer since it represents the activities of PD. Actors of the inner layer are the persons who execute the PD activities: teachers with or without the help of experts in the construction of new knowledge and skills. This layer describes the content and the process that determines the objectives, activities and results of PD.

The content, according to Guskey and Sparks, refers to new knowledge, skills, understanding and attitudes that are developed in PD activities, whereas the process refers to how (by what activities in the community) the content is developed (Guskey & Sparks, 1996). Across studies the content of PD activities varies; the focus can be on subject content and instructional process knowledge (Jeanpierre et al., 2005; Garet et

al., 2001; Birman et al., 2005), specific instructional practices (Desimone et al., 2002; Peers et al., 2003), and on the policy and other professional activities (Birman et al., 2005). While the content of PD activities, influences the extent of support needed by the community (Ganser, 2000), it also determines the willingness of other educational actors to support the activities (Sparks & Hirsh, 1997; St. John, Ward, & Laine, 1999). Sparks and Hirsh (1997) and St. John, et. al. (1999) further stress that the content of PD activities is related to high standards of students' achievement and teacher development and has a straightforward connection to improved practice. Such content is likely to get financial support from the policy makers and the school boards. However, Corcoran (1995) underlines that the content of PD activities must be on issues perceived by teachers and be central in teachers' daily practices. The content of PD activities should not be by force delineated from (externally) offered formulas. Having such content, it is expected that the knowledge and skills gained from PD activities can be applied in the teachers' practice.

The process in the inner layer, according to Guskey and Sparks (1996) concerns not only types of activities but also the way those activities are planned, organized, carried out, and reflected upon. Studies reveal that many types of PD activities can be effective for teachers: collaboration, active learning, reflection with or without colleagues, opportunities for practice, sharing knowledge, and asking and giving help (Birman et al., 2005; Boyle et al., 2004; Erickson et al., 2005; Jeanpierre et al., 2005; Stolk et al., 2009). Some studies also found that activities should have a substantial number of contact hours and should be sustained over a period of time to have a strong impact on teaching practice (Birman et al., 2005; Boyle et al., 2004; Lieberman, 1996; Little, 1993). For all types of activities, Merriem (2001) highlights the importance of considering teachers as adult learners and applying an adult learning model (*andragogy*) in order to stimulate teachers' learning. Knowles (1975) explains that in an adult learning model, teachers are considered as independent learners who are responsible for their own learning and thus take initiatives for their own learning, with or without the help of others. This indicates that teachers should have control over the content and process of their own PD activities. Considering this, empowering teachers becomes a key principle to facilitate a sense of ownership and to promote internalization of learning (King & Newman, 2001).

PD activities of teachers have been reported to result in specific (positive) changes of teachers. Singh and Shifflette (1996) find five areas of changes after teachers participated in PD activities; instructional effectiveness, interpersonal relationships, discipline, self-confidence, and personal change. Similar changes are also recognized in a study by Cheng and Yeung (2010), who reported that their teachers improved their teaching competencies, readiness to implement new innovations, confidence, and motivation in performing their role. In a study by Ponte, Beijaard, and Wubbels (2004) the teachers

observed an improvement of their "technical domain of knowledge" (p. 574), i.e. insight into educational methods, techniques and strategies that teachers can use and bring improvement towards the goals of education.

6.3 The setting of this study and the research question

The current study was conducted in the newly decentralized educational system of Indonesia. However, this decentralization concerns only schools governed by the Ministry of National Education (MONE) which is responsible for all education in the nation. The educational policy established by MONE should be implemented by all the schools in the nation, including *madrasah* (Islamic schools), on which this study is focused. However, *madrasah*, are managed by the Ministry of Religious Affairs (MORA), which uses a centralized policy. Having these two systems of education, *madrasah* are positioned in a complicated situation of management (MORA, 2007).

The community of (chemistry) teachers in this study was initiated by a group of nine teachers who came from different *madrasah* (five public and two private) within a district in Indonesia. The establishment of this community was a response towards a decentralization of the management of communities of teachers, implicitly announced by MORA at national level (Chapter 4 and 5). Therefore, this community was an effort aligned with the decentralization of *madrasah* teachers' PD activities. Together with a facilitator, these teachers in their first meeting decided to invite educational actors from MORA at the district level and the principals of *madrasah* in the district to be involved in the development of the community, since ownership of all educational actors was considered to be important (Chapter 3). These educational actors of the outer layer (MORA officials and principals) were considered by the teachers to have a strong influence on their participation in the community and thus they needed to be involved. The actors' involvement was expected to provide the necessary support (the organizational support) that should enable the teachers in the district to participate in PD activities in the community. Through several meetings, the actors and the teachers agreed upon five strategies for the organizational support that the teachers considered as important to provide the conditions for teachers' participation in the community. The strategies were: giving a legal status to the community, providing recognition for teachers' participation, providing accommodation for teachers' activities, providing incentives for teachers and experts, providing time for teachers' activities, and facilitating boundary crossing among the actors (Chapter 4 and 5).

Two cycles of planning, implementing and evaluating these strategies were conducted to assess the conditions enabling teachers' participation in the community. In the first cycle, it was found that the conditions were not completely fulfilled because not all strategies

were completely implemented. To a large extent, the teachers were provided with accommodation, given a teaching schedule in which one day a week was intended to be used for PD activities, and provided with fair incentives, and the community was given a legal status. In the second cycle, an additional strategy involved facilitating boundary communication among actors. The conditions in the second cycle were to a large extent favorable for the teachers to give shape to the new curriculum policy. While time and accommodation for activities remained available, the incentives were somewhat lower than in the first cycle. However, the teachers did receive certificates of recognition which they used for the accreditation and certification process. This was achieved only through rather strident efforts, because the actors of the outer layer did not intuitively implement the strategies. As a consequence, the teachers needed additional efforts to ensure that the intended conditions were fulfilled beside their own responsibility for PD activities (Chapter 4 and 5).
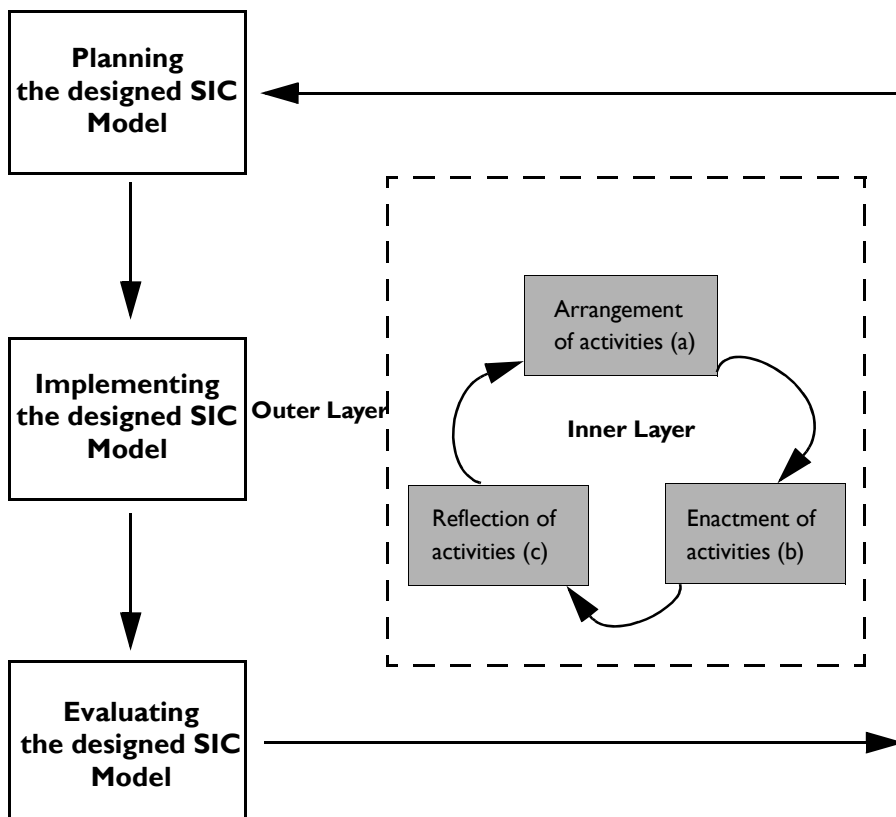
Figure 6.2 The iterative process of PD activities of teachers in the community within the implementation of the designed SIC model

Under the above described conditions of the context or the outer layer, this study focuses on details of the teachers' PD activities (the inner layer or the content and process of the community). The activities involved three subsequent stages; arrangement (a), enactment (b), and reflection (c) that were carried out by the teachers (Figure 6.2). In the arrangement stage (a) teachers identified the knowledge or skills they intended to learn or gain (content). Teachers' activities (process), including schedule and frequency of meetings, were also determined in this stage. The subsequent stage was the enactment (b) of what have been decided in the previous stage. The reflection stage (c) was conducted at the end of each cycle. In this stage, the teachers evaluated the activities they had conducted and made arrangements for the next cycle. The arrangement, enactment, and reflection stages were facilitated and conducted in an iterative process. More details about the specific activities in each cycle and the corresponding aims of the activities are provided in the Appendices A-D to this chapter.

The aim of this study is to investigate the facilitation of these PD activities in the community of teachers during the new school-based curriculum policy in a decentralized educational system. Focusing on the PD activities, this study addresses three research questions which focus on the PD activities of the teachers:
1. *What changes did the teachers perceive after their PD activities?*
2. *What PD activities did the teachers perceive to be meaningful for their practices?*
3. *What factors did the teachers find supporting or hindering to sustain the long-term application of the new knowledge or skills?*

6.4 Method

This study is exploratory in nature, not aiming at verifying hypotheses or testing a conceptual model. This study investigates the facilitation of PD activities of teachers to gain positive changes and meaningful knowledge and skills from the activities. This study is also expected to indicate factors that support or hinder the application of the knowledge and skills gained from their PD activities in their daily practices. Factors from the outer layer that potentially affected teachers' PD activities have been investigated in a previous study (Chapter 5). Considering the aim of this study, a qualitative method was used.

6.4.1 Participants

This study was conducted in Cirebon district (Kabupaten), West Java, Indonesia, where the community of chemistry teachers was established (Chapter 3). The participants in this study were the teachers of the community that came from different *madrasah* within the district. Four teachers came from three public *madrasah* and two from two private *madrasah*. These six teachers were among the nine initiators previously described and

had actively attended the activities in both cycles. Because they had actively attended the activities, the teachers were assumed to have ample experience of the activities conducted in the community and therefore they had a broad understanding and perceptions enabling them to provide information for this study. The overview of the teachers is shown in Table 6.1.

Table 6.1 *Overview of participating teachers*

No.	Code	Age	Gender	Educational background	Years of teaching experience	*Madrasah*, Employment status
I	TCHR-3	45	Male	Master in evaluation of education Bachelor in chemistry education	12	Public, P
2	TCHR-4	43	Male	Bachelor in chemistry education	13	Public, P
3	TCHR-5	45	Female	Bachelor in chemistry education	16	Public, P
4	TCHR-6	30	Female	Master in educational management Bachelor in biology education	6	Public, P
5	TCHR-7	37	Female	Bachelor in chemistry education	12	Private, NP
6	TCHR-8		Female	Bachelor in chemistry education	6	Private, NP

*All names of teachers are pseudonyms
Employment status: P = permanent, NP = non-permanent

6.4.2 Data Collection and Analysis

Throughout two cycles of activities, data were collected to trace the process of PD activities and to answer the research questions. Three strategies for the collection of qualitative data were used in this study: semi-structured interviews, group discussion, and observations. The interviews and discussion were the main sources of data, and

were conducted with six teachers at the end of each cycle. In these interviews and discussions, the teachers were asked to describe mainly the changes they perceived, the PD activities they thought meaningful, and the factors that hindered or supported the implementation of their new knowledge and skills gained from the activities. All interviews and discussions were recorded and transcribed entirely. The observations, on the other hand, were conducted in each meeting and limited to the sequence of activities, teachers' activities, and the activities of the experts (if applicable). Hand-written data from the observations were rewritten in a digital version to have full descriptions and better presentations of the observation data. These data served as a supplement to cross-reference, verify and enhance information from the other sources of data.

Using the structure of the questions, the data from the interviews and discussions were analyzed and interpreted to uncover themes and construct meanings (Davidson & McAllister, 2002) using a coding procedure (Miles & Huberman, 1995; Rubin & Rabbie, 2005). To begin, the researcher managed the data with the help of QSR NVIVO 9.2, computer software for qualitative data analysis (Gibbs, 2003). Pseudonyms were assigned to teachers and *madrasah* to increase confidentiality (Table 6.1). The data from the observations, on the other hand, were used to enrich the result of the analysis of the data from the interviews and discussions. Having different sources of qualitative data, richer information was gained.

The content was related to two themes: meaningful changes and PD activities (Table 6.2). These themes represent each of the research questions. The content of the theme "changes" involved mainly teachers' answers to the question "What do you consider as changes you gained from your participation in PD activities in this community?" The content of the theme "PD activities" was determined initially from teachers' responses to the question, "What particular activities do you think contributed to your changes?". Some questions that enriched teachers' responses on this question were: "What do you think about the time provided for PD activities with regard to the changes you determined?", "Was the time effectively used?", "Did you get access to resources that extended your learning and did this provide you with reference materials to use in the future?", "Did you practice your products in your classroom with your students?", "What did the expert do with regard to the knowledge practice and feedback?". The content of the theme "factors of implementation" was determined mainly from teachers' responses to the question: "What factors do you think may support or hinder you in implementing the knowledge or skills you gained from the activities?". Then the content of each of the themes was re-read and re-managed because some answers provided information that was related to more than one theme. For instance, content gathered from the question on the theme "PD activities" was found to be relevant for the theme "factors of implementation".

Q:"What do you consider as positive changes you gained from your participation in PD activities in this community?"

TCHR-5: "To be honest I learned a lot from the activities we have conducted. I found that skill in chemistry experiments was the most meaningful change for me and for my students. Even though I realized that there was very little support from my principal for me to conduct the experiments in my classroom, my students gave me strength to make the experiments happen. It was a challenge for me. I hope I can sustain teaching with experiments."

Table 6.2 *Themes, codes, and sub-codes determined from the data*

Themes	**Codes**	**Sub-Codes**
Meaningful changes	Personal	Self-confidence Awareness Willingness
	Professional	Knowledge or (practical) skills
	Institutional	Inter-relationships
PD activities	Practicing	-
	Reflecting	-
	Collaborating	-
	Assisting	-
	Time	-
	Structure of activities	-
	Experts	-

Data from the observations served to support and enrich the data from the interviews and discussions, particularly in relation to PD activities. For instance, teachers reported about the PD activities in which chemistry experiments were carried out. Details about these activities were gathered from the observation data. Finally, the researcher discussed the results with her supervisors. The researcher and the supervisors checked for the underlying content for answering the research questions through the teachers' responses, prevalence of topics raised during the discussions, and observations.

6.5 Results

The results will be presented in the sequence of the three research questions.

Research question 1: What changes did the teachers perceive after their PD activities?

Four categories of changes were found; personal, interpersonal, professional, and institutional changes.

a. Personal change

The teachers described their personal changes primarily as awareness of conducting better teaching, willingness to listen to students' voices, and self confidence. Examples of teachers' expressions on this personal change during interviews and discussions are:

> "*I feel better prepared for teaching now*" (TCHR-7)

> "*I feel more confidence now since I previously found myself left behind by my colleagues in my* madrasah." *(T*CHR-6)

> "*After the (experiments) activities conducted by students, I found my students were very enthusiastic in learning. I tried to listen to what they wanted to learn (from chemistry experiments), as I now knew that doing experiments in our class was possible.*" (TCHR-3)

> "*Now I could share my problems of teaching in the community. I knew that my colleagues had different experiences that might help me out of the problems I faced in my teaching, like what I did with the topic of atoms and molecules.*" (TCHR-5)

b. Interpersonal change

At least four teachers mentioned that their interpersonal relation with their principals and students had improved. The teachers said that the involvement of students (for example, in the gray shading of Appendix C) had developed their relations both with their students and principals. Two teachers (TCHR-6 and TCHR-4) reported that after having the competition with the chemistry experiments, their students asked them to teach details about these chemistry experiments. Realizing that financial support was lacking, the students were willing to collect money to buy substances necessary for the experiments. Knowing the students' enthusiasm, the principals gave additional support to allow the teachers to conduct chemistry experiments with the students. Such relations between principals, students, and teachers had rarely occurred before. Another case of interpersonal change in relation to the students' experiments was experienced by two teachers (TCHR-5 and TCHR-4). Their students asked them to approach their principals to establish "a student scientific group" (kelompok ilmiah remaja - KIR) in their *madrasah*. As an extracurricular activity, this group aimed to enable students who enjoyed chemistry or science in general to explore and learn more about chemistry experiments. It was observed that by the end of the second cycle, three *madrasah* had an officially established KIR. This establishment was a major achievement for the teachers and the students in the *madrasah*. The KIR was given financial assistance from the principal every semester. It was reported by teachers that the amount of funding increased over time, and that the number of members rose significantly.

Some of the teachers' expressions on this change are given below.

> "*During the accreditation process of my* madrasah*, my principal asked me to be the representative of the teachers in my* madrasah*. This was because he [the principal] knew that I was a member of the community and the only one who actively participated in the PD activities.*" (TCHR-5)

> "*My principal often asked me about the PD activities in this community, as she knew that I always attended the activities. Previously, she came to me only if there was an urgent or important thing.*" (TCHR-3)

> "*I was never this close with the students. They were so enthusiastic in learning chemistry.*" (TCHR-7)

c. Professional change

The professional change concerned issues of knowledge and skills that teachers found to be improved as a result of their PD activities. Each teacher identified different knowledge and skills they gained from the activities. All teachers, however, found that the knowledge and skills in teaching chemistry concepts through experiments was the most visible change they perceived. Among the teachers, three reported that they had implemented such knowledge and skills in their classrooms. They found that their students were so enthusiastic that they asked the teachers to carry out more of such experiments in their chemistry classes. In addition, the teachers mentioned the gain in knowledge and skills in constructing test items for students as an important outcome. One teacher (TCHR-6) reported that the acquisition of this knowledge enabled her to manage test items in students' workbooks in order to have test items better suited with her intentions. The teachers in the interview and discussion appreciated their new knowledge and skills in the development of syllabi. One teacher (TCHR-7) explained that she was appointed to teach her knowledge and skills to her colleagues in a different community of teachers, because she had acquired this specific knowledge and the related skills. Acknowledging these professional changes, at least two teachers (TCHR-5 and TCHR-7) articulated that such knowledge and skills became a starting point towards better teaching.

Some of the teachers' remarks on the issue of professional changes are provided below.

> "*I had gone to many PD activities in the past. So, basically I knew already the theories and details about experiments. But the problem was I never had a chance to try them [the experiments] out on my own and within the context of my* madrasah*. Having these [the experiments] in this community, it opened my eyes that it was possible to conduct experiments in classrooms.*" (TCHR-5)

"I have learnt more about practical chemistry now. It gave me more alternatives to expose my students to chemistry experiments." (TCHR-3)

"I was a member of a community of teachers of general schools [the schools under the Ministry of National Education - MONE]. To be honest, I learnt more in this community [the community in this present study]. Particularly for syllabi development, I gained a lot of knowledge about it and I have now taught my colleagues in the community [of teachers of general schools]." (TCHR-7)

"I used my knowledge on item construction to develop the assessment of my students. I found it helpful to direct my students towards the intention of my teaching. This [constructing students' assessment] was much better than having my students relying on their workbooks." (TCHR-6)

d. Institutional change

The institutional change has been described by the teachers as the most significant change. This institutional change involved the teachers' feelings of ownership on their community. The teachers experienced that this change influenced their interpersonal relationships with the principal and their colleagues within their *madrasah* and within their community.

The following excerpts from the interviews and discussions describe some of the opinions of the teachers:

"I was a quite passive kind of person. I taught in private madrasah *and knew little about the world outside [the two* madrasah *in which she was teaching]. Having been involved in this community, this made me find my real world. Being actively attending the PD activities, I was connected to my colleagues."* (TCHR-8)

"Before, I just knew [by name] them [some of the colleagues in the community], but now I knew them better. I feel happy to have friends from the same field to share [my profession] with." (TCHR-4)

To sum up, among the four categories of change that were perceived by the teachers as a result of their PD activities, the institutional change was the most important for them. This institutional change seems to influence the other three changes, such as better interpersonal relationship of the teachers and their principals (interpersonal change), increased opportunities to carry out meaningful PD activities (personal change), and conducting better teaching to the students (professional change).

Research question 2: What PD activities did the teachers perceive to be meaningful for their practices?

Based on the data from all sources, four types of PD activities occurred during the meetings; reading, practicing, reflecting, and collaborating (Table 6.2). Teachers in the interview and discussion mentioned that (1) practicing to do experiments, (2) collaborating and practicing to develop syllabi, and (3) supervising students were within these activities the most meaningful activities (*bermanfaat*, literally translated as beneficial and defined as "meaningful" in this study).

Evidence of practicing chemistry experiments (1) was observed during the micro-teaching of chemistry experiments. All teachers were engaged in these activities since each teacher was asked to practice their own chemistry experiment when they met during the PD activities. In the discussion on the first cycle, the teachers described how the practice of teaching experiments helped them think of doing similar teaching in their classrooms. One teacher in the interview (TCHR-3) reported that he had applied such teaching in his classroom and got positive feedback from his students. He argued that the micro-teaching process conducted during the PD activities in relation to this experiment was meaningful to help him to elaborate similar experiments for his students. During the discussion, another teacher (TCHR-5) acknowledged the importance of providing opportunities for teachers to try out their own experiments. Having conducted her own experiment during the PD, she stated that her understanding of these experiments increased her willingness to apply these in her classroom.

During the discussion the teachers mentioned that collaboration made it easier for them to acquire new knowledge and skills (2). This was particularly experienced by the teachers during the development of syllabi in which teachers worked collaboratively. It was observed that teachers shared experiences, ideas and knowledge, and gave help to each other in order to complete their syllabi. Three teachers stated that such collaborative learning allowed them to develop their understanding on the development of syllabi.

Supervising students was an activity outside the formal PD of the teachers in the community (3). It was designed for the purpose of helping students to prepare for their chemistry competition. When the teachers had been given the knowledge and skills of teaching experiments, they found that supervising was helpful to reflect on what they had learned in their PD activities. Besides, two teachers in interviews noticed that the activities on supervising increased the motivation of their students to learn chemistry.

Added to their remarks about meaningful activities, teachers reported that the activities were related to the scheduling of meetings, the structure of the activities, and the help of the expert. The schedule of meetings determined the importance of having organized a specific time for a meeting and topics of the meetings. Teachers reported that such a

schedule was apparently important to guide their activities. The schedule appeared to make teachers more committed to carry out the PD activities that had been agreed upon. This specifically could be observed in the first cycle of activities. In contrast to the first cycle, when teachers lost their orientation on the activities, a clear schedule in the second cycle guided and motivated the teachers.

The structure of the activities was another issue the teachers found important. In both discussions, the teachers mentioned that the PD activities in general should be sequentially structured to provide theory, allowing practice and reflection, and to provide time for revision. The teachers reported that the activities of teaching the chemistry experiments were an example of the ideal structure of activities. It was observed that the activities with experiments were sequentially structured accordingly (Appendix C, cycle 1, fourth and fifth meeting). According to the teachers, this structure has allowed them to understand the knowledge and skills to be learnt. The structure of the activities was as follows:

1. Teachers were asked to choose one experiment and to gain a better understanding of their experiment according to their perception;
2. Teachers were asked to carry out their own experiment;
3. Teachers were asked to present their experiment (micro-teaching experience);
4. Teachers were given feedback;
5. Teachers were asked to further develop the experiment to be implemented in their classroom.

With respect to the expert, the teachers were positive about the presence of the experts with their ways of conveying knowledge and skills (discussions and interviews). Teachers acknowledged the expertise and competencies the experts had, noting that they helped them to understand more about the topics. Teachers reported on the expert at the first cycle of PD activities as motivating and encouraging. In the interviews two teachers (TCHR-3 and TCHR-4) reported that the expert made the knowledge and skills grounded in their practice, which was intriguing. However, they had the opinion that the expert, who was involved in every meeting during the first cycle, showed too much guidance and provided little room for the teachers' freedom for learning. One teacher stated that as a result of this, he thought that the aim of the activities slightly deviated. In contrast, teachers reported that the three experts in the second cycle, i.e. experts respectively in pedagogy, chemistry content, and curriculum development, gave too little intervention as they were only involved in three meetings during the cycle. Teachers perceived this guidance as insufficient to develop the knowledge and skills they needed.

To summarize the above findings, two issues emerged from the teachers with respect to answering the research question on the meaningful activities; the type of activities and

the aspects that influenced the activities. With regard to the type of activities, teachers found the following activities most meaningful:
- Carrying out practical experiments with students,
- Collaborative working with teachers, and
- Experiencing the new knowledge and skills.

These activities were reported to be supportively influenced by the clear schedule of the meetings and the help of experts.

Research question 3: What factors did the teachers find supporting or hindering to sustain the long-term application of the new knowledge and skills?

The teachers reported three factors that influence the sustainability of applying the new knowledge and skills in their practices. These were the curriculum guidelines, which influence time needed to apply the new knowledge and skills, the psychological support of colleagues and principals in teachers' working environment, and the involvement of students.

With respect to the curriculum guidelines, two teachers (TCHR-4 and TCHR-5) reported that the guidelines hindered teachers from sustaining the application of the new knowledge and skills in their practices. According to these teachers, the guidelines provided little room to make adjustment in incorporating the new knowledge and skills in their teaching. Particularly the fact that the recommended topics should be taught in a certain time constraint was reported as a hindering factor, because the new knowledge and skills would change the teachers' teaching time; more time was thus needed than was suggested in the guidelines. This particularly was related to the skills of involving chemistry experiments in the lessons.

> "*My worry was always related to the curriculum policy in which I had to teach all the recommended topics.*" (TCHR-6)

> "*I just tried doing an experiment with my students. I thought the experiment was fine in a sense that I could still relate it with the chemistry concept I wanted to convey. It was true that the experiment took quite some time out of my teaching schedule. Thus, in the next semester, I think that I need to really plan ahead to have some experiments so that I still can follow my teaching schedule.*" (TCHR-7)

Psychological support could be a hindering and supporting factor for the sustainability for applying the new knowledge and skills. Two teachers (TCHR-3 and TCHR-5) in the interview reported that their colleagues did not support the teachers' effort in applying the new knowledge and skills; these colleagues stated that experiments and new teaching methods were just prolonging the time of teaching and might not have much influence

on the students' performance on exams. The colleagues made these teachers reluctant to apply their new knowledge in their practices. Their principal, who could not afford to provide material support for the teachers, de-motivated the teachers through putting his attention on establishing a new program related to Islamic study in the *madrasah*. According to these teachers, this implied that their principal did not give any support to the current efforts to develop science in the *madrasah*:

> "*I always wanted to try out the skills I gained from these PD activities, but when I shared this with my colleagues they said that trying new things just might involve additional problems for my teaching. In fact, the students looked fine with the current way of our teaching. Why bother by trying new things with them? Then I was de-motivated.*" (TCHR-5)

> "*We already had three academic programs here in our* madrasah *[science, social science, and religion]. How could he [the principal] establish another program [*syariah *or Islamic law] where in fact the current programs were not seriously taken into account, let alone science? I felt that the support for chemistry was limited to students*' *experiments we previously had and not for further efforts to sustain the development of science.*" (TCHR-3)

The other teachers experienced a supportive environment from their principals and colleagues. They found that such an environment gave them freedom and opportunities to implement their new knowledge and skills. However, they reported that it was left to them to take the opportunity to try implementing the knowledge and skills in their practices. They said that they needed the psychological support in order to increase their confidence to sustain the application of their new knowledge and skills in their practices.

Regarding the involvement of students, two teachers reported in the interview (TCHR-5 and TCHR-6) that the success of the implementation depended on the students. When the students were involved and enthusiastic, the implementation was fruitful and challenging. According to the teachers, this motivated them to continue the application and to gain more knowledge and skills.

> "*I think what we have done here was pretty doable for our conditions. It was just about whether we wanted to try the chemistry experiments in our classes or not.*" (TCHR-6)

To sum up, three factors influenced the implementation of the new knowledge and skills teachers gained from their PD activities: the curriculum guidelines, the support from their environment, and the involvement of students in the implementation. These factors can both support or hinder teachers in implementing the new knowledge and skills in their practices.

6.6 Discussion and conclusions

The aim of this study was to investigate the facilitation of PD activities of teachers in their community in a new school-based curriculum policy in a decentralized educational system. This investigation included PD activities that generate teachers' changes and meaningful new knowledge and skills and factors that influence the long-term application of the knowledge and skills in their practices. The PD activities of the teachers were facilitated by giving them freedom to arrange, enact, and conduct their own PD activities and to gain ownership of the activities. Within this facilitation, this study addressed three research questions. Each question is answered below.

1. What changes did the teachers perceive after their PD activities?

Teachers perceived four changes after their PD activities: institutional, interpersonal, professional, and personal. The institutional change was considered as the most important change. This institutional change has led to the interpersonal change where teachers' relation with their principals and students was improved. Teachers' ability and availability to regularly conduct PD activities changed, and through these regular PD activities they gained new knowledge or skills they applied in their practices (professional change). This knowledge and these skills strengthened the teachers' confidence to conduct better teaching and to increase their awareness of improving students' learning (personal change). Considering the relationships between the different kinds of changes, it might be concluded that the role of the institutional change was most critical for the teachers.

2. What PD activities did the teachers perceive to be meaningful for their practices?

Teachers considered the activities that allowed them to practice the new knowledge and skills being learnt as the most meaningful PD activities; these activities were learning to teach experiments through practicing and microteaching, and collaborating and practicing to develop syllabi. Additionally, it was reported that the teachers considered these activities meaningful because they were given a clear schedule of the activities, helped by the experts, and a certain structure that described the sequence of activities. Regarding the activities with chemistry experiments, for instance, the structure was (1) inviting teachers to understand the content of the experiments being learnt, (2) asking teachers to gain experience with the experiments, (3) conducting micro-teaching the experiments, (4) providing feedback from the expert, and (5) asking teachers to develop their own practice. Considering these activities, it is therefore important to consider the time, the experts, and the structure of activities while developing PD activities for teachers. A balance between the experts influencing the process too much, and too little structuring, needed to be taken into serious consideration to develop meaningful activities.

3. *What factors did the teachers find supported or hindered them to sustain the long-term application of the new knowledge and skills?*

To sustain the application of the activities in their practices, teachers reported the influence of three factors: the curriculum policy (the curriculum guidelines), the working environment involving the principals and colleagues, and the involvement of students. The curriculum policy (guidelines) restricted teachers to the long-term application of the new knowledge due to teachers' dependency on the guidelines which provided little room for teachers to manage their lessons. This particularly influenced them in applying chemistry experiments in class. The working environment involved the psychological support. Lack of a supportive working environment, such as provocative statements from colleagues to keep to the current practices, was reported to hinder the application. However, when teachers experienced a supportive environment, it was found that they became enthusiastic in applying the knowledge. This situation was strengthened when teachers involved students in the application. This involvement increased teachers' enthusiasm to apply the knowledge and also students' motivation to learn. It is therefore important to consider these three factors if teachers are expected to sustain the application of their new knowledge and skills.

Five important issues in the process of facilitation have to be discussed. These are; gaining ownership of PD activities, the laboratory activities, the influence of the expert, the involvement of students in the activities, and the understanding of curriculum guidelines. Regarding the first issue, gaining ownership of PD activities, the findings of this study confirmed the importance of teachers as decision makers for their PD activities, as has been reported in other studies (Good & Weaver, 2003; Lee, 2004-2005; Mushayikwa & Lubben, 2009). While these studies acknowledge the process of teachers arranging their activities, the current study has exemplified a process of collaborative work of teachers in a community. Studies on such processes have seldom been found in the literature. Only Little (2003) presented an intensive teachers' interaction and dynamic of collaborative learning in their community to understand teacher development opportunities. Therefore, this study contributes to the knowledge on PD activities that aim at gaining teachers' collaborative ownership.

The second issue concerns the laboratory activities. As reported in other studies, laboratory activities are PD activities that provide meaningful results for teachers' practices. This type of activity is more effective than a workshop or a traditional lecturing approach (Penuel et al., 2007), and is recommended in reform oriented PD (Garret, 1990). The findings of this study also support studies in the context of Indonesia (Thair & Treagust, 1999). A laboratory activity that is applied in the teaching practice (the Operational Curriculum) can contribute to the development of scientific skills of

students (the Experienced and Attained Curriculum). As a consequence, the emphasis of scientific skills development can be strengthened in the curriculum development and accordingly it can contribute to reduce the slippage in this emphasis (Chapter 2). From this rationale, it is inferred that in order to develop certain curriculum emphases, the PD activities should be consistent with the emphases intended to be developed. This study has demonstrated an example of how an emphasis on scientific skill development potentially can be developed through PD activities that involve laboratory experiments. This example can serve as a base for further studies on PD activities of teachers that contribute to coherency in curriculum development.

The third issue emerging from this study is related to the influence of an expert in teachers' PD activities. The findings of this study support the understanding about the help teachers need from an expert to conduct meaningful activities (Kirkwood, 2001; Penuel et al., 2007; Saxe et al., 2001). Saxe (2001), for instance, found that a group of teachers that had input from an expert in their activities had significantly better results than the group which only used peer support. However, the findings of our study suggest that a careful balance is needed between too much and too little guidance from an expert in the activities. The expert needs to empower the teachers in their activities (Stolk et al., 2011; Stolk et al., 2012) and to allow teachers' emancipation from a process steered by him/her (Eilks & Markic, 2011). This empowerment and emancipation is found to be important in order to stimulate the teachers' gradual development (Eilks & Markic, 2011; Stolk et al., 2012). Our study provides additional evidence with respect to the need for a clear role of the expert in PD activities.

The fourth issue is the involvement of students in PD activities of the teachers. As described in the findings, activities within which students were involved provided meaningful changes for students, teachers, and principals. This study supports the study of Cherubini et al. (2002) who report the increase of students' motivation to learn after being involved in PD activities of teachers. The students who are involved in the PD activities can stimulate interpersonal relations between the teachers and other educational actors that result in increased support for teaching and learning given by the other educational actors (Appelhof, Bulte, & Seller, 2008). This implies a potential role of the students as a type of "boundary crosser" to gain praise for students' chemistry learning from the teachers and the principals. Regarding the role of the students as boundary crossers empowering teachers in PD activities, this study shows that the teachers will gain improvement in their personal, interpersonal, professional, and institutional changes. The process of the involvement of the students in this study also enhances the understanding of the need for a balanced role of an expert in the PD activities of teachers to empower them.

The last issue involves teachers' understanding of the content of the curriculum as written in the curriculum guideline so that they are able to manage their time sufficiently to apply the new knowledge and skills. Teachers in this study found it difficult to apply the new knowledge and skills in their practice as a result of their PD activities. They perceived an overload of content in the curriculum. The content as recommended in the curriculum guideline made them think that more time was needed for applying the new knowledge and skills in their practice, for example regarding the use of experiments. The perception of teachers on the curriculum overload is experienced all over the world (cf. Pilot & Bulte, 2006). This may be because there is indeed an overload, or because teachers perceive an overload when they stick to the old topics. When teachers keep to this perception, it is likely that it is difficult for them to apply the new knowledge and skills. They also need more time for teaching activities that go beyond their routine. Yet, this study shows that teachers who have sufficient understanding of the content likely can manage their teaching on the new topics recommended in the guideline, like using experiments in their teaching. They likely also can manage the time needed for the application of their new knowledge and skills, while at the same time keeping to the recommended curriculum guideline.

To conclude, in this study teachers were empowered with ownership for their own PD activities in a community of teachers. The PD activities, within which teachers arranged, enacted and reflected on their activities, resulted in the development of knowledge and skills that were meaningful for their practices. These activities were conducted in a decentralized educational system and supported by local educational actors (Chapter 5). Although the curriculum guidelines still restricted the teachers, this study found five aspects that need to be considered to facilitate teachers' PD activities. These aspects are: giving teachers ownership of their PD activities, providing PD activities that are consistent with the development of curriculum emphases, balancing the supportive involvement of the expert, involving students to empower teachers, and making teachers understand the content of the curriculum. These five aspects appeared to be important in empowering teachers in their PD, especially within the Indonesian educational system. This empowering of teachers in their local communities is a major step forward (Hadi, 2002; Thair & Treagust, 2003; Wahyudi & Treagust, 2004).

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Appendix A Main activities and aims in the first and second cycles

The First Cycle	The Second Cycle
<u>**Activity**</u> Learning to develop test items to measure students' understanding of topics taught <u>**Aim**</u> To understand how to develop students' test items	<u>**Activity**</u> Working together to develop syllabi and got feedback from the experts to ensure that the syllabi were 'good' <u>**Aim**</u> To produce 'good' syllabi for all grades (10 to 12)
<u>**Activity**</u> Learning how to manage teaching the topics recommended by the curriculum under time constraint <u>**Aim**</u> To be able to manage teaching the topics under time constraint	Note: 'good' syllabi were described by the teachers as those followed what have been recommended by the curriculum guideline
<u>**Activity**</u> Learning to teach chemistry experiments, with household equipment and substances, and integrated with chemistry concepts <u>**Aim**</u> To be able to teach chemistry concept by doing simple experiments	

Appendix B The planned (scheduled) and realized activities of the first and second cycle

Cycle 1 – The activities were realized as planned (scheduled)			
Topic	**Date**		
Developing student assessment	10 October 2009		
Assessment of items in the national examination	24 October		
Teaching management of topics recommended by the curriculum policy	14 November		
Teaching basic chemistry experiment, with household equipment and substances, integrated with chemistry concepts	18, 19 December		
Reflecting on the first cycle and arranging for the second cycle	30 January 2010		
Cycle 2			
Planned (scheduled) Activities		**Realized Activities**	
Topic	**Date**	**Topic**	**Date**
Developing syllabi and lesson plans for grade 1, 2, and 3.	23 October 2010	Starting to plan for activities in the next meetings. Self-study on the development of syllabi and lesson plans (teachers were divided into three groups, 1st grade, 2nd grade, 3rd grade	4 December
Invite an expert on syllabi and lesson plans development (expert from local district).	The date for these meetings, including inviting the expert, will be decided at the end of every meeting.	Continue working on the development of the syllabi (discussion on syllabi for grade 1)	15 December
		Expert 1 and 2 for managing teaching and subject matter content	18 December
		Continue working on the development of the syllabi (discussion on syllabi for grade 3)	8 January
The revision and finalization of the syllabi and lesson plans.		Expert 3 – Workshop on the development of the syllabi and lesson plans	22 January
		Expert 3 (same person) – lecturing on the syllabi and lesson plans and assessing teachers' lesson plans	23 January
		Teachers revised their lesson plans and planned to be submitted to the expert by the end of December	5 February
		Evaluation and planning for the next cycle	12 February

Appendix C The activities of the teachers in the enactment stage of the first and second cycle

Cycle 1		Cycle 2	
Meeting	Activities	Meeting	Activities
First (25 teachers)	• The expert in PD activities of chemistry teachers shared her experiences about her works with *madrasah* teachers, students of *madrasah* and the policy makers of *madrasah* in the nation. • The expert gave a lecture about students' assessment and overview on the overall performances of students in the nation in relation to chemistry • The expert invited the teachers to discuss their madrasah students' performances on examination, both local and national. • The expert gave a brief lecture about general types of assessments and provided some examples.	First (9 teachers)	• Teachers discussed activities for developing syllabi and lesson plans. They decided to develop syllabi of grade 10 to 12. • Teachers discussed and formed a consensus about the aspects, the content, and the presentation of the syllabi. • The teachers worked in their groups. Each group was assigned to work on syllabi of one grade • For today's meeting, teachers decided to work together on a syllabus for one standard competency as an example. • Each teacher was assigned to develop syllabi of two competencies at home.
Second (23 teachers)	• The expert continued explaining more about the types of assessment in the exam and related these to the management of teaching the topics recommended in the curriculum. • The expert gave further examples about how items of assessments were developed. • Teachers worked in group of two and were asked to make some examples. • The expert gave more examples on generating items for students' assessment. • The expert gave individual homework to the teachers to develop possible students' assessment for topics that according to the teachers were of lower priority for teaching	Second (10 teachers)	• Six teachers did not do their homework, three teachers did only partly, and two teachers were new comers. • The teachers continued to work on their syllabi in their groups. • At the end of the meeting, the syllabi have not yet been completed.

Cycle 1		Cycle 2	
Meeting	**Activities**	**Meeting**	**Activities**
Third* (17 teachers)	• The expert started to explain general ideas about the development of the new chemistry curriculum. • The expert shared her experiences while participating in the development of the current national chemistry curriculum at MONE and while her school became one of the pilot schools to implement the curriculum. • The expert invited discussion about topics recommended in the curriculum, particularly in relation to the importance and feasibility of teaching the topics within the time constraint as advised in the curriculum guideline. • The expert asked the teachers to connect their understanding of the topics with possible assessments given to students. • The expert asked the teachers to create their own planning for managing their teaching for the next academic semester in which assessments played a role.	Third (8 teachers)	• Two experts, one in pedagogic and the other in chemistry content, were invited in this meeting. The experts were expected to give ideas to the teachers to strengthen their syllabi and lesson plans. This meeting was set on the basis of a seminar in which lectures were given by the experts and there was time for questions and answers. • Especially for the expert in chemistry content knowledge, the expert invited teachers to discuss topics that are difficult to teach or are not their competence. Suggestions and tricks were given by the expert in order to teach difficult subjects.

Cycle 1		Cycle 2	
Meeting	**Activities**	**Meeting**	**Activities**
Fourth (7 teachers)	• The expert invited the teachers to practice how to manage a lab; she invited the teachers to analyze the lab they were in, particularly in relation to chemical management. • The expert gave each teacher two books* • The expert invited the teachers to collaboratively organize the lab based on the principles of good management. • The expert asked the teachers to choose one experiment in the book of chemistry experiment (avoid teachers chose same experiments) and tried it in their own desks. • The teachers were divided in groups of three and invited to discuss about the experiments they chose and possible chemistry concepts that will be taught. • Each teacher was asked to develop a plan for his or her experiment along with the concept developed from the experiment.	Fourth (7 teachers)	• The teachers continued discussing and working on their syllabi and lesson plans with their groups. They were asked by the leader of the community to consider the knowledge gained from the experts. • At the end of this meeting, it was found that only one teacher had finished their tasks and the rest of them, including the leader of the community, did not finish their tasks.
The teachers and the facilitator decided to invite students in for the chemistry experiments activities. Students from five *madrasah* (4 public and 1 private), two each, were trained by the expert to do five experiments from the book. The students were then asked to develop seven experiments in their *madrasah* assisted by their teachers. These students were asked to perform their seven developed experiments in front of their friends and students in two neighbouring *madrasah*. Their performances were graded by three judges (the expert, the facilitator, and one lecturer of chemistry education from a local higher institution). The students' performances were competed. (December to February)		Fifth (9 teachers)	A local expert in curriculum was invited by the teachers. This expert did a two-day workshop on the development of syllabi and lesson plans. In this first day, the expert gave lecture about the new curriculum policy; history, the components of the curriculum, the standards, and syllabi. Focusing on the syllabi, the expert described the syllabi; the definition, legal basis, principles, components, development mechanism, steps in the development. During the lecture, there were moments for questions and answers.

Cycle 1		Cycle 2	
Meeting	**Activities**	**Meeting**	**Activities**
Fifth (9 teachers)	• Each teacher was asked to undertake the experiment in front of their colleagues as if he or she taught the experiment and to his/her students (microteaching). • Discussion and reflection occurred after each presentation. • The teachers decided to work in a group and to redevelop and design one experiment for their own teaching.	Sixth (9 teachers)	• Instead of starting to develop syllabi from scratch, as asked by the expert, the teachers offered the expert to work on one of the syllabi the teachers were currently working on. • The expert and the teachers started to work together on one standard competency to be developed in the form of the syllabus and assessed it. • At the end of the meeting, the teachers agreed to revise and continue working on the rest of the syllabi and sent them to the expert to get his feedback.
Sixth (3 teachers)	• Evaluation of the activities in the first cycle	Seventh (6 teachers)	• The teachers worked on the finalization of their syllabi in their groups. • Discussion across the groups also happened. • After finishing the syllabi, each group assigned one teacher to re-write the whole syllabus and send them to the expert. • The teachers discussed on the evaluation of the activities in this cycle.

* The books were *Panduan Pengelolaan Laboratorium Kimia* (A guide for managing the chemistry laboratory) and *Permainan Kimia* (Playing with chemistry experiments). The principals through MK2MA paid for all the books the expert brought for the teachers.

Appendix D Learning activities of the teachers in the first and second cycles

Categories	Learning Activities
Reading	• Studying the new curriculum; educational standards, syllabus development • Studying the two new books given during activities of experiments • Studying chemistry books (grade 10, 11 and 12)
Practicing	• Preparing a plan for micro teaching of the experiments • Testing individually the experiments • Experimenting with new method to teach with the experiments • Constructing students' assessment • Developing syllabi • Assisting and teaching students the experiments*
Reflecting	• Receiving colleagues' feedback during teaching with the experiments, constructing assessment, and developing syllabi • Receiving the expert's feedback during teaching with the experiments • Receiving guidance from the expert during syllabi development • Assisting students* • Self-reflection during working on homework and syllabi*
Collaborating	• Sharing experiences, knowledge, and skills • Giving and asking for help • Developing lesson plans for micro teaching with the experiments • Constructing students' assessment • Developing syllabi

*Occurred outside the meetings of learning activities

CHAPTER 1 Introduction and overview of the research

Main Research Question
In what way can professional development activities of *madrasah* chemistry teachers be facilitated during curriculum change in a decentralized educational system?

Sub-Research Question 1
What are the characteristics of chemistry education and the conditions during the curriculum change?

CHAPTER 2	**CHAPTER 3**
Characteristics of chemistry education in terms of curriculum emphases and representations in Indonesian *madrasah*	The operational curriculum of *madrasah* chemistry teachers: an analysis of conditions during the school-based curriculum change in a decentralized educational system of Indonesia
Research Question	**Research Question**
What are the characteristics of Indonesian upper secondary chemistry education in madrasah in terms of curriculum emphases and representations in madrasah?	What are the conditions for chemistry teachers of madrasah when they give shape to the Operational Curriculum during the curriculum change in a decentralized educational system?

Sub-Research Question 2
In what way can professional development activities of chemistry *madrasah* teachers be facilitated?

CHAPTER 4
Establishing a community of teachers in a decentralized educational policy: A case study of participatory design approach in Indonesian *madrasah*
Research Questions
1. What strategies and arguments do the educational actors agree upon in establishing a community of teachers?
2. What indicators of favorable conditions are formulated from the actors' shared agreements?

CHAPTER 5
Facilitating a community of teachers: A case study of participatory design approach in Indonesian *madrasah*
Research Question
To what extent were the intended favorable conditions fulfilled, what strategies were implemented and in what way?

CHAPTER 6
Facilitating a community of teachers: A case study of professional development activities of teachers in a decentralized educational system
Research Questions
1. What changes did the teachers perceive after their professional development activities?
2. What PD activities did the teachers perceive to be meaningful for their practices?
3. What factors did the teachers find supporting or hindering the use of new knowledge and skills in their practices?

CHAPTER 7 Conclusions and Reflection

Figure 7.1   Overview of the thesis

Chapter 7

Conclusions and Reflection

7.1 Introduction

Providing favorable conditions for implementing an educational change is a major challenge for all actors in education, including the government, schools, principals and teachers (Fullan, 2007). These educational actors should act in coherence with the objectives of the change. This coherency can be determined by analyzing the curriculum development, from the government's intended objectives to the students' outcomes. In a decentralized educational system, where educational matters are transferred from the government to the local authorities and schools, analysis of the curriculum development is therefore important. The involvement of many educational actors will influence the curriculum development and it is likely that different interpretations of the objectives of a curriculum occur within different curriculum representations.

Incoherency in curriculum development is described by Goodlad (1979) as "the slippage from any ideal formulation to what reaches the student, or of working backwards from what the student perceives to what is the formal curriculum intended for him or her" (p. 64). Slippage, the term also used by Van Berkel (2005) to describe this incoherency, creates problems in education, because it implies that the objectives of education are not achieved (Cohen & Spillane, 1992; McLaughlin & Talbert, 1993). Therefore, possible slippage should be analyzed before any action to improve the educational practice is determined.

For improving educational practice, the role of teachers is undeniably very significant for the success of the action (Fullan & Hargreaves, 1992; Little, 1993; Nolan and Meister, 2002; Pilot, 2005). The organization of professional development (PD) activities is important for teachers. It is widely believed that PD has a strong influence on teachers' practices in curriculum development (Penuel et al., 2007).

However, most studies in the field of professional development of teachers have only focused on activities to develop specific competencies, e.g., content knowledge, pedagogical knowledge, or understanding of the curriculum policy. Few studies have focused on how the professional development of teachers is organized in a decentralized educational system within which local educational actors participate. Therefore, it is important to investigate professional development activities that are meaningful for teachers' practices during a curriculum change in a decentralized educational system.

7.2 Setting of the research, objectives, and research questions

The educational system in Indonesia has for more than three decades been a centralized system. Just recently decentralization of education was established in Indonesia, as implied by the decree of the national education system of 2003. Strengthened by the decree of

regional autonomy in 2004, educational matters have been transferred from the government, i.e. the Ministry of National Education (MONE) to the local authorities and the schools. A competence-based curriculum (*Kurikulum Berbasis Kompetensi* - KBK) was promoted in 2004 in response to this new educational system. This KBK was still relatively centralistic in nature, noting that the government developed standards for all competencies, basic lessons, and indicators of performance that were required to be taught by teachers in their operational curriculum. Only under certain conditions, which were determined by the government (i.e. the availability of resources), is a school allowed to develop the operational curriculum according to its own choice of competencies.

After two years of implementation of KBK, a new policy of school-based curriculum (*Kurikulum Tingkat Satuan Pendidikan* - KTSP) was established in 2006. Using minimum standards (i.e. competencies, content, and students' performance), determined by the government, this KTSP policy requires each school to develop these minimum competencies based on the school's resources, students, and district (local) educational aims. This KTSP curriculum policy was considered a refinement curriculum policy, aiming at a fully decentralized educational system.

This study is conducted in Islamic schools, called *madrasah*. *Madrasah* schools are rooted in Islamic values and previously offered only Islamic studies in their teaching (Mukhtar, 2001). This is why *madrasah* are governed by the Ministry of Religious Affairs (MORA). The teaching in the *madrasah* was for a long time not comparable to the teaching in general schools. As a consequence, *madrasah* were not part of the formal education in the nation. Consequently, the graduates of *madrasah* did not receive diplomas from MONE, which is responsible for education in the nation. The graduates of *madrasah* neither could continue to higher general schools or seek employment where candidates were required to hold a MONE diploma.

Starting in the 1920s, *madrasah* have developed from being exclusively dedicated to classical religious learning to a modern type of schooling as conducted in general schools. This development was further stimulated by a ministerial decree in 1975 to accept the *madrasah* as part of the national educational system. This brought about a regulation stipulating a 70%:30% ratio of non-Islamic subjects (such as science, social science, and language) and Islamic subjects (such as Arabic language, *Qur'anic* lessons (history and interpretation of the Koran), ritual (*Ibadah*), and ethics (*Akhlak*). The involvement of general subjects in their curriculum, particularly science, has become another problem *madrasah* need to cope with.

The status of *madrasah* as part of the national educational has been strengthened through the decree of the National Educational System in 1989 which defines *madrasah*

as "schools with Islamic characteristics" (*madrasah bercirikan Islam*) (Mukhtar, 2001; Zuhdi, 2006). With this decree, *madrasah* were required to have all the (non-Islamic) subjects of the school apart from the Islamic subjects from MORA. Ever since, *madrasah* and their graduates have been equal with the general schools.

However, the status of *madrasah* under MORA creates another challenge. While MONE has been decentralized, MORA remains centralized. It means that *madrasah* are subject to being centrally managed by MORA. However, as a consequence of being part of the national educational system, *madrasah* are required to implement the educational policy of MONE, i.e. the school-based KTSP policy of 2006 which is embedded in the decentralized educational system. Considering the two ministries controlling the educational system and the characteristics of the KTSP policy previously described, it is difficult for *madrasah* to work with this system, particularly regarding science because this is a rather new subject for *madrasah*. This complication in the status has influenced the whole organization of *madrasah*. This has particularly caused confusion in educational management and in the support for the teachers.

The studies in this thesis focus on the work of the teachers, especially chemistry teachers, within this setting. The aim of the studies was to gain a better understanding of professional development (PD) activities of *madrasah* chemistry teachers that were facilitated during a curriculum change in a decentralized education system. The main question in this thesis is therefore:

> *In what way can professional development activities of madrasah chemistry teachers be facilitated during curriculum change in a decentralized education system?*

In order to meet the aim and to answer this research question, a series of studies was conducted from 2008 to 2011, which focus on the curriculum change (Chapter 2 and 3) and the planning and evaluation of PD activities of teachers (Chapter 4, 5, and 6). Two sub questions are addressed:

1. *What are the characteristics of chemistry education and the conditions for curriculum change in Indonesian* madrasah*?*
2. *In what way can professional development activities of* madrasah *chemistry teachers be facilitated during curriculum change in a decentralized education system?*

The first sub-question was expected to provide a better understanding of the current chemistry curriculum as it was operational for two years after the establishment of the KTSP policy. The second sub-question concerned the conditions in which chemistry teachers of *madrasah* should give shape to the recent change. Specific measures were needed in order to facilitate teachers to enhance the conditions for their practices and

for the development of a coherent curriculum. Taking advantage of the decentralized system, these measures were to provide teachers with the professional development they considered necessary, in which the participation of all local educational actors was important. The results of this series of studies have led to answering the main research question. In the next section, the findings of each of the sub-questions are presented.

7.3 Main Findings

This section describes the main findings from all studies for each of the sub-questions.

1. What are the characteristics of chemistry education and the conditions for curriculum change in Indonesian madrasah?

Two studies were conducted in order to answer this question. The first study characterized the current chemistry curriculum policy by using the theories of curriculum representations of Van den Akker (1998; 2003) and the curriculum emphases concept of Roberts (1982) respectively. Analyzing the coherency of emphases in each of the curriculum representations, this study identified a sizable slippage in emphases because the vision on the curriculum goals (the Ideal Curriculum) and the examinations, including the items in the exam and the students' results (the Attained curriculum; Chapter 2). The Ideal Curriculum covered most of the emphases of Roberts, except for Solid Foundation and Self as Explainer. One additional emphasis was found, not included in the seven introduced by Roberts: Religious Orientation (Table 7.1). This emphasis was only found in the Ideal Curriculum and was not in any of the other curriculum representations.

Among the six emphases in Ideal Curriculum, only two remained in the Formal Curriculum, i.e. Everyday Coping and Correct Explanations, and continued to appear in the remaining curriculum representations. However, two new other emphases, namely Scientific Skill Development and Solid Foundation, appeared in the Perceived, Operational, Experiential, and Attained Curriculum. Among the emphases indicated in these curriculum representations, strong indications were found for the emphasis of Correct Explanations and Solid Foundation. But the latter emphasis was not found in the Ideal Curriculum. According to these findings, it was concluded that the chemistry education in Indonesian *madrasah* showed a sizable slippage of curriculum emphases in the development of the curriculum; the shift of emphases from the Ideal to the Attained Curriculum led to inconsistent messages. This has important implications for the Operational Curriculum where teachers play an important role, and need to interpret the messages of the current policy. A further study was therefore needed to investigate the conditions for the development of the Operational curriculum where teachers give shape to the curriculum change being undertaken.

In the second study (Chapter 3) the model of Havelock and Huberman (1978) was used to analyze the conditions for change with Infrastructure, Authority, and Consensus (the IAC model). With this model favorable and unfavorable conditions for change were described for *madrasah* teachers within the educational system in the new school-based curriculum policy. The results of this study showed that the *madrasah* teachers were highly dependent on the national curriculum policy of MONE, regardless their status under the centralized MORA. However, MORA was not very much involved in the development of science education in *madrasah*. While the extent of centralization differed between MORA and MONE, the assigned tasks of the educational actors (MORA and MONE at the national and district level and the principals at local level) were not clear (involving the condition Authority). This led to a lack of commitment of the actors (Consensus) to support the teachers who had to give shape to the Operational Curriculum. As a consequence, teachers did not get sufficient support for developing their Operational Curriculum. There was a lack of textbooks and teaching materials, and insufficient time for instruction, incentives, and opportunities for professional development (Infrastructure).

The lack of professional development activities left the *madrasah* teachers with insufficient knowledge of both the content and the pedagogy. This might explain the higher emphasis on Correct Explanation as was shown in the Operational curriculum (Chapter 2). In order to help teachers to give shape to the new curriculum, they were facilitated to develop their own professional development activities. This was done by establishing a community of teachers as a first step. Within a decentralized educational system, a local setting is considered an appropriate way of establishing a community of teachers. When establishing a community in the local setting the involvement and participation of all local educational actors should be considered in order to improve the conditions. The development of consensus among all actors who should have ownership of the community was essentially important; this implied a high level of autonomy among all local educational actors. Therefore, a further study was needed on how to establish a community of teachers, and how the notion of ownership could be brought to all educational actors.

Summarizing the results of the two studies, the new Indonesian chemistry education is characterized by a sizable slippage of emphases from the Ideal Curriculum of the policy makers to the Attained Curriculum of students. This slippage created problems for teachers in the Perceived and the Operational Curriculum. These problems were found to be related to unfavorable conditions for teachers to give shape to the new Operational Curriculum: ambiguous tasks, the lack of ownership of the educational actors like MONE, MORA, principals and teachers (Authority), the lack of commitment of the actors (Consensus), and the lack of support, such as curriculum guidelines, facilities,

time, incentives, and insufficient professional development activities (Infrastructure). Insufficient professional development leads to a lack of knowledge of the teachers, and this leads to a too strong emphasis on Correct Explanations in the operational curriculum. A further study was therefore needed on how to facilitate teachers' professional development activities, primarily through establishing a community of teachers in a local setting, since this was appropriate in the policy of decentralization of education. Local educational actors had to develop ownership of the community and accordingly to provide better conditions for the teachers' PD.

2. *In what way can professional development activities of* madrasah *chemistry teachers be facilitated during curriculum change in a decentralized education system?*
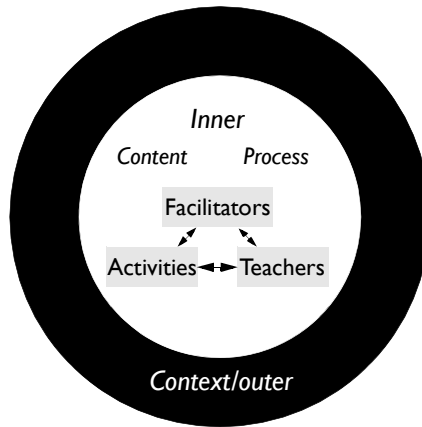
To provide in-depth answers for this question, a case study approach was conducted in a local setting in a decentralized educational system. Chapter 3 had showed that facilitation of professional development activities of *madrasah* teachers should begin with establishing a community of teachers in a local setting. In this study a community of teachers was defined (adapted from Borko, 2004) as an organizational system with two layers: the outer layer describing the context of the community, and the inner layer describing the teachers, their professional development activities, and the facilitator (Figure 7.2). The case study approach was used to describe and analyze the facilitation and development of the community of teachers in terms of the outer layer (Chapter 4 and Chapter 5) and the inner layer (Chapter 6).

This study focused on the facilitation of establishing a community of teachers for their professional development activities through the participation of local educational actors and the identification of strategies to fulfill favorable conditions for change. In the study on the outer layer of the community (Chapter 4) the following educational actors in the district participated: teachers, principals, and the ministerial officer at the district level. Within this study, two cycles of planning, implementing, and evaluation were conducted using a participatory design approach (PDA) with much autonomy for all actors to decide about the cycles. The involvement of all actors in the planning stage was important because they should discuss and come up with agreements upon which strategies are needed to fulfill favorable conditions for teachers' PD activities and how to implement them when establishing the community. The strategies and favorable conditions were systematically structured in a new model in which the intended favorable conditions were arranged, following the IAC model used in the previous study. This new model structures the Strategies for Intended Conditions and was called the SIC model (Figure 7.3).

Table 7.1 The six curriculum representations of Goodlad and Van den Akker reflected through Roberts' emphases

Curriculum representations Emphases	Ideal Curriculum	Formal Curriculum	Perceived Curriculum	Operational Curriculum	Experiential Curriculum	Attained Curriculum
Religious Orientation	To create a positive attitude towards the beauty of nature, as well as praising the One God	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Everyday Coping	Relating concepts, laws, and theories to everyday life and technology	Indicated to understand certain laws in everyday life and industrial settings	No indication in the development of syllabi and lesson plans	Indicated in examples given during lectures	Indicated in discussions of examples during lectures	Indicated in a few items in the exam, involving everyday contexts
Structure of Science	To cultivate scientific attitudes To gain experience in implementing scientific methods	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-

Curriculum representations / Emphases	Ideal Curriculum	Formal Curriculum	Perceived Curriculum	Operational Curriculum	Experiential Curriculum	Attained Curriculum
Science, Technology, and Decisions	To develop awareness of the application of chemistry	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Scientific Skill Development	To cultivate scientific attitudes To gain experience in implementing scientific methods	-No indication-	-No indication-	Indicated in laboratory experiments using guided procedures; were rarely conducted	Indicated in laboratory experiments that used guided procedures and were rarely conducted	Indicated in a few items in the exam involving use of results of experiments
Correct Explanations	To understand concepts, laws, and theories	Indicated to understand concepts, laws, and theories	Indicated to understand concepts, laws, and theories	Indicated by teaching concepts, laws, and theories	Indicated that students were taught concepts, laws, and theories	Indicated in most items in the exam
Self as Explainer	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-	-No indication-
Solid Foundation	-No indication-	-No indication-	-No indication-	Indication of the strong need to teach concepts as prerequisite to teach other ones	Mostly learned concepts, laws, theories; no laboratory experiments	Exams consist of items about concepts, laws, theories, and calculations

Figure 7.2 The outer and the inner layer of community as an organizational development (adapted from Borko, 2004)
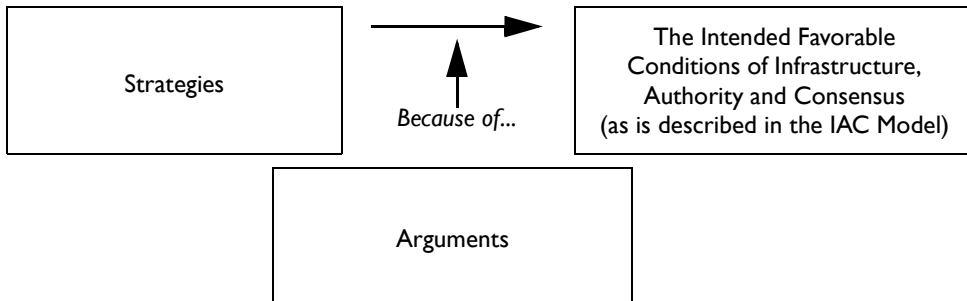
Figure 7.3 The model with Strategies (S) and Intended Conditions (IC): the SIC model

At the planning stage in the first cycle (Chapter 4), the educational actors agreed that five strategies should be implemented. The actors expected that these strategies would fulfill the favorable conditions that, according to the teachers, would enable their PD activities. These strategies were (see Figure 7.4):
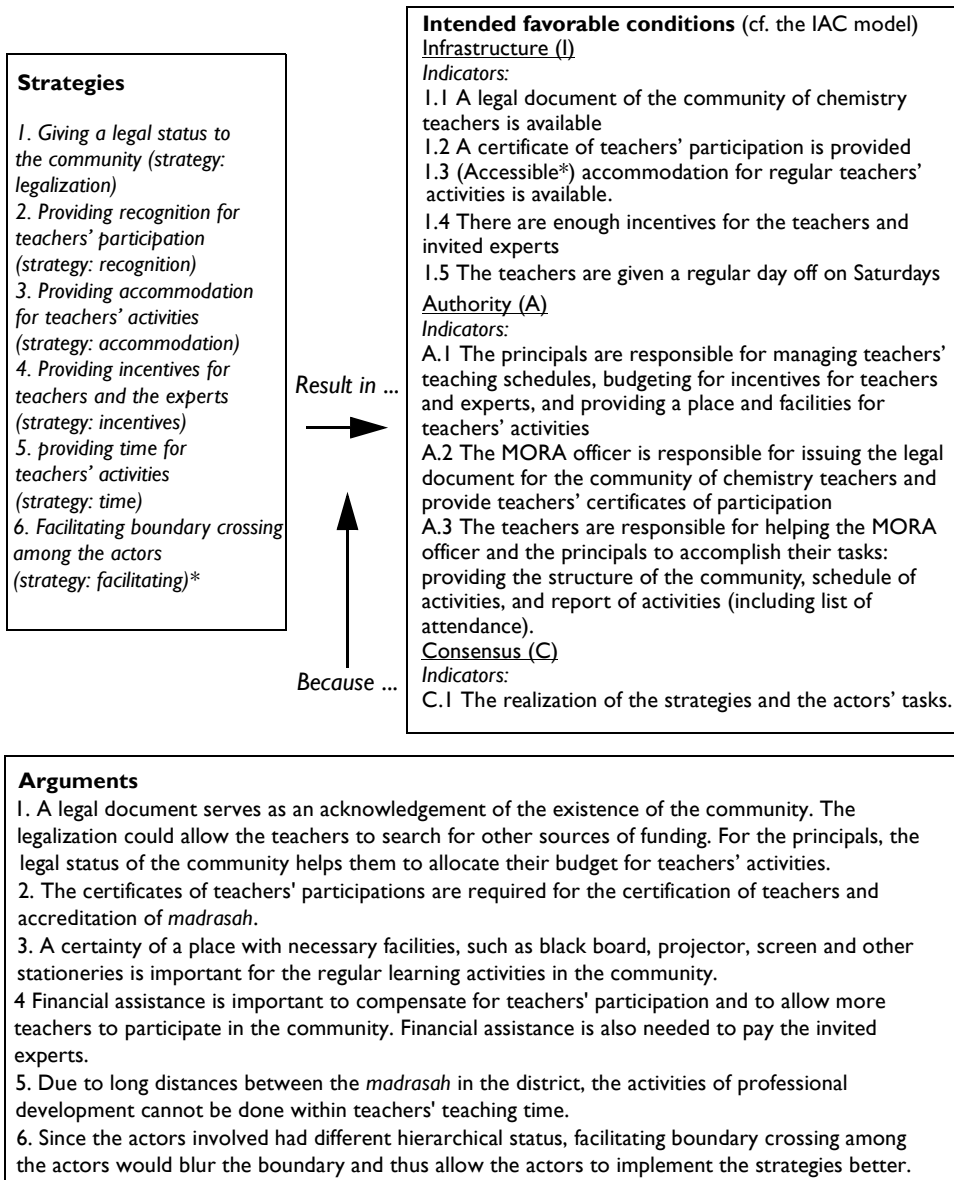1. Providing a legalization of the community;
2. Providing recognition for teachers' participations;
3. Providing accommodation for teachers' activities;
4. Providing incentives for teachers and experts; and
5. Providing time for teachers' activities.

The implementation and evaluation of these strategies in the first cycle and the full process of the second cycle were analyzed (Chapter 5). It was found that the intended conditions were not completely fulfilled because the educational actors did not fully

implement the strategies. One of the causes was that there was a boundary between the teachers and the actors at higher hierarchical level. The principals and the officers of the ministry, being actors at a higher hierarchical status, influenced the implementation of the strategies they initially agreed upon. These actors did not automatically do their tasks. They were reminded and assisted by a facilitator who was not involved in the hierarchical levels of the educational system. Considering this, in the second cycle a sixth strategy was added to improve the favorable conditions as intended (Figure 7.4): facilitating boundary crossing among the actors. In the second cycle some of the conditions were fulfilled to a larger extent when compared with the first cycle, particularly the availability of time and accommodation for PD activities. The new strategy influenced the actors in the outer layer in the implementation of the other strategies and the fulfillment of the intended conditions for teachers' professional development activities in the inner layer. Facilitating boundary crossing between the outer layer and the inner layer appeared to lead to fulfilling favorable conditions for the teachers' PD activities: a legal status for the community, certificates of participation, accommodation, (limited) incentives, and time for PD activities.

The study on the inner layer (Chapter 6) focused on the PD activities of teachers within the setting of favorable conditions as described in the previous study (Chapter 5). The PD activities were facilitated by giving teachers ownership to arrange, enact, and reflect on the activities. The results showed that the activities have led to personal, professional, interpersonal, and institutional changes of the teachers. Considering the relationships between the different kinds of changes, it might be concluded that the role of the institutional change was most critical for the teachers. Regarding the professional changes, related to the development of new knowledge and skills, the teachers identified specific PD activities that contributed to the change, e.g., learning to use experiments in their teaching through microteaching and practicing, and to develop syllabi through collaborating and practicing. These activities resulted in knowledge and skills that were perceived by the teachers as meaningful and applicable in their practices. The teachers perceived the long-term meaningfulness of the new knowledge in their practices to be dependent on the curriculum guidelines, their working environment, and the involvement of students. The application of chemical experiments in class might strengthen the emphasis of Scientific Skill Development in the Operational curriculum (Chapter 2). This strengthening in the Operational curriculum is a first step to bring what students experience in their education more in line with the intentions of the policy (Experiential curriculum) and may thus lead to a reduction of the slippage that occurred in the curriculum development (Table 7.1 and Chapter 2).

Strategies

1. Giving a legal status to the community (strategy: legalization)
2. Providing recognition for teachers' participation (strategy: recognition)
3. Providing accommodation for teachers' activities (strategy: accommodation)
4. Providing incentives for teachers and the experts (strategy: incentives)
5. providing time for teachers' activities (strategy: time)
6. Facilitating boundary crossing among the actors (strategy: facilitating)*

Result in ...

Because ...

Intended favorable conditions (cf. the IAC model)
<u>Infrastructure (I)</u>
Indicators:
I.1 A legal document of the community of chemistry teachers is available
I.2 A certificate of teachers' participation is provided
I.3 (Accessible*) accommodation for regular teachers' activities is available.
I.4 There are enough incentives for the teachers and invited experts
I.5 The teachers are given a regular day off on Saturdays
<u>Authority (A)</u>
Indicators:
A.1 The principals are responsible for managing teachers' teaching schedules, budgeting for incentives for teachers and experts, and providing a place and facilities for teachers' activities
A.2 The MORA officer is responsible for issuing the legal document for the community of chemistry teachers and provide teachers' certificates of participation
A.3 The teachers are responsible for helping the MORA officer and the principals to accomplish their tasks: providing the structure of the community, schedule of activities, and report of activities (including list of attendance).
<u>Consensus (C)</u>
Indicators:
C.1 The realization of the strategies and the actors' tasks.

Arguments
1. A legal document serves as an acknowledgement of the existence of the community. The legalization could allow the teachers to search for other sources of funding. For the principals, the legal status of the community helps them to allocate their budget for teachers' activities.
2. The certificates of teachers' participations are required for the certification of teachers and accreditation of *madrasah*.
3. A certainty of a place with necessary facilities, such as black board, projector, screen and other stationeries is important for the regular learning activities in the community.
4 Financial assistance is important to compensate for teachers' participation and to allow more teachers to participate in the community. Financial assistance is also needed to pay the invited experts.
5. Due to long distances between the *madrasah* in the district, the activities of professional development cannot be done within teachers' teaching time.
6. Since the actors involved had different hierarchical status, facilitating boundary crossing among the actors would blur the boundary and thus allow the actors to implement the strategies better.

The issues with a "*" appeared in cycle 2

Figure 7.4 The specification of the SIC model of organizational support for the first and the second cycle as a result of participatory design work of all educational actors involved.

Summarizing the results of these three studies (Chapters 4, 5 and 6), development activities of *madrasah* teachers were facilitated by giving ownership of establishing the community of teachers to the local educational actors. This also facilitated ownership of

the PD activities of the teachers, which resulted in positive contributions to the changes they perceived. The local educational actors, the principals and the MORA officer in the district participated in the establishment of the community. Favorable conditions which were fulfilled in the outer layer of the teachers' community proved to enable teachers to conduct professional development activities. The involvement of a facilitator as a boundary crosser between the teachers and the other actors enhanced the participatory work of the actors, including the association of *madrasah* principals (MK2MA). Such facilitated participation contributed to improving the conditions for teachers' PD activities. The PD activities were facilitated by giving teachers ownership to arrange, enact, and reflect on their activities, and promoted professional, personal, interpersonal, and institutional changes. PD activities which involved students doing chemical experiments were found to strengthen the emphasis of Scientific Skill Development. This is likely to reduce the slippage in curriculum development.

7.4 Conclusions on the main research question

The main research question of the studies, described in this thesis, was:

> *In what way can professional development activities of chemistry teachers be facilitated during curriculum change in a decentralized educational system?*

From the findings of the five studies it was concluded that the professional development activities of chemistry teachers during a curriculum change in a decentralized educational system could be better understood by the facilitation through three steps of sequential studies. The first step was a general analysis of the curriculum development. The second step was an analysis of the conditions of the operational curriculum in which teachers have an important role. The third step was to conduct a study in a local setting to provide favorable conditions for professional development activities of teachers. In order to develop a further understanding the results of these three steps, a case study on the professional development of teachers in the context of the decentralized educational system of Indonesia was conducted. The three steps were found to be beneficial to improve the professional development and the educational practices in a local setting, thereby contributing to the general objectives of the curriculum change. The three steps are now described in more detail.

The first step involved the analysis of chemistry education in the Indonesian *madrasah* with respect to curriculum representations and curriculum emphases in order to determine possible slippage in the curriculum development (Chapter 2) and to find a feasible route towards solutions for improvement. Two theoretical perspectives were used: the curriculum representations of Van den Akker (1998; 2003) as adapted from Goodlad (1979), and the curriculum emphases of Roberts (1982). It was found that a sizable slippage of emphases occurred between the curriculum representations.

The second step was an analysis of the conditions for the chemistry teachers when they gave shape to a curriculum change. The IAC model of conditions by Havelock and Huberman (1978) was used to assess the conditions. It was reported that due to the unfavorable conditions the teachers were hindered from giving shape to the curriculum change.

The third step involved the establishment of a community of teachers in the district. This work was analyzed with the perspective of the outer layer and the inner layer of the community which involved the work of the educational actors and the professional development activities of teachers, respectively. Regarding the outer layer, the community of teachers was established with the participation of local educational actors. A cyclical process of participatory design approach (PDA) was conducted by planning, implementing, and evaluating the design of the community and the intended conditions. The cooperation of all actors determined strategies in order to provide favorable conditions for teachers' professional development activities. The agreed strategies and the intended conditions were systematically structured in the Strategies for Intended Conditions (the SIC model; Figure 7.3 and 7.4). Having all six strategies implemented, teachers found that the intended favorable conditions were to a large extent fulfilled. In the inner layer, teachers were given authority to conduct an iterative process of arrangement, enactment, and reflection on their PD activities. It was found that through these activities, teachers experienced professional, personal, interpersonal, and institutional changes. The reported professional changes involving practical activities influence the emphases within the perceived and operational curriculum representations, and might help reducing the slippage in the curriculum development.

The results of these three steps of studies were found to be beneficial to facilitate professional development activities of chemistry teachers in a decentralized educational system. Three important considerations emerged from these studies that need to be taken into account when applying the three steps in other settings:

1. It is important to understand the problems in the curriculum development, particularly in the phases in which teachers play an important role, prior to conducting actions to facilitate the teachers.
2. It is essential to conduct specific measures that stimulate different local educational actors to work together to facilitate the teachers in a local setting. A participatory design approach (PDA) was found to be effective for the participation of the actors. Three aspects should be taken into consideration in this approach:
   a Determining local actors who, according to the teachers, are influential for the community and teachers' PD activities. For the studies in the Indonesian context, the actors were the officers from the ministry of education at district level, the principals, and the association of principals, apart from the teachers themselves.

b   Involving a facilitator who is able to cross boundaries between the teachers and those influential actors.

c   Giving all actors (and the facilitator) an authority to conduct a continuous process of planning, implementing, and evaluating strategies that according to them enable teachers to fulfill favorable conditions for teachers' PD activities.

3. It is important to give teachers ownership of their PD activities, including the arrangement, enactment, and reflection on the activities in order to attain knowledge and skills that are beneficial for their practices. Noteworthy in these activities is the involvement of students which can increase the potential of applying the knowledge and skills in teachers' practices.

7.5 Reflection on contributions to the theoretical perspectives

The studies in this thesis involved the complex situation of facilitating chemistry *madrasah* teachers' professional development. In order to describe the relevance of these studies for other situations and for further studies, a reflection on the outcomes of these studies is given. Six aspects emerge from the studies that contribute to the knowledge in the field of science education: the sequential steps in these studies, the framework of curriculum representations and curriculum emphases, the IAC model of conditions of change, the framework of a community of teachers, the SIC model for developing a community, and the participatory design approach (PDA). The next section presents the reflection on each of these aspects.

The sequential steps in the studies

The three sequential steps of studies were important to facilitate teachers' PD activities in a process of curriculum change in an educational system with a decentralization policy. These steps were carried out through a sequential pathway of studies from a general problem analysis of the curriculum development to an analysis of a local educational change. To a certain extent this contributed to resolve the problems in the curriculum development. The first step involves a general analysis of the curriculum development, providing a clear overview of problems. The second step involves an exploration of the problems, particularly those at the level of teachers. The results of these two steps are essential in providing a feasible route towards an approach for solutions to facilitate the teachers. The third step focuses on the execution of an approach for solutions in the local setting. The local setting of this step provides an in-depth analysis of the conditions that can be delineated to facilitate teachers enjoying favorable conditions for their PD activities. The results of these studies in three steps are not only more understanding and offering teachers better facilities for their PD activities, but this also contributed to a reduction of slippage in the curriculum development. When this slippage is reduced,

this can improve the coherency of the curriculum and thus bring the students' affective and cognitive outcomes more in line with the educational objectives. These three steps seem to be beneficial in any effort to improve educational practice particularly in a decentralized educational system.

The framework of curriculum representations and curriculum emphases

The theoretical perspectives on curriculum representation of Goodlad (1979) and Van den Akker (1998; 2003) and the curriculum emphases of Roberts (1982) proved to be fruitful for the analysis of the characteristics of a curriculum change in the decentralized educational system (Chapter 2). The use of a full set of these perspectives in the analysis provided an analysis of the level of coherency in curriculum development. A direct comparison of the curriculum representations and emphases can determine the problems of slippage in the curriculum development between what has been intended by the government (policy makers) and what is attained by students. Recognizing the problems in each of the representations enables teachers, researchers and educators to determine which measures should reduce the problems.

The importance of these two perspectives has been acknowledged in many studies in the field of curriculum research (Bulte, Westbroek, De Jong & Pilot, 2006; Roberts, 1995; Van den Akker, 1998, 2003; Van Berkel, Pilot & Bulte, 2009; Van Driel, Bulte & Verloop, 2008; Wei & Thomas, 2006;). However, most of these studies did not use a full set of representations, implying that only one or two curriculum representations were analyzed in relation to the curriculum emphases. Most studies focused on the perceived and operational curriculum representations in which teachers play an important role (e.g., Van Driel et al., 2008; Wei & Thomas, 2006). Analyzing only these representations may provide a direct contribution for teaching practices, but this contribution to the whole of the curriculum objectives might not be well understood. The use of the full set of the perspectives can make noteworthy contributions to the analysis of curriculum development in the contexts of other educational systems.

The IAC model of conditions for educational change

The IAC model of the conditions of Infrastructure, Authority, and Consensus for educational change (Havelock & Huberman, 1978), was found to be useful. It supported the *analysis* of the conditions for educational change (Chapter 3), and also the *planning* to improve the conditions for change (Chapter 4 and 5). This model provided a thorough problem analysis and important indicators for a successful improvement in the educational change (Chapter 3). In the planning to improve the conditions, the IAC model helped structuring conditions and indicators, directing the actors involved in the

educational change towards their objectives of the change. The condition Consensus in the model was particularly important as it may be an essential condition in any program of educational change according to Hubbard et al. (2006). The explicit involvement of Consensus in the IAC model provided for a complete structure for the analysis of the conditions, which is rarely found in other models for analyzing educational change, for example in the models of Rogan and Grayson (2003) and Fullan (2007). In a local process of educational change, particularly within the policy of decentralized educational system, a high level of Consensus is a critical component in order both to *initiate* and to *implement* an innovation (Havelock & Huberman, 1978). Havelock and Huberman expected that Infrastructure and Authority are more likely to follow when Consensus is determined and committed. This model has been developed already in 1978, but it is not been widely used so far. However, it appeared to be very useful in this case of a local educational change. Therefore, the use of this model in a local educational change as has been done in this study is considered a contribution to the research field of local educational change in other contexts.

The framework of a community of teachers

The framework of a community of teachers was adapted from the professional development system of Borko (2004). The use of this framework has provided a full analysis of a community of teachers in the research conducted in this thesis. The framework gave a distinction in the outer and inner layer of the community in which the first layer determines the context and the second layer describes teachers and their PD activities. This distinction provided a good overview of the interaction between the two layers. Studies about a community of teachers often center on the teachers and their learning activities only (the inner layer), such as collaborative learning among the teachers to develop certain content or pedagogical knowledge (Grossman et al., 2001; Jaworski, 2005; Little et al., 2003; Stolk et al., 2011; Stolk, Bulte, De Jong, & Pilot, 2012). While acknowledging the importance of the context (the outer layer), they mostly give much less attention to it. Particularly in a decentralized educational system with a local setting of an educational change, the role of the context is critical for all of the local educational actors. The adapted framework of Borko assisted in understanding the role of these local actors in the community of teachers.

The SIC model for the outer layer of the community of teachers

The model for Strategies and Intended Conditions, the SIC model, was found to be helpful in planning and assessing the local educational change, i.e. the establishment of the community of teachers with different educational actors. Important in this model is the visualization of the relations between the strategies, the arguments for the strategies,

and the intended conditions (Figure 7.3 and 7.4). This visualization of the SIC model structured agreements of the actors involved in the change upon the specific strategies for change, their arguments for the strategies, and the indicators for the conditions they intended to be fulfilled. This visualization has been adapted from the concept of educational design principles as used by Prins (Prins et al., 2011), inspired by an idea of Van den Akker (1999). These design principles have been used in many studies, particularly in the study of curriculum development and design of students learning (Gravemeijer & Cobb, 2006; McKenney et al., 2006; Prins et al., 2011; Meijer, 2011; Reeves, 2006). This representation of design principles has not been used before in the field of designing a community of teachers for professional development. Therefore, the development and the use of the SIC model in this research make a contribution to the understanding and use of such design principles in fields other than curriculum development, particularly the study of a community of teachers.

The participatory design approach (PDA)

The participatory design approach (PDA) used in this study is a new approach in the field of a community of teachers in which human-human relations are very important. Most of the participatory design has been executed in the field of human-computer relations, such as online learning and educational software development (Ellis & Kurniawan, 2000; Silva & Breuleux, 1994). A common approach for research involving human-human relations in the field of education is participatory action. This kind of approach has been widely applied in many educational changes in a local setting. Studies involving this approach often deal with particular teaching and learning problems, i.e. the development of the operational curriculum and improving teaching strategies (Eilks, 2002; Marks & Eilks, 2010; Ponte, Ax, Beijaard, & Wubbels, 2004). In such studies, the educational actors involved are limited to the teachers and experts, mostly researchers coming from universities.

The PDA in the study in this thesis is used in a different setting than the participatory design and participatory action approach as commonly applied. The PDA for a community of teachers concerns three important aspects which are not found in the other approaches: the involvement of different actors with different hierarchical status (i.e. ministry, principals, teachers), the control of the actors over the process and decision making, and the involvement of a facilitator as a boundary crosser between the actors (Chapter 4 and 5). These aspects strengthen the understanding of the use of the PDA which appeared to be very useful in helping to enhance the capacity of local educational actors in establishing the community of teachers and supporting teachers' PD activities. The use of this PDA contributes additional evidence for the potential involvement of different educational actors in a local educational change within a decentralized educational system.

7.6 Limitations

While the studies in this thesis contribute to the development of knowledge in the field of education, several limitations should be acknowledged and addressed. The first limitation concerns the theoretical frameworks used in this research, the second concerns the extent of the generalization of the findings and the third concerns the methodologies applied.

Theoretical frameworks

The theoretical frameworks and models used in this thesis involve the combination of two curriculum perspectives, the IAC model, the SIC model, and the participatory design approach (PDA). The combination of these frameworks is rather new within this kind of study. The nature of these frameworks and models has been used for a wide perspective of analysis. For example, the combination of the two curriculum perspectives (Chapter 2) was used to investigate a full picture of the characteristics of the curriculum based on all curriculum representations regarding all curriculum emphases. This is different from many studies in this area that have most often analyzed the curriculum emphases in one or two curriculum representations. Another example was the use of PDA for establishing a community of teachers (Chapter 4). In general, the PDA was a refinement of participatory action research and design based research providing advantages from each type of research, including: the participatory work of different actors, the iterative process as an effort for a continuous improvement, and a systematic way of arranging agreements of the actors (strategies, arguments, and intended favorable conditions). Considering the nature of the frameworks and models in this thesis, therefore, the framework and models function as a large lens through which the results gained from the studies will be dynamic and broad, not authoritative or static. However, the nature of the frameworks and models can be a limitation of the studies in this thesis.

The generalization of the findings

The studies in this thesis were conducted within the setting of *madrasah* in a "centralized-decentralized" educational system of schools. *Madrasah* are managed by the centralized system of MORA and yet should conduct curriculum development in a decentralized system, i.e., developing a school-based curriculum, as recommended by MONE. This setting of the educational system is characteristic for Islamic schools in Indonesia and may not be found in other countries. However, the nature of the problems in the education of *madrasah* has been found to be rather similar to other cases where a decentralized system is established (see the case in Norway and Canada (Karlsen, 2000)), the UK and some East Asian countries (Green, 1999), and the Netherlands,

Sweden and Portugal (Van Amelsvoort, 1997). Since the initiation of a decentralized educational system mostly came from the central authorities, decentralization has led to new centralized regulation as can be seen from the standardized content of the operational curriculum (Chapter 2 and Chapter 3). In addition, decentralization of tasks and responsibilities does not necessarily mean a shift of power from the central authorities to the local authorities and to schools since the responsibilities are limited by centralized laws and regulations. While the degree of the problems may vary among the countries, a similar nature of decentralization might make the lessons learned from the studies in this thesis relevant in other decentralized educational systems.

The methodologies

In general, the nature of the data in the studies was qualitative and came from many different sources. Having different qualitative data sources increases the possibility of different interpretations of the information gathered. This might bring difficulties in the final interpretation and analysis. At the same time, having different data sources also allows a validating process through triangulation of the data. To minimize different interpretations and to increase the validation in the studies, critial friends in the same field and supervisors were involved. Both the critical friends and the supervisors provided second opinions on the interpretation of the data. By this arrangement the work of the main researcher was validated.

The short time for the series of studies did limit the search for information. To cope with this issue, structured interviews were used as the major source of data in the studies. The format of interviews directed the participants to provide detailed information on the important issues needed for the studies. Therefore, despite the limited time for the studies, the information gathered was relatively rich.

Furthermore, in a case study the detailed and rich environment is influenced by many different circumstances such as the persons being involved with their political influence, the choices being made on the teachers and schools involved. Generalization of findings of this study should be considered with considerable care.

7.7 Implications

The conclusions and limitations of the studies lead to some implications for researchers, policy makers, principals, and teachers.

Implications for further studies

The most important implication for further studies is the continuation of the use and elaboration of the frameworks and models. A more thorough understanding could be achieved by studying cases in other contexts with considering valid and reliable methodology for the analysis of data, and the involvement of more and different educational actors. It seems to be relevant to conduct similar studies in other settings which are historically and culturally different from those in the current study. Particularly studies on communities of teachers and teachers' professional development activities in other domains, involving other educational actors and other PD activities of teachers, might give more understanding of facilitating the establishment and sustaining of teachers' communities and PD activities.

Implications for policy makers

Very few empirical studies are available about science education in *madrasah*. This research has revealed the problems and challenges when local educational actors and teachers try to understand the ideal and formal curriculum determined by policy makers. The analysis of the involvement of policy makers in considering the real difficulties in the local setting showed superficial perceptions and operationalization of the curriculum policy by the local actors and the teachers. Concurring with the findings of other researchers of curriculum policy and practice, such as Bybee (1991), Honig (2003), Cohen and Spillane (1992), and Fuhrman (1993), this research suggests that policy makers should primarily consider the coherency of educational policy and practice. This implies that support given by policy makers should aim at reducing the gaps that occur between policy and practice. The findings in this research on what has facilitated or hindered the practice of teachers and other educational actors at the local level show that policy makers can come up with strategies that will engage the teachers and the other actors in appropriate efforts that support the development of an operational curriculum that is coherent with the ideal curriculum.

Implications for principals

The studies in this thesis have revealed the important role of principals in the development of the operational curriculum by teachers and the professional development of teachers. Since teachers' professional development was found to be

needed to fill the gap between the Ideal and the Operational Curriculum, the principals can significantly contribute to reduce the slippage in curriculum development. Considering this, principals should support the professional development activities of teachers, particularly in the context of the complicated status of *madrasah*.

Implications for teachers

This study showed that PD activities will be beneficial for teachers if they have ownership of the management of their activities and are trusted by the other educational actors to conduct their own development. A community of teachers proved to be a suitable place for teachers' PD activities, particularly when teachers from different *madrasah* participate in the activities. Looking at the long history of the centralized educational system, this research has provided a new perspective for teachers to independently work on their own development. This process of independent work may contribute to their understanding on how to conduct their PD activities in order to get beneficial knowledge and skills for their practices.

7.8 Concluding remarks

In a process of educational change, providing favorable conditions for implementing the change is a major challenge for all actors in education, including the government, schools, principals and teachers. The challenge has been high for these actors in a decentralized educational system. Particularly important among these educational actors are the teachers for which the favorable conditions are critical for a successful implementation of the change in their practices. This research provides a sequential process to facilitate *madrasah* chemistry teachers to face the challenge of a new school-based curriculum policy in a decentralized educational system in Indonesia. This sequential process gives an understanding how to facilitate teachers to give shape to the new curriculum policy. Particularly important in this case study was the process in the local setting, in which local educational actors were supporting the empowerment of the teachers. The results of these studies may pave the way for further studies to improve the facilitation of the teachers in order to improve teachers' educational practices.

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Summary

Samenvatting

Acknowledgements

Curriculum vitae

FIsme Scientific Library

List of Abbreviations

Summary

Providing favorable conditions for implementing an educational change is a major challenge for all actors in education, including the government, schools, principals and teachers. The conditions are particularly important for teachers as the key actors in education in order for them to act in accordance with the educational objectives. For the purpose of providing favorable conditions, it is important to understand the process of educational change. The role of teachers is important for its success. Professional development contributes to the knowledge and skills needed in this change. Several studies have reported the importance of communities of teachers. However, studies on establishing communities and the professional development of teachers in a decentralized educational system are lacking.

This thesis describes research on facilitating the professional development of teachers of Islamic schools (*madrasah*) during a curriculum change in the decentralized educational system of Indonesia. The studies in this research project aim to contribute to the knowledge base on facilitating teachers to conduct professional development activities and to develop knowledge and skills that are meaningful for their curriculum development and teaching. The overall research question in this thesis is:

In what way can professional development activities of madrasah chemistry teachers be facilitated during curriculum change in a decentralized education system in Indonesia?

Two additional sub-questions are derived to answer the main question:
1. *What are the characteristics of chemistry education in madrasah as a result of a decentralization policy in Indonesia and what are the conditions during this curriculum change?*
2. *In what way can the professional development activities of chemistry madrasah teachers be facilitated in their community of teachers?*

Chapters 2 and 3 of this thesis contribute to answering the first sub-question, while chapters 4, 5, and 6 address the second sub-question. The findings are combined in Chapter 7 to answer the overall research question.

Sub-question 1. What are the characteristics of chemistry education in *madrasah* as a result of a decentralization policy in Indonesia and what are the conditions during this curriculum change?

In Chapter 2 chemistry education in Indonesian *madrasah* is characterized by analyzing the content and coherency of the curriculum from the goals as intended by the policy makers (curriculum developers) to the students' outcomes. This characterization was conducted with the perspective of curriculum representations (Van den Akker) and curriculum

emphases (Roberts). A sizable slippage in emphases was found by comparing the vision on the curriculum (the Ideal Curriculum) and the results of students' examinations. The Ideal Curriculum covered most of the emphases, except the emphases of Solid Foundation and Self as Explainer. An emphasis of Religious Orientation was also found in this Ideal Curriculum, yet, it was not found in the other curriculum representations. In the curriculum representations in which teachers play an important role, the Perceived and the Operational Curriculum, there were three emphases; Scientific Skill Development, Everyday Coping and Correct Explanations. Besides, the emphasis of Solid Foundation that was not found in the Ideal Curriculum appeared in the Perceived and the Operational Curriculum. In these representations Correct Explanations and Solid Foundation were dominant. The findings in this characterization of the chemistry curriculum in the context of *madrasah* implied that there were severe problems in the curriculum change that influenced the teachers to perform their tasks in the curriculum development.

Chapter 3 describes a study in which the conditions in the process of educational change were analyzed as well as the impact these conditions have on the teachers when they give shape to the new Operational Curriculum. The results revealed the conditions were not favorable for teachers. These conditions were related to Authority, Infrastructure, and Consensus, using the model of Havelock and Huberman. As for Authority, the unclear tasks and understanding of the actors in the educational system influence *madrasah* teachers and principals. Particularly the confusing difference in responsibilities of the decentralized policy of the Ministry of National Education (MONE) and the centralized policy of the Ministry of Religious Affairs (MORA) induced problems. Regarding the Infrastructure, teachers were given limited facilities, such as textbooks, learning materials and time, and also limited opportunities to participate in professional development activities. This condition resulted in a lack of Consensus and commitment of the responsible actors to provide necessary support for the teachers. Therefore teachers needed to be facilitated in their professional development activities at the local level to deal with the curriculum change. This facilitation was related to the development of favorable conditions for teachers' professional development activities.

Sub-question 2. In what way can professional development activities of chemistry *madrasah* teachers be facilitated in their community of teachers?

The facilitation of teachers' professional development activities was studied by differentiating between the two layers of a community of teachers, i.e. the outer layer and the inner layer. The outer layer concerns the support given by educational actors like principals and ministries that influence teachers' professional development activities. The inner layer involves the actual professional development activities. In Chapters 4 and 5 the establishment of a community of *madrasah* teachers is studied from the perspective

of the outer layer. The establishment of the community was conducted through a participatory design approach which involved local educational actors developing agreements on, and futher implementing, several strategies to provide favorable conditions for teachers' activities in the community. The agreements of the actors were systematically structured in a model that links Strategies (S) underpinned by arguments that were planned to be implemented by the educational actors to fulfill Intended Conditions (IC) for teachers' professional development activities (the SIC model).

Six strategies were agreed by the actors. These were found to be beneficial to fulfill the intended favorable conditions. The strategies were (1) providing a legal status for the community, (2) providing recognition for teachers' participation, (3) providing accommodation for teachers' activities, (4) providing incentives for teachers and experts to participate, (5) providing time for teachers to attend, and (6) facilitating boundary crossing among the actors. The last strategy, which facilitated boundary crossing among the actors at a higher hierarchical level, was introduced in the second cycle of design and research. This strategy was found to be critical to enhance the fulfillment of the intended conditions for change in the second cycle. The findings revealed that all the six strategies were implemented to a large extent and resulted in rather favorable conditions for the teachers.

Chapter 6 reports a study on the facilitation of professional development activities of teachers in the community (the inner layer) within the fulfilled conditions of the outer layer as reported in the previous chapter. The results showed that the professional development of the teachers was facilitated by teachers' ownership of arranging, enacting, and reflecting on the activities. The teachers reported that these activities did lead to personal, professional, interpersonal, and institutional changes for them. Among these changes, the institutional change was the most important for the teachers. This institutional change seems to influence the other three changes. As for the professional changes, that were related to the development of new knowledge and skills, activities such as preparing practical chemical experiments, microteaching, and involving students in these experiments, were found to be important. Professional development activities which involved students doing chemical experiments were found to strengthen the emphasis of Scientific Skill Development that might become apparent in the Perceived and the Operational Curriculum. This may reduce the slippage found in the first study. The teachers reported that the new knowledge and skills they acquired were meaningful for their practices. The teachers considered the sustainability of the community, professional development activities, and applying the new knowledge and skills, to be dependent on the curriculum guidelines, their working environment, and students' involvement.

Main research question. The results of these studies were combined to answer the main research question:

In what way can professional development activities of madrasah chemistry teachers be facilitated during curriculum change in a decentralized educational system?

To facilitate the professional development activities of *madrasah* teachers, a sequence of studies was conducted. The first study involved an analysis of the chemistry curriculum through characterizing the curriculum representations and emphases. The second study involved an analysis of the conditions for the curriculum change that influenced the teachers. These studies were conducted to provide a better understanding of the conditions within which measures should be planned to facilitate the teachers. The third and fourth study focused on the design and implementation of intended conditions of change by the teachers and other local actors. This was based on the results of the previous studies, such as the sizable slippage found in the curriculum representations and the unfavorable conditions for professional development of teachers. A participatory design approach was used to facilitate the establishment of a community of *madrasah* chemistry teachers for their activities in curriculum development. The implementation of six strategies by the educational actors did result in conditions that were to a large extent fulfilled as intended.

In the final study, teachers' professional development activities were investigated under the favorable conditions provided in the outer layer of their community. The teachers experienced ownership of arranging, enacting and reflecting on their professional development. They reported professional, personal, interpersonal, and institutional change. Particularly important for their practice in class were their professional changes which also involved practical chemical experiments by students. This can contribute to the implementation of the emphases Scientific Skill Development and Correct Explanation in the Perceived and the Operational Curriculum. The slippage in the curriculum emphases, as found in the first study, might be reduced in such a process of facilitating the professional development activities of chemistry teachers with ownership at the local level.

The results of these last studies were beneficial to facilitate professional development activities of chemistry teachers in a decentralized educational system. Three important considerations emerged from these studies that need to be taken into account when applying the three steps in other settings:

1. It is important to analyze and understand the problems in the curriculum development prior to conduct actions to facilitate the teachers, particularly in the

phases in which teachers play an important role,. The theoretical perspectives of curriculum representations, the curriculum emphasis concept, as well as the model of Infrastructure, Authority and Consensus, were useful to describe and understand the findings.

2. It is essential in a local setting to conduct actions that stimulate local educational actors to work together to facilitate the teachers. A participatory design approach was found to be effective for the participation of these actors. Three aspects should be taken into consideration in this approach:

    a   Determining local actors who, according to the teachers, are influential for the community and their professional development. In the studies in the context of Indonesian *madrasah*, the actors were the officers from two ministries at district level, the principals, and the regional association of principals, apart from the teachers themselves.

    b   Involving a facilitator who is able to cross boundaries between the teachers and those influential actors.

    c   Giving all actors (and the facilitator) an authority to conduct a continuous process of planning, implementing, and evaluating strategies that according to them enable teachers to fulfill favorable conditions for teachers' professional development.

3. It is important to give teachers ownership of their professional development, including the arrangement of, enactment of and reflection on the activities to acquire the knowledge and skills that are beneficial for their teaching practices. Important in their professional development is the involvement of students that increase the potential of applying the knowledge and skills in class.

A model that connects Strategies and Intended Conditions, the SIC model, was helpful in planning and assessing the educational change. This structured connection visualized the relations between the strategies, the arguments for the strategies, and the intended conditions that were agreed by the actors involved in the change. Such a visualization was adapted from the concept of educational design principles as defined in design-based research on instructional units.

While making several contributions, the studies in this thesis also have limitations on at least three issues; the theoretical frameworks used in this research, the extent of the generalization of the findings, and the methodologies applied. Nevertheless, both the contributions and limitations of the studies, together with the overall results of the studies, offer important lessons to be learned by policy makers, principals and teachers who aim to improve the professional development of teachers and curriculum development. The results of these studies might also pave the way for further studies to understand and improve the facilitation of teachers in improving their educational practices.

Samenvatting

Het creëren van gunstige condities voor het invoeren van een onderwijsinnovatie is een grote uitdaging voor alle actoren binnen het onderwijs: regering, beleidsmakers, scholen, schoolleiders en docenten. Het is vooral voor docenten belangrijk om deze gunstige condities te creëren, zodat zij hun onderwijs kunnen vormgeven in overeenstemming met de onderwijsdoelen. Docenten spelen immers een cruciale rol bij de succesvolle implementatie van een innovatie. Daarom is het ook noodzakelijk de betreffende onderwijsinnovatie goed in kaart te brengen. Want professionele ontwikkeling van docenten speelt daarbij een belangrijke rol, omdat zij de inzichten en vaardigheden moeten ontwikkelen die noodzakelijk zijn in het innovatieproces. Diverse studies hebben aangetoond, dat leergemeenschappen de professionele ontwikkeling van docenten kunnen bevorderen. Het is echter onbekend op welke wijze de condities voor de vorming van deze leergemeenschappen gecreëerd kunnen worden, met name in een gedecentraliseerd onderwijssysteem, zoals in Indonesië was ingevoerd.

In dit proefschrift wordt een onderzoek beschreven naar het faciliteren van de professionele ontwikkeling van docenten in een curriculuminnovatie op Islamitische scholen (*madrasah*) in het gedecentraliseerde onderwijssysteem in Indonesië. De deelstudies in dit onderzoek zijn erop gericht een bijdrage te leveren aan de kennisbasis over curriculuminnovatie. Voor die innovatie moeten docenten gefaciliteerd worden in hun professionele ontwikkelingsactiviteiten zodat zij op een voor hen betekenisvolle manier daarvoor de benodigde inzichten en vaardigheden kunnen verwerven. De hoofdvraag in het onderzoek in dit proefschrift is:

Op welke manier kunnen activiteiten voor de professionele ontwikkeling *van madrasah chemiedocenten worden gefaciliteerd binnen een curriculuminnovatie in het gedecentraliseerde onderwijssysteem in Indonesië?*

Uit deze hoofdvraag zijn twee subvragen afgeleid die richting geven aan de deelstudies in dit onderzoeksproject:

1. *Wat zijn de kenmerken van chemieonderwijs in* madrasah *als gevolg van het onderwijsbeleid in Indonesië en wat zijn de condities waaronder de huidige curriculuminnovatie plaatsvindt?*
2. *Op welke manier kunnen professionele ontwikkelingsactiviteiten worden gefaciliteerd in een leergemeenschap van chemiedocenten in* madrasah-*scholen?*

Hoofdstuk 2 en 3 van dit proefschrift richten zich op de eerste subvraag, terwijl hoofdstuk 4, 5, en 6 ingaan op de tweede subvraag. De bevindingen worden in hoofdstuk 7 gecombineerd tot een antwoord op de hoofdvraag.

Subvraag 1. *Wat zijn de kenmerken van chemieonderwijs in* madrasah *als gevolg van het onderwijsbeleid in Indonesië en wat zijn de condities waaronder de huidige curriculuminnovatie plaatsvindt?*

In Hoofdstuk 2 worden de kenmerken van het chemieonderwijs in de Indonesische *madrasah*-scholen beschreven met behulp van een analyse van de inhoud en van de consistentie in het curriculum tussen de (leer)doelen, zoals geformuleerd door de beleidsmakers (curriculum ontwikkelaars) en de leerresultaten van de leerlingen. Deze analyse werd uitgevoerd vanuit het perspectief van alle curriculumrepresentaties, zoals beschreven door Van den Akker en vanuit het perspectief van de curriculumoriëntaties, zoals beschreven door Roberts. Deze analyse constateerde onder andere een aanzienlijke inconsistentie tussen de curriculumoriëntaties bij de vergelijking tussen de visie op het curriculum (het Ideale curriculum) en de examenresultaten van de leerlingen (het Geleerde curriculum). Het *Ideale Curriculum* omvatte de meeste oriëntaties, met uitzondering van *Basiskennis* en *Persoonsgebonden Verklaring*. De *Religieuze Oriëntatie* die werd gevonden in dit *Ideale curriculum*, en niet door Roberts werd beschreven, werd echter niet meer gevonden in de andere, ook geanalyseerde curriculumrepresentaties. In de curriculumrepresentaties waarin docenten een belangrijke rol spelen, het *Geschreven* en *Operationele Curriculum*, vonden we drie curriculumoriëntaties: *Ontwikkeling van Wetenschappelijke Vaardigheden*, *Alledaagse Toepassingen* en *Juiste Verklaringen*. Daarnaast verscheen de *oriëntatie op Basiskennis*, die niet werd aangetroffen in het *Ideale*, *Geschreven* en *Operationele Curriculum*. In deze drie representaties waren de oriëntaties *Juiste Verklaringen* en *Basiskennis* dominant. Deze analyse van het chemiecurriculum geeft aan dat de *madrasah*-scholen te maken hebben met een inconsistente curriculuminnovatie die de uitvoering ervan door de docenten beïnvloedt.

Hoofdstuk 3 beschrijft een onderzoek waarin de condities werden geanalyseerd, waaronder het proces van onderwijsinnovatie plaatsvindt. De impact van deze condities op de docenten in het *Operationele curriculum* werd eveneens geanalyseerd. De resultaten laten zien dat die condities voor de professionele ontwikkeling van docenten niet gunstig waren. Deze condities zijn vervolgens verbonden met de dimensies Autoriteit, Infrastructuur, en Consensus van het model van Havelock en Huberman. Wat betreft de dimensie Autoriteit, worden de docenten en schoolleiders van de *madrasah*-scholen vooral beïnvloed door de condities (1) onduidelijke verantwoordelijkheden en (2) het gebrek aan inzicht die deze actoren hebben ten aanzien van het onderwijssysteem. Vooral het verwarrende verschil in verantwoordelijkheden tussen het gedecentraliseerde beleid van het Ministerie van Onderwijs (MONE) en het gecentraliseerde beleid van het Ministerie van Religieuze Zaken (MORA) leverde problemen op bij de facilitering. Wat betreft de Infrastructuur werd duidelijk dat docenten zeer beperkte faciliteiten kregen (3[e] conditie): bijvoorbeeld schoolboeken,

onderwijsmaterialen en tijd. Bovendien hadden zij zeer beperkte mogelijkheden om deel te nemen aan professionele ontwikkelingsactiviteiten (4[e] conditie). Deze conditie leidde ook tot een gebrek aan Consensus en betrokkenheid onder de personen (met name de beleidsmakers), die verantwoordelijk waren voor de noodzakelijke ondersteuning van de docenten. Het faciliteren van docenten is noodzakelijk om deel te kunnen nemen aan professionele ontwikkelingsactiviteiten om de curriculuminnovatie in de lokale situatie vorm te geven. Het gunstiger maken van de genoemde condities is hiermee verbonden.

Subvraag 2. *Op welke manier kunnen* professionele ontwikkelings*activiteiten worden gefaciliteerd in een leergemeenschap van chemiedocenten in* madrasah-*scholen?*

De facilitering van de professionele ontwikkelingsactiviteiten van docenten is onderzocht door onderscheid te maken tussen twee lagen van leergemeenschappen, de buitenlaag en de binnenlaag. De buitenlaag betreft de ondersteuning door onderwijsactoren die invloed hebben op de professionele ontwikkelingsactiviteiten van docenten, zoals schoolleiders en ministeries. De binnenlaag betreft de eigenlijke professionele ontwikkelingsactiviteiten van docenten. In Hoofdstuk 4 en 5 wordt de vorming van een leergemeenschap van chemiedocenten van *madrasah*-scholen onderzocht vanuit het perspectief van de buitenlaag. De vorming van de leergemeenschap werd uitgevoerd in een *participatory design* aanpak, bestaande uit twee cycli. Daarbij maakten lokale onderwijsactoren afspraken en zetten verschillende strategieën in om de condities gunstiger te maken voor de docenten in hun leergemeenschap. Deze afspraken werden systematisch in kaart gebracht met het SBC-model. Dit model geeft het verband aan tussen de Beoogde Condities (BC) voor professionele ontwikkelingsactiviteiten van docenten en de met argumenten onderbouwde Strategieën (S), samen het SBC model. Die strategieën werden gepland door de onderwijsactoren om de Beoogde Condities te vervullen.

De actoren spraken zes strategieën met elkaar af, die zij nuttig achtten voor het vervullen van de beoogde condities. Deze strategieën waren:
1. zorgen voor een legalisering van de leergemeenschap;
2. zorgen voor erkenning van de deelname van docenten aan de activiteiten van de leergemeenschap;
3. zorgen voor accommodatie voor de activiteiten van de docenten;
4. zorgen voor vergoedingen voor docenten en de experts;
5. het beschikbaar maken van tijd voor de activiteiten van docenten;
6. facilitering van communicatie tussen de actoren in de binnen- en buitenlaag.
De laatste strategie (6), die vooral de communicatie tussen de actoren op een hoger hiërarchisch niveau diende te bevorderen, werd geïntroduceerd in de tweede cyclus van

de *participatory design* aanpak. Dit bleek in de tweede cyclus een kritische strategie te zijn om de beoogde condities voor verandering te creëren. Het onderzoek toonde aan dat alle zes strategieën uit het SBC-model in hoge mate werden uitgevoerd en dat daarmee gunstige condities gecreëerd werden om professionaliseringsactiviteiten van docenten te faciliteren.

Hoofdstuk 6 beschrijft de facilitering van de professionele ontwikkelingsactiviteiten van docenten in de leergemeenschap (in de binnenlaag). De resultaten lieten zien dat door de uitgevoerde strategieën de professionele ontwikkelingsactiviteiten van docenten mogelijk werden, waarbij de docenten zich eigenaar van de leergemeenschap beschouwden en hun activiteiten zelf regelden, uitvoerden en erop reflecteerden. De docenten rapporteerden dat deze activiteiten leidden tot persoonlijke, professionele, inter-persoonlijke en institutionele veranderingen. Volgens de docenten was de institutionele verandering het meest belangrijk, en beïnvloedde de andere drie veranderingen. De professionele veranderingen hielden verband met de nieuwe inzichten en vaardigheden die volgens de docenten vooral het resultaat waren van activiteiten, zoals het voorbereiden van praktische chemische experimenten, het betrekken van leerlingen bij deze experimenten, en microteaching. Activiteiten van docenten waarbij leerlingen chemische experimenten uitvoerden, bleken de curriculumoriëntatie Ontwikkeling van Wetenschappelijke Vaardigheden te stimuleren. Deze curriculumoriëntatie vormde een onderdeel van het *Geschreven* en *Operationele Curriculum*. De aandacht voor deze oriëntatie kan de inconsistentie verminderen die in het eerste onderzoek (hoofdstuk 2) gevonden was. De nieuw verworven inzichten en vaardigheden zijn volgens de docenten betekenisvol voor hun praktijk. De docenten waren van mening dat de continuïteit in de leergemeenschap, de professionele ontwikkelingsactiviteiten en het toepassen van de nieuwe inzichten en vaardigheden vooral afhankelijk waren van de richtlijnen voor het curriculum, hun werksituatie en de betrokkenheid van leerlingen.

De hoofdvraag van het onderzoek
De resultaten van de deelstudies zijn vervolgens gecombineerd om de hoofdvraag van het onderzoek te beantwoorden:

> *Op welke manier kunnen* professionele ontwikkelingsactiviteiten *van* madrasah-chemiedocenten *worden gefaciliteerd binnen een curriculuminnovatie in het gedecentraliseerde onderwijssysteem in Indonesië?*

Om de facilitering van professionele ontwikkelingsactiviteiten van *madrasah-chemiedocenten* te onderzoeken is de beschreven reeks deelstudies uitgevoerd. De eerste studie betrof een analyse van het chemiecurriculum door de kenmerken vast te stellen met behulp van curriculum representaties en curriculumoriëntaties. De tweede studie betrof

een analyse van de huidige condities waaronder de curriculuminnovatie plaats vond. Deze studies werden uitgevoerd om meer inzicht te verkrijgen in de condities om docenten te faciliteren bij het uitvoeren van professionaliseringsactiviteiten. De derde en vierde studie waren geconcentreerd op het ontwerp en de invoering van de beoogde condities om professionaliseringsactiviteiten van docenten te faciliteren door docenten en andere lokale actoren. Deze studies waren gebaseerd op de bevindingen uit de voorgaande studies: een aanzienlijke inconsistentie tussen het Ideale en het Geleerde curriculum en ongunstige condities voor het uitvoeren van professionele ontwikkelingsactiviteiten door docenten. Een *participatory design* aanpak werd vervolgens toegepast om chemiedocenten van de *madrasah*-scholen te faciliteren, zodat zij professionaliseringsactiviteiten in een leergemeenschap konden organiseren. Invoering van de zes strategieën door de onderwijsactoren leidde ertoe dat condities werden gecreëerd zoals bedoeld.

In de laatste studie wordt gerapporteerd over de uitvoering van professionele ontwikkelingsactiviteiten door docenten in de gunstige condities die door de actoren in de buitenlaag van de leergemeenschap werden gerealiseerd. De docenten rapporteerden dat ze zich eigenaar voelden van de leergemeenschap zodat zij daarin hun professionele ontwikkelingsactiviteiten konden organiseren, uitvoeren en daarop reflecteren. Zij rapporteerden professionele, persoonlijke, inter-persoonlijke en institutionele veranderingen. Vooral professionele veranderingen, die chemische experimenten van leerlingen in hun lessen betroffen, droegen bij aan de invoering van de curriculumoriëntaties *Ontwikkeling van Wetenschappelijke Vaardigheden* en *Juiste Verklaringen* in het *Geschreven* en *Operationele Curriculum*. Dit kan leiden tot een reductie van inconsistentie in de curriculumoriëntaties.

De resultaten van de laatste studies laten zien dat de activiteiten nuttig waren voor de professionele ontwikkeling van chemiedocenten in een gedecentraliseerd onderwijssysteem. Als de resultaten worden toegepast in andere situaties moet met drie belangrijke overwegingen rekening worden gehouden:

1. Het is belangrijk om de problemen in curriculumontwikkeling eerst te analyseren en te doorzien, voordat maatregelen genomen worden om docenten te faciliteren. De theoretische perspectieven van curriculumrepresentaties en curriculumoriëntaties, en het model van Infrastructuur, Autoriteit en Consensus bleken bruikbaar om de bevindingen te beschrijven en te begrijpen.
2. Het is in een lokale situatie essentieel om die maatregelen te nemen die lokale onderwijsactoren stimuleren om samen te werken aan de facilitering van de docenten. Een *participatory design* aanpak bleek effectief om de actoren daarin te betrekken. Drie aspecten moeten in deze aanpak in acht worden genomen:
   a Vaststellen welke lokale onderwijsactoren volgens de docenten in belangrijke mate invloed hebben op hun leergemeenschap en hun professionele ontwikkeling.

     In dit onderzoek in de situatie van de Indonesische madrasah scholen, waren die actoren, naast de docenten zelf, de ambtenaren van twee ministeries op districtsniveau, de schoolleiders en de regionale organisatie van schoolleiders.

  b Betrekken van een facilitator die in staat is de communicatie tussen de docenten en die invloedrijke actoren te bevorderen.

  c Het geven van gezag aan alle actoren (en de facilitator) om strategieën te plannen, in te voeren en te evalueren, zodat gunstige condities worden gecreëerd voor de professionele ontwikkeling van docenten.

3. Het is belangrijk om docenten het eigenaarschap te geven over hun professionele ontwikkeling, met inbegrip van het organiseren, uitvoeren en het reflecteren op de activiteiten. Belangrijk voor hun professionele ontwikkeling is ook de betrokkenheid van leerlingen, die de mogelijkheden vergroten om hun nieuwe inzichten en vaardigheden in de klas toe te passen.

Het is belangrijk om eerst de problemen in de curriculumontwikkeling te analyseren en te doorzien, voordat maatregelen genomen worden om docenten te faciliteren. De theoretische perspectieven van curriculumrepresentaties en curriculumoriëntaties, en het model van Infrastructuur, Autoriteit en Consensus bleken bruikbaar om de bevindingen te beschrijven en te begrijpen.

Het model dat Strategieën en Beoogde Condities verbond, het SBC-model, bleek waardevol in de planning en evaluatie van deze onderwijsinnovatie. Dit gestructureerde verband visualiseerde de relaties tussen de strategieën, de argumenten en de beoogde condities, waartoe de betrokken actoren in de innovatie besloten. Deze visualisering was een aanpassing van het concept van onderwijsontwerpprincipes, zoals ontwikkeld voor ontwerponderzoek voor onderwijsmodules.

Deze studies hebben verschillende waardevolle opbrengsten opgeleverd, maar kennen ook verschillende beperkingen, vooral wat betreft de drie aspecten: de theoretische kaders die in dit onderzoek gebruikt zijn, de mate van generalisatie van de uitkomsten en de toegepaste methodes. De bijdragen en beperkingen van de studies, samen met het geheel van de uitkomsten leveren belangrijke aanbevelingen voor beleidsmakers, schoolleiders en docenten die eigenaar willen zijn van hun eigen professionele ontwikkeling tijdens curriculumveranderingen. De resultaten van deze studies dragen bij aan de wetenschappelijke kennis over facilitering van de professionaliseringsactiviteiten van docenten; daarmee kan de onderwijspraktijk van docenten worden verbeterd.

Curriculum Vitae

Salamah Agung was born in June 24, 1979 in Cirebon, West Java, Indonesia. She got her high school diploma in 1996 from SMA Negeri 1, a public high school in Cirebon. In 1993, after state examinations, she was accepted at the Department of Pharmacy, Faculty of Science, University of Indonesia, Jakarta. Four and a half years later she got her bachelor degree and continued with the one year aphotecary program at the same university department. In 2003, she entered her master's program in science education at McGill University, Canada, and got her Master's degree two years later. She was then accepted as a lecturer at the Departement of Chemistry Education, the Faculty of Tarbiyah and Teaching Science, the State Islamic University Syarif Hidayatullah Jakarta. In early 2008, she was awarded a scholarship to pursue her doctoral study at Utrecht University from the Training Indonesian Young Leaders Program (TIYL), a joint project between the Netherlands embassy and the Ministry of Religious Affairs (MORA). At Utrecht University, she joined the the Freudenthal Institute for Science and Mathematics Education (FIsme)of Utrecht University under the supervision of prof. dr. Albert Pilot and Ir. Astrid M. W. Bulte.

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List of abbreviations

MONE	Ministry of National Eduation	*Kementerian Pendidikan Nasional*
MORA	Ministry of Religious Affairs	*Kementerian Agama*
KBK	Competence-Based Curriculum	*Kurikulum Berbasis Kompetensi*
KTSP	Educational Unit Level Curriculum (a school-based curriculum)	*Kurikulum Tingkat Satuan Pendidikan*
SI	Content Standards	*Standar Isi*
SK	Competence Standards	*Standar Kompetensi*
KD	Basic Competences	*Kompetensi Standar*
SKL	Standards of Graduate Competences	*Standar Kompetensi Lulusan*
BSNP	Body of National Education	
Standards	Badan Standarisasi Nasional Pendidikan	
PD	Professional Development	
IAC	Infrastructure, Authority, Consensus	
PDA	Participatory Design Approach	

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