Teacher Development in Cuba

- An Analysis of Two Strategies

Helena Buchberger

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Abstract

The aim of this study is to describe two strategies of professional teacher development in Cuba and analyse how they affect the professional growth of the teachers. The strategies investigated are methodological work sessions and further education at the university. Eight upper-secondary school teachers were interviewed and it was analysed how their professional growth was affected by the Cuban professional development strategies. The model utilized was the interconnected model of professional growth (Clarke & Hollingsworth, 2002).

The results show that, four of the eight interviewed teachers experienced change sequences and growth networks as a consequence of participating in the two investigated strategies. The methodological work sessions promote a collaborative approach among the teachers to developing the education in their school. Further education in the university, on the other hand, encourages the teachers to reflect individually on practical school-related problems. The results indicate that the organization of the work both the professional development strategies provided acted as an incentive for the interviewed teachers’ development.

Keywords

Interconnected model of professional growth; professional development; Teacher development; Teacher professional development; further education; Continuing education; Cuba; methodological work; Methodology; Trabajo metodológico; University courses; Cooperative work; Collaborative work; Collaboration; Cooperation; Teacher effectiveness
Lärarutveckling i Kuba

- en analys av två strategier

Helena Buchberger

Sammanfattning

Målet med den här studien är att beskriva två lärarutvecklingsstrategier i Kuba och analysera hur de påverkar lärarnas professionella utveckling. De undersökta strategierna är metodologiska arbetsmöten och vidareutbildning vid universitet. Åtta gymnasielärare intervjuades och det analyserades hur deras professionella utveckling påverkats av de kubanska lärarutvecklingsstrategierna. Modellen som använts är the interconnected model of professional growth (Clarke & Hollingsworth, 2002).

Resultaten visar att de metodologiska arbetsmötena uppmuntrar lärarna att arbeta kollektivt med att utveckla utbildningen i sin skola. Universitetsvidareutbildning, vad andra sidan, främjar individuell reflektion över praktiska skolrelaterade problem. Resultatet indikerar att den organisation av arbetet som båda lärarutvecklingsstrategierna medför stimulerar lärarna att utvecklas.

Nyckelord

Interconnected model of professional growth; vidarutbildning: professionell utveckling; lärarutveckling; Kuba; metodologiskt arbete; metodologi; universitetskurser; samarbete; lärareffektivitet
Desarrollo profesional de profesores Cubanos

- un análisis de dos estrategias

Helena Buchberger

Resumen

El objetivo de esta redacción es describir dos estrategias de desarrollo profesional para profesores en Cuba y analizar cómo influyen al crecimiento profesional de los profesores. Las estratégicas investigadas son trabajo metodológico y superación profesional en la universidad. Ocho profesores preuniversitarios fueron entrevistados y se analizó como las estrategias cubanas influyeron en su desarrollo profesional. El modelo utilizado para el análisis fue the interconnected model of professional growth (Clarke & Hollingsworth, 2002).

El resultado muestra que cuatro de los ocho profesores entrevistados experimentaron secuencias de cambios y redes de desarrollo como consecuencia de las dos estrategias de desarrollo profesional. El trabajo metodológico promueve trabajo colaborativo entre los profesores para desarrollar la educación en su escuela. Superación profesional en la universidad, por otro lado, incita los profesores a reflexionar individualmente sobre problemas prácticos relacionados a la escuela. El resultado indica que la organización del trabajo que suministra ambas estrategias de desarrollo profesional incentiva el desarrollo profesional de los profesores.

Palabras clave

Interconnected model of professional growth; desarrollo profesional; desarrollo para profesores; superación profesional; Cuba; Trabajo metodológico; trabajo colaborativo; preuniversidad
This study has been carried out within the framework of the Minor Field Studies Scholarship Programme, MFS, which is funded by the Swedish International Development Cooperation Agency, Sida.

The MFS Scholarship Programme offers Swedish university students an opportunity to carry out two months' field work, usually the student's final degree project, in a country in Africa, Asia or Latin America. The results of the work are presented in an MFS report which is also the student's Master of Science Thesis. Minor Field Studies are primarily conducted within subject areas of importance from a development perspective and in a country where Swedish international cooperation is on-going.

The main purpose of the MFS Programme is to enhance Swedish university students’ knowledge and understanding of these countries and their problems and opportunities. MFS should provide the student with initial experience of conditions in such a country. The overall goals are to widen the Swedish human resources cadre for engagement in international development cooperation as well as to promote scientific exchange between universities, research institutes and similar authorities as well as NGOs in developing countries and in Sweden.

The International Relations Office at KTH the Royal Institute of Technology, Stockholm, Sweden, administers the MFS Programme within engineering and applied natural sciences.

Lennart Johansson
Programme Officer
MFS Programme, KTH International Relations Office
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Table of contents

Introduction ............................................................................................ 1
  Teacher professional development.............................................................. 1
  Reflection ................................................................................................ 1
  Cooperative learning................................................................................ 1
  Motivation ............................................................................................... 2
  Analysis of teacher professional development........................................... 2

Aim and research questions ..................................................................... 4

Background ............................................................................................ 5
  Teacher profession in Cuba......................................................................... 6
  Emergency teachers .................................................................................. 6
  Rural schools ............................................................................................ 7
  Standardization ....................................................................................... 7
  Responsibility for teacher professional development.............................. 7
  The Ministry of Education ....................................................................... 7
  Universities ............................................................................................... 8
  Upper-secondary schools.......................................................................... 8
  Strategies of professional development .................................................... 8
  Further education ..................................................................................... 9
  Methodological work sessions .................................................................. 9
  Training courses ....................................................................................... 10
  Tutoring during teacher practice ............................................................. 10

Theoretical framework .......................................................................... 11

Research ethics ....................................................................................... 15

Method .................................................................................................. 16
  Thematization ......................................................................................... 16
  Planning ................................................................................................ 16
  Data collection method........................................................................... 17
  The interviews ........................................................................................ 17
  Study group ............................................................................................. 17
  Interview language .................................................................................. 18
  Derivation of the interview questions ....................................................... 18
  Test interviews ........................................................................................ 19
  Interview process ..................................................................................... 20
  Transcription and analysis ...................................................................... 20

Results .................................................................................................. 22
  Case A: Alejandro - Exercises for teacher students ................................... 22
  Collective growth ..................................................................................... 24
Introduction

The mathematics results of Cuban students far outshine the results of students in other Latin American countries. Martin Carnoy (2007) has researched why Cuban students performs better on international tests; one important reason he found is the emphasis put on observing and improving classroom practice. Carnoy (2007, p. 143, 151) believes this is the success variable most easily transferred to other countries. To better understand this characteristic of the Cuban educational system this thesis aims to describe the workings of the strategies utilized to improve and develop the teachers’ classroom practice. The focus of this thesis lies on the two most utilized strategies; methodological work sessions and further education.

Teacher professional development

According to Handbook of Research on Teacher Education, the teacher’s importance for education has only recently been researched thoroughly (Sprinthall, Reiman & Thies-Sprinthall, 1996). For many years studies of fixed personality characters of teachers were popular; however, these studies were not helpful in designing professional development. The first models able to theoretically support programs for professional development were based on the notion of learning as knowledge transfer: first the teacher learns something theoretically than utilize the new knowledge in the classroom.

Reflection

According to Jonas Aspelin and Sven Persson (2008), this way of seeing professional development was prevalent until the 80’s when reflection increasingly was seen as an important process in learning. Donald Schön describes the process of professional development as a reflective practice, a notion developed in his work The Reflective Practitioner. A reflective practice is the tacit knowledge of professionals that renders them able to reflect on their actions (Schön, 1983, p. 49). David Clark and Hilary Hollingworth (2002), who developed the model utilized in this thesis, see professional development as a result of both reflections and actions. A new tendency in the research on professional development is emphasising the importance of relationships in the learning process (Richie, 2006; Aspelin & Persson, 2008).

Cooperative learning

Ann Lieberman (1995) writes that teacher development is primarily considered to be taking place during workshops, conferences and other traditional development opportunities outside school. However, the type of learning that is desired for the students, solving real problems utilizing their experiences and cooperating with others are not desired or taken seriously for the teachers. The teachers themselves also report that it is important for their learning that the professional development activities are in coherence with other learning
activities and encourages professional communication between teachers (Garet, Porter, Desimone, Birman & Yoon, 2001).

The importance of communication between teachers is the basis of the notion professional learning community. The current definitions of a professional learning community can be summarized as “a group of teachers sharing and critically interrogating their practice in an on-going, reflective, collaborative, inclusive, learning-oriented, growth-promoting way” (Stoll & Louis, 2007, p. 2). According to Garet et al. (2001) long-term professional development activities involving many hours are more likely of high quality. As seen in the definition above a learning community involves long time professional development. Milbrey McLaughlin and Joan Talbert (2006) further emphasise that the teachers try to understand the relationship between practice and student outcomes to improve their teaching. There is evidence of a professional learning community being able to encourage and sustain the learning of the teachers as well as increasing students’ achievements. For example Karen Louis and Helen Marks (1996, p. 549) who researched how professional communities in 24 schools, found a higher achievement level of the students in schools with strong professional communities. Valerie Lee and Julia Smith (1996) used data from 620 high-schools and concluded that student achievement is higher in schools where teachers cooperate more and take collective responsibility for the academic success of the students.

Motivation

Conditions encouraging professional development are explained in a review of research written by Darleen Opfer and David Pedder (2011). Changes in the teachers’ beliefs and learning orientation are found to occur if the learning processes results in more and better: classroom experience, opportunity for reflection, opportunity for understanding oneself or applied knowledge. The review also elaborates on policy conditions that, according to research, can promote both the teachers’ individual learning and the organizational learning of the school. These factors are: developing a learning environment across all levels of the school, using self-evaluation, examining values underpinning institutional practices and creating systems of knowledge management.

Analysis of teacher professional development

In earlier years teacher’s professional development has often been described in a rather linear fashion: e.g. due to a professional development activity the teacher changes her beliefs, this leads to her changing her classroom practice, which leads to changes in the students’ learning (see Figure 1). Recently this linear model has been challenged by the notion that teachers may not change their views until after they have seen the changes in the students learning. Tomas Guskey (1986) is one of the investigators who advocate that significant change in practices and beliefs of teachers are likely to take place only after they have seen the evidence of change in the students’ learning outcome (see Figure 2).
Recently, Clarke and Hollingsworth (2002) have developed a new model taking into account many different pathways to professional development. The model is called the interconnected model of professional growth (see Figure 4 under Theoretical framework).

In the interconnected model, professional development is viewed as taking place when a teacher changes. Teacher change can be interpreted in multiple ways; earlier it was often seen as something that was done to the teachers, the teachers were changed. However, in the interconnected model the teacher is instead understood as an active learner, and change is the learning or growth that the teacher experience during professional activities.

The interconnected model describes professional development as changes in the way the teacher acts and thinks. When one change results in another change this is called a change sequence, e.g. if the teacher changes her opinion about a method of teaching and this leads to her utilizing this method more. If the changes in the change sequence proves to be lasting this is called a growth network. A lasting change is something the teacher does not only try short period and thereafter forgets, but something that influences her teaching for a longer time. This lasting change is denoted growth by Clarke & Hollingsworth. The conceptions of change sequence, growth and growth network are utilized in the research questions and will be further explained under Theoretical framework.
Aim and research questions

The aim of this study is to describe two Cuban strategies of professional teacher development, methodological work sessions and further education in the university, and analyse how they affect the growth of the teachers. The study focuses on upper-secondary school mathematics teachers and the specific research questions are:

1. Do the strategies for teacher professional development result in change sequences, growth networks or iterative growth networks for the teachers?

2. What characteristic of the strategies promote the teacher change and teacher growth discovered?
Background

The education in Cuba is known for its superior result compared to other Latin American countries; Cuban students score much higher on international tests (Carnoy, 2007). The underlying cause for this is the efforts put on developing the education ever since the Cuban revolution in 1959.

In Figure 3 the mathematics results of an international survey carried out in 1997-1998 are illustrated. The study was carried out by UNESCO's Latin American Laboratory of Educational Evaluation and tested students in third and fourth grade in mathematics (Carnoy, 2007, p. 65).

Directly after the revolution extensive efforts were put on eradicating illiteracy; almost 270 000 voluntary teachers, about 100 000 of them adolescents, were sent to remote regions to teach people to read and new schools were established all around the country. The illiteracy rate is claimed to have decreased from 24 % to 4 % in less than a year (Museo de la Alfabetización, La Habana, Cuba).

Still today Cuba gives high priority to education; in 2010 Cuba spent 12.9 % of its GDP on education. This figure can be compared with Peru 2.6 %, USA 5.4 % or Sweden 7.3 %. Even if Cuba's GDP is much smaller than Sweden's this is an indicator of the importance put on education in the different countries. (The United Nations Educational, Scientific and Cultural Organization [UNESCO], 2012, p. 156) However, during recent years there have been a teacher shortage and a quality decrease in the Cuban education (Utrikesdepartementet, 2013), more information about this under Emergency teachers.

In this chapter an overview of the teacher profession and professional development in Cuba is given. First, the teacher education and work of the upper-secondary school teachers is described to give the reader an understanding of the background and work of the teachers interviewed for the study. Thereafter, it is described how the responsibility for the professional development is organized. Lastly, the professional development strategies utilized in Cuba are described.

During the research in Cuba the writer was connected to the Pedagogical university of Havana (Instituto Superior Pedagógico Enrique José Varona). Some of the information in this chapter comes from interviews and personal communication with teachers of this university. Firstly, the writer interviewed Dr. Julio Vázquez Conde who has knowledge about the system of professional development in Cuba. The interview was carried out the 21st of February 2013

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1 People able to write a letter to Fidel Castro were counted as literate.
Teacher profession in Cuba

The university education to become an upper-secondary school teacher in mathematics (and another subject e.g. physics) takes five years. During the first year the students are only taking university courses and thereafter their school practice is continuously increased. The following example of how the teacher education is organized is taken from the pedagogical university of Havana. The curriculum of the mathematics-physics teacher students was studied and observations supported that the curriculum was followed. In their first year the students receive university education 4 hours and 40 minutes a day. The subjects taught are: pedagogy, school mathematics, school physics, Marxism-Leninism, Spanish, English, national defence, physical education, preparation for practice and reflection and debate. During the subsequent years the students study similar subject as well as more advanced mathematics and physics courses. As mentioned the school practice is increased over the years and in the fifth year the students study at the university only two days a week. (Curriculum for mathematics-physics teacher students, Instituto Superior Pedagógico Enrique José Varona, Havana)

It has not been possible to determine exactly how much upper-secondary teachers work. However, apart from the work in the school they have an obligatory methodological work session on municipal level every other week (see Methodological work sessions). Although it is not mandatory, many teachers also pursue a master or study other university courses which are scheduled for them every other week; this is more common in the cities where the university is near.

The teacher salary is around 400 Cuban pesos a month, equivalent to about 16 dollars (communication with Cuban upper-secondary teacher, June 2013). This salary is typical for governmental jobs which are paid in Cuban pesos. Few people can live on their salary and therefore many also work in the informal sector where they can earn more and in Cuban convertible pesos¹ (Utrikesdepartementet, 2013).

Below some of the recent developments in the Cuban educational system are explained.

Emergency teachers

For many years there has been a teacher shortage in Cuba. This is mainly because many Cubans prefer to work with tourists since they can earn more in this way. Cubans working with tourists receive tips whereas Cubans working for the government receive comparatively very low wages. As an example, a chamber maid in a hotel might earn double or triple a teacher’s salary (Carnoy, 2007, p. 32). The problem is particularly grave for the English

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¹ These subjects were taught during the spring term.
² The parallel currency roughly equal to the dollar and utilized by the tourists and for more luxury commodities.
education; many educated teachers never work in a school (communication with Cuban university English teacher, April 2013).

In 2002 a new and faster way to graduate teachers were introduced to do something about the shortage. The teachers then studied only one year in the university and afterwards started working full-time while taking university courses only once a week. These teachers were called emergency teachers, it was also said that the school worked like a micro-university as the teachers received a tutor in the school. However, in 2011 the project was stopped and now the teachers receive a five year university education with a slower introduction to work. (Interview with Dr. Julio Vázquez Conde at the pedagogical university of Havana, 21 February 2013)

Rural schools

Previously most upper-secondary schools were located in rural areas and the urban students were sent to the country to study. This was changed in 2009 by the government, probably because it was expensive to send the students to the countryside (communication with Cuban upper-secondary teacher, June 2013). This change resulted in a sudden increased need for teachers in the cities. Therefore teachers from rural areas were sent to the big cities, like Havana. Several of the teachers interviewed were such teachers and had only worked in Havana for one or two years.

Standardization

In Cuba all teachers teach the same material and at approximately the same time. This makes the methodological work sessions (see Methodological work sessions) easier to realize as all teachers will teach more or less the same lessons at the same time. Furthermore, all teachers utilize the same books; the current books were written more than 15 years ago according to one of the interviewed teachers. However, the curriculum has changed during the years and therefore the content of the books are slightly inadequate (communication with Cuban upper-secondary teacher, April 2013).

Responsibility for teacher professional development

This chapter is written with the help of articles about the Cuban educational system and documents from the Cuban ministry of education. To what extent the rules of for example what a headmaster should do are followed have not been investigated. The rules can also have been changed and the updates not yet uploaded to the web sites. Still, the documents from the ministry of education give an indication of the regulations regarding professional development.

The Ministry of Education

In Cuba the initial and further education of teachers is executed in the pedagogical universities and schools. Nevertheless, the ministry of education is highest liable for the education in Cuba. It is the responsibility of the ministry to define the general aims of the professional development (García Ramis, 2004). A directorate[^4] is assigned the responsibility

[^4]: La Dirección de Formación del Personal Pedagógico
of guaranteeing the efficiency of the pedagogic universities and schools in meeting these aims.

The directorate primarily works with teacher education in pedagogic universities and schools: developing the curriculum and guaranteeing the quality of this education. Nevertheless, it also controls the performance of new teachers during the first two years after graduation. (Ministerio de Educación de la República de Cuba, n.d.)

**Universities**

The pedagogical universities\(^5\) organize the professional development courses. Nevertheless, the major part of professional development occurs in the schools in the form of methodological work sessions. The planning of these sessions is the responsibility of methodology experts of the provinces and municipalities; although they receive advice from specialists from the pedagogical institutes.

In this system the responsibility is divided between the provinces and the municipalities in the following way. The provinces decide: who should receive what professional development and how often, elaborates the curriculum of the professional development and guarantees the quality of the institutions providing it. The municipalities guarantee the continual diagnosis of the education of all teachers and determine their needs, propose strategies of professional development and develop aims for them. (García Ramis, 2004)

**Upper-secondary schools**

The headmaster of the upper-secondary school also has certain responsibilities related to the development of teaching quality. Below the responsibilities of the headmaster is described, the information is taken from a manual for headmasters issued by the Ministry of Education in Cuba (Ministerio de Educación de la República de Cuba, 2007).

The headmaster, vice headmaster and the heads of departments inspect classes. These visits should be organized so that every teacher receives at least one visit per month. The headmaster should visit a class every day and the vice headmaster and the heads of departments twice a day. The management of the upper-secondary schools also should provide the teachers with individual plans based on the evaluations during the visits (García Ramis, 2004).

**Strategies of professional development**

In this part of the report the professional development strategies of Cuba will be explained. The information comes from an interview with the university teacher Dr. Julio Vázquez Conde (21 February 2013) unless otherwise noted.

The professional development in Cuba is constructed around methodological work and further education. Every other week the teachers attend municipal methodological work sessions; these are obligatory. The teachers also attend methodological work sessions on school level.

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\(^5\) Los Institutos Superiores Pedagógicos
During the other week, when the teachers have no municipal methodological work session, they have further education instead. This is not obligatory, but a majority of the teachers attend. During the further education the teachers can take university courses or study to receive a diploma, master's degree or doctoral degree.

The investigative work of this thesis will focus on methodological work and further education. However, in addition to these two approaches other strategies of professional development are utilized in Cuba; these strategies will also be explained below.

**Further education**

Many teachers choose to take university courses or to graduate in a higher level: study for a diploma, a master's degree or a doctoral degree. To continue one's training is almost expected of the teachers. Particularly for the emergency teachers, who received less university education, the further education is important. The teachers are expected to work as a teacher while studying. Teachers who graduate a master’s program or doctoral degree raise their teacher salary some and can also carry out research, work as head of school or as a methodology expert.

Receiving a diploma takes about two years, partial time; there are classes every two weeks but the teachers mostly work individually. The education closes of with a thesis work. The master’s programs and doctoral degrees are similar to the diploma but on a more advanced level, they also take longer time, about three years.

The master's theses are often closely linked to the problems and needs of the schools, in particular the school where the teacher is working. One of the teachers interviewed for example wrote his thesis on how to develop the teaching of functions in 11th grade; this was a problem he chose from the municipal problem bank. Another teacher wrote his master’s thesis about how to prepare a course for gifted students who would enter international contests; this course was needed in the school and he would later hold it.

The best graduates from the teacher education are offered extra chances of professional development and post-university education. Especially students who show abilities to lead are given extra chances of development and responsibilities.

There are also possibilities of taking courses to become an expert in some field. However, this is not something the teachers decide themselves to do; rather a teacher is asked to take the courses to become an expert if the institution considers an expert needed. For example an institute might need an expert in pedagogy for the blind.

In this investigation further education refers to diplomas, master’s programs or doctoral degrees and not shorter courses or expert courses.

**Methodological work sessions**

The information presented about the methodological work sessions in this paragraph were given by the upper-secondary teachers interviewed for this thesis and by the university teacher Dr. Julio Vázquez Conde (21 February 2013).

A lot of effort is put on methodological work in Cuba; that is, how to teach the classes. There is a methodology expert in every municipality and one responsible for each province. These
experts organize the methodological work. The teachers attend classes on methodology every two weeks and meetings in the school where the subject is discussed the other weeks.

The methodological work sessions on municipal level are organized by a methodology expert. During these sessions the theme is how to teach the content of the following lessons (in Cuba all teachers teach the same material the same weeks and utilize the same book, which facilitates these sessions). During the sessions the methodology experts talk about how to teach the content of the classes which will be held during the following weeks, exercises are recommended as well as methods and procedures of teaching. Furthermore, the methodology experts talk about the aim of the classes and what content is most important.

Methodological work sessions are also held in the schools, these are led by a subject responsible teacher. During these meetings the teachers discuss and reach consensus on how to teach the following weeks; in this work they have the provincial guidance as a basis. The teachers discuss how to best teach the content, how much time will be dedicated to each theme and what type of evaluation will be applied that week. If, for example, a written report will be utilized as evaluation method, the theme of the report might be decided during the methodological work session.

Apart from this continual planning school-specific problems can be discussed and solved during these sessions. One of the teachers interviewed for this thesis talked about that the teachers had decided to search for and bring new exercises to these session; as they had found that the prevailing exercises did not fit their students (which were not ordinary upper-secondary students, but teacher students). This example shows that more long-term development work is also carried out during the methodological work sessions.

**Training courses**

To incorporate new practices (e.g. a new evaluation system) short training courses called “Entrenamientos” are given. These are organized by the university and normally given during the further education day the teachers have every week.

**Tutoring during teacher practice**

During teacher practice the student-teacher is assigned a mentor at the university, who visits the school where the student has her practice. During her two last years of studying the student-teacher are in school four days a week and in the university only two (one of them Saturday). Apart from the mentor the student-teacher receives help from the head of the subject who review her classes.
Theoretical framework

The theoretical model utilized in this study is the interconnected model of professional growth, developed by David Clarke and Hilary Hollingsworth (2002). This model describes professional development as changes in the teacher’s way of thinking or acting; the changes are categorized into four domains, see Figure 4. According to the model, change in one domain can result in change in another domain, this happens by way of the mediating processes of reflection and enactment. Below follows an explanation of the domains and the mediating processes.

![Figure 4: The interconnected model of professional growth (Clarke & Hollingsworth, 2002)](image)

Changes occurring in and around the teacher are divided into four domains. The external domain incorporates all new information or stimulus that is presented to the teacher from external sources: information presented in professional development courses, advice from mentors or colleagues etc.

The other three domains are all parts of the teacher’s personal world. Changes in the teacher’s knowledge, beliefs\(^6\) or attitudes\(^7\) pertain to the personal domain. This could be new

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\(^6\) A belief is “a mental attitude of acceptance or assent toward a proposition without the full intellectual knowledge required to guarantee its truth” according to Encyclopedia Britannica.

\(^7\) An attitude is “a cognition, often with some degree of aversion or attraction (emotional valence), that reflects the classification and evaluation of objects and events” according to Encyclopedia Britannica.
knowledge of teaching strategies, change in the value the teacher attach to a strategy etc. Further, the domain of practice, incorporate change in the teachers practice; that is, experimentation. The last domain, the domain of consequence, includes change in what outcomes the teacher consider salient; that is, the result she notice of her experimentation in the domain of practice. Different teachers can have dispersed perceptions of the salient outcome, even looking at the same classroom; as an example on teacher might see an unruly class where another sees students engaged in discussion.

Now, a change in one of these domains can result in a change in another by way of mediating processes. The mediating process are represented by arrows in the model, these are marked with numbers to make it easier to distinguish them. The mediating process reflection is depicted by dashed arrows in the model. Reflection refers to the teacher reflecting on a change in one domain, which results in a change in another domain. Dewey’s definition of reflection as “active persistent and careful consideration” (Dewey, 1910, p. 6) is utilized, as suggested by Clarke and Hollingsworth (2002). The solid arrows in the model depict the mediating process enactment. This process refers to teachers changing their actions as a result of a change in one of the domains; they put a new idea, belief or practice into action. All the arrows are separately explained below.

Thus, the interconnected model describes how change in one domain leads to change in another; this is called a change sequence. The change sequence is the pathway of the changes in the interconnected model; that is, order in which the reflection and enactment mediates changes in the different domains. The change can be temporary; however, if the change is more than momentarily, the teacher is said to experience growth. If the teacher experiences growth the change sequence is denoted growth network. This is the same definition of change, growth, change sequence and growth network as the inventors of the model utilizes.

As mentioned Clarke and Hollingsworth (2002) define growth as a lasting change; that is, a change that is not abandoned rapidly. However, it this quotation from their article they also write about how a change can be continually refined:

> Such change may be fleeting, a single instance of experimentation, quickly relinquished. In our analysis, the term ‘growth’ is reserved for more lasting change. This does not preclude a changed practice or belief from being further adapted or refined. Indeed, the adoption of a growth perspective conceives of change as on-going.

Clarke & Hollingsworth, 2002, p. 958

In this paragraph I believe that two types of growth can be distinguished: iterative and non-iterative. The notion iterative growth network will be utilized when the teacher refines the new practise or belief after having adopted it. The refining of a practice or belief is depicted as a loop in the interconnected model. However, the iterations need not be ceaseless; one instant of refining a practice or belief is enough to call the network an iterative growth network. A non-iterative growth network is when the teacher adopts a new practice or belief but does not refine it; these networks will simply be denoted growth networks.
Reflection arrows

Reflection 1
The teacher reflects on the new information or stimuli she has received and this reflection leads to a change in her knowledge, beliefs or attitudes.

Reflection 2
The teacher reflects on how accurate her reproduction of a strategy or idea was; that is, how true it was to the original.

Reflection 3
The re-evaluation of outcomes in the classroom due to changed knowledge, beliefs or attitudes. A teacher might, for example, value interaction between students more and more (change in attitude) and this might lead to the teacher seeing an active student discussion where she would previously have seen a disciplinary problem (change in salient outcome).

Reflection 4
The teacher notices a particular outcome in her classroom and this leads to her changing her knowledge, attitudes or beliefs. For example a teacher might notice that utilizing group work does not lead to disciplinary problems and thus change her attitude towards group work.

Reflection 5
The teacher reflects on the outcomes of her classroom experimentation; which the results are and whether they are desirable or not. This reflection does not change her beliefs or attitudes.

Enactment arrows

Enactment 6
The teacher actively looks for knowledge from external sources of knowledge (changes the external knowledge and stimuli she is exposed to). This is the result of a change in her knowledge, beliefs or attitude; for example, she might become interested in developing some part of her teaching practice.

Enactment 7
The direct application of a new strategy or practice suggested by another teacher, supervisor etc. If the strategy is reflected upon before the experimentation arrows 1 and 8 should be used.

Enactment 8
A change in the teacher’s beliefs or attitudes is enacted in the classroom. For example a teacher might have changed her view on the merits of group work which result in her utilizing this strategy more often.

Enactment 9
The teacher carries out professional experimentation because she has seen a new outcome in her students (change in salient outcomes). It could either be that the teacher’s previous experimentation has resulted in new outcomes she wants to further investigate through experimentation; another scenario is that
the teacher has re-evaluated (reflection 3) outcomes from methods she frequently utilize and this leads her to experimenting with new strategies.

However, this arrow should not be utilized if the teacher has changed her attitude towards a certain strategy because of the new salient outcomes, and utilizes this strategy again because of her new attitude towards it. In that case arrow 4 and 8 should be utilized.
Research ethics

For ethical considerations the Act concerning the Ethical Review of Research Involving Humans was followed (SFS, 2004). Fundamental in this Swedish statute is the statement that research can only be conducted with respect for human dignity and if human rights and basic freedoms are considered at all times. Human welfare is to be given priority over the needs of society and science. According to The Act concerning the Ethical Review of Research Involving Humans, research may only be carried out if it conforms to the requirements concerning information and consent.

Concerning information, the act states that the subject of the research is to be informed about

- "the overall plan for the research
- the purpose of the research
- the methods that will be used
- the consequences and risks that the research might entail
- the identity of the responsible research body
- the fact that participation in the research is voluntary, and
- the right of the research subject to cease participating at any time" (STS, 2004, p. 5)

Concerning consent, the act states that the research may only be carried out if subjects of the research give their consent. They have to be given information concerning the research beforehand and the consent must be voluntary, explicit and documented.

In this study, the above mentioned provisions were taken into account in the redaction of the information leaflet given to the interviewed teachers (Appendix 2). The leaflet of information also granted the confidentiality and anonymity of the teachers during the research process and redaction of the research rapport. The content of the leaflet was discussed before the interview. All teachers were asked whether it was ok to record the interview and none said no or seemed bothered by being recorded.
Method

Below the methods utilized in this project are described. Further, the quality of the methods is analysed with the help of the tools reliability and validity.

To explain reliability and validity Staffan Stukát (2011) exemplifies with an investigation measuring the circumferences of people's heads to gauge their intelligence. The reliability describes how exact the measurement is; that is, if it correctly measures the circumferences. The validity, on the other hand, describes if the investigation measures what it intend to measure; in this case, intelligence.

The purpose of explaining the method is to make it possible for the reader to judge the quality of the study. The quality analysis that makes judgement possible is, in itself, a contributing factor to the quality of the study. The text is divided into chapters corresponding to the different phases of the interview study. Suggestions given by Steinar Kvale (1997) inspired which aspects of these phases were described to illustrate the quality of the study.

Thematization

Thematization refers to the derivation of the research questions from the theory (Kvale, 1997). The more logical this derivation, the more valid is the thematization.

The theory utilized in this study is the interconnected model of professional growth. The derivation of the research questions is valid as the questions are closely related to key concepts of the interconnected model; such as, change and growth networks.

These concepts (together with the subordinate concepts reflection and enactment) are strictly defined under Theoretical framework. The strict definitions of the concepts ensure the reliability of the thematization, since they warrant clearly defined research questions.

Planning

The planning of the project was done with inspiration from methods utilized in project management. During the project a project diary was kept, to keep track of what had been done when, important dates and information, and to remember what should be achieved the following days.

The diary mitigated the risk of forgetting important thoughts and deadlines, hence ensuring the spotted problems were solved and the goals met. Meeting goals is highly important both for reliability and validity; an unaccomplished interview means no information either valid or invalid. To solve spotted problems is important for the quality of the investigation; an example from this project is the uncertainty felt about how to define the different enactment and reflection arrows; a question which could have been blissfully forgotten. Such unsolved problems of definition results in blunter measurements, and thus lower reliability.
Data collection method

The interview was chosen as the method for gathering data about the change processes in the teachers. As we want to investigate change a first thought might be that we should gather data during a period of time to compare in the look for changes. However, the field work of the project is limited to a couple of months, and we do not want to restrict our investigation to changes occurring within two months. Moreover, to limit the time like that would render it unlikely to come across lasting changes; that is, growth networks.

We want to gather data about changes in the domains of the interconnected model; simplified: changes in the teachers' practice and opinions. The persons having the most data about this should be the teachers themselves; therefore we wanted to collect the data directly from the individual teachers. For this reason interviews were chosen above focus groups and classroom observation.

Both qualitative and narrative interviews were considered; however, in the end the qualitative interview was selected. Narrative interviews are used when it is the course of events that is central to the research question. In this data collecting method the interviewee is encouraged to tell the course of events of something, without much intervening questions (Flick, 2009). At first glance this might seem an appropriate way to encourage the teachers to tell the course of events of a change sequence or growth network. However, the method is more suitable for developing grounded theories than for applying models already existing, such as the interconnected model. When seeking to apply a model the interviews need to be more closely directed so as to yield useful data in accordance with the approach of the model (Flick, 2009).

The decision to use the interview as data collection method presumes that the teachers have some insight into changes in their practices and views. Nevertheless, the most solid changes are probably the ones you are conscious of and can explain. Apart from needing to have insight into changes in their views and practices, the teachers also need to be able to remember their reasoning and acting. The idea was to mitigate this reliability problem by asking the teachers to think about what changes they wanted to bring up beforehand, so that they might choose changes they remembered much about. Unfortunately, it was never possible to distribute the preoperational material to the teachers beforehand, which may have made the stories poorer in detail.

The interviews

Eight upper-secondary school mathematics teachers from four schools in Havana were interviewed. All interviews were executed by the thesis writer in Spanish. The interviews were recorded and lasted about 30 minutes each.

Study group

The objective of the interviews was to investigate how the Cuban strategies of professional development work. To delimit the investigation only upper-secondary school mathematics teachers were interviewed. This choice was made because the thesis writer studies to become such a teacher and would therefore easier understand the teachers’ experiences. Eight
teachers were interviewed from four different upper-secondary schools in the municipality of Havana. The schools were chosen for convenience; a university teacher had to accompany the thesis writer to the schools and this person was visiting these schools as a part of his work. This means that the schools were chosen randomly, without thought of choosing especially successful schools.

All the teachers were mathematics teachers on upper-secondary school level. Their experience range from five to 34 years and some of the recently graduated teacher were emergency teachers. The thesis writer asked for randomly chosen teachers and it did not seem the teachers were singled out on any other basis than being accessible for an interview.

The investigation tries to determine how the strategies of professional development work; naturally we can only ever say something about how the strategies worked on the teachers who were interviewed. However, some common traits can be found and these could be expected to bear similarities with how other teachers would react to the strategies. Nevertheless, it is hard to say something about how teachers in other countries would react to the Cuban strategies. Furthermore, it is possible that the results are limited to mathematics teachers and that teachers in other fields would react differently to the strategies.

**Interview language**

The interviews were carried out in Spanish. This is not the first language of the thesis writer, which might have influenced the understanding negatively. Misinterpreted answers would constitute a serious reliability problem. To mitigate this risk the interviewees were asked to clarify when something was unclear. The interviewer also checked with the teachers during the interview if her understanding of their answers was correct. Furthermore, the interviews were recorded so that the most information possible could be extracted from the interviews.

**Derivation of the interview questions**

The interview questions were developed to give answers that could be interpreted to answer the research questions. These are the research questions:

1. Do the strategies for teacher professional development result in change sequences, growth networks or iterative growth networks for the teachers?
2. What characteristic of the strategies promote the teacher change and teacher growth discovered?

To answer research question 1 the pathway of the changes in the interconnected model needs to be followed. The interview questions are designed to disentangle this pathway.

It was decided to start the questions from the domain of practice. The teacher was asked about a time when she had tested something new in her classroom (a change in the domain of practice) as a result of a methodological work session. The reasons and consequences of this change were then investigated through follow-up questions or just encouragement to keep talking. By this means the pathway in the interconnected model was followed.
The reason for starting in the domain of practice was to receive a concrete example of a change. It was assumed that a concrete example would increase the reliability as discussing general professional development presumes that the teacher has a great insight into her own development. Furthermore, a general discussion might lead interviewees to try to impress by exaggerating their development, which is harder when talking about a concrete example.

During the trial interviews a second part of the interview was included, in which the questions started out from the personal domain. However, this part was eliminated as the questions about changes in conception of e.g. a method (personal domain) quickly lead the teachers into talking about utilizing the method more/less frequently (domain of practice). Therefore, this starting point was practically equal to starting out from the domain of practice. Another reason for eliminating this part was that the anticipated preparation could not be carried out by the teachers. As this question about changes in conception is a bit harder to answer the teachers would have needed a preoperational task, something that was concluded during the trial interviews in Sweden (see Test interviews below).

In addition to analysing what changes the strategies induce in the teachers, we also want to study what characteristics of the strategies promote these changes (research question 2). To answer this research question the interviewees were asked about their reasons for changing their classroom practice or trying the new method. Other parts of the interviews where the teachers mentioned conditions that could be interpreted as reasons for the change were also analysed.

Test interviews

In an effort to ensure valid interview questions, test interviews were made with five upper-secondary school mathematics teachers in Sweden. The teachers were asked to criticize all aspects of the interview. These interviews were transcribed and analysed to gauge which questions yielded valid answers and which did not.

During the test interviews some parts of the interview were changed (see Appendix 1 and 2): the interviewees were given a preparation task, as it can be hard to come up with a “change of opinion” directly; the introduction to the interview became more informal, so as to create a good atmosphere; the table of teacher knowledge areas were simplified, as the complicated words, whereas meant to be general, could be perceived as intimidating; and the interviewer made an effort to avoid pressing questions about the results of the professional experimentation. These alterations served to increase the validity of the interviews by making the teachers more comfortable and thus promote uninfluenced answers. Furthermore, the reliability was improved by clarifying the questions and preparation material so that the teachers understood them better. Although, the preparation material could not be given to the Cuban teachers beforehand the table of teacher knowledge areas (see Appendix 2) was utilized during the interview.

Important to note is that the trial interviews were carried out in Sweden, whereas the real interviews were done in Cuba. Of course it would have been better to do the trial interviews in the same country as the real ones, as cultural and linguistic factors influence what makes a person feel comfortable and an explanation clear. Still, the similarities are probably greater than the differences, and it is helpful just having thought about these questions.
The interviews were further adapted after the first interviews in Cuba. A greater emphasis was put on explaining that it was important that the interviewee explained a change in practice or opinion. Further it was decided to directly ask about changes initiated by the methodological work and further university courses as it had been decided that the thesis would focus on these strategies.

**Interview process**

In this passage the process of the interview is explained, see Appendix 1 for the interview plan. All interviews were conducted by the thesis writer in Spanish; further, they were recorded and lasted for approximately 30 minutes.

In the beginning of the interview the teacher received a leaflet with information about the interview, see Appendix 2. When developing the leaflet the directions concerning what information should be given to research subjects were considered (the, SFS, 2004; McMillan & Weyers, 2010). This leaflet explained the interview, the project, ethical questions etc. Before the interview started the information of the leaflet was explained orally and questions answered.

The first questions of the interview treated background information about the teacher: how long they had worked, what subjects they taught and if they had participated in any kind of professional development.

The first part of the interview started with the teacher being asked to tell the interviewer about a time when she had tried something new in her classroom as a result of a methodological work session. Some examples of areas were given: method for student work, leadership method, instruction method, material and assessment method. These examples were meant to help the teachers remember things they might have tried. To avoid leading the teachers to certain areas and consequently overlooking other areas, the examples sought to be as all-embracing as possible without losing their intelligibility.

When the interviewer had understood the test the teacher had made, she continued by asking the teacher about the reasons for trying this. Subsequently, the teacher was asked about the result of the trial and whether she had tried the same thing, or an altered version, again. In conclusion, the interviewer said that she now had the information she needed from this part of the interview and the teacher was asked whether she wanted to add anything on the subject.

In the second part of the interview the teacher was asked the same questions, but this time about something she had tried as a result of further education. This part was excluded if the teacher had not participated in further education.

**Transcription and analysis**

The analysis of the interview should not start after the interview is finished; rather, it should be almost done at that time (Kvale, 1997). This allows the interviewer to verify her interpretations during the interview. This was accomplished by summing up what the interviewee had said at regular intervals and asking the interviewee if the conclusions were correct. However, the interviews were also analysed more thoroughly afterwards.
The transcription of the interviews was done in Spanish and the parts utilized in the thesis were translated to English. The parts where the teachers talked about changes they had done in their teaching due to the professional development strategies were carefully transcribed. For readability the interviews were transcribed in a fashion resembling written language: pauses and non-lexical utterances were not noted, orations changed midway through were written as the interviewee intended them in the end. In the initial part of the interview when the teachers answered the background questions only the answers were noted. Some of the teachers misinterpreted the question and initially talked about something they had always done in their classroom instead of something they had changed, since these parts of the interview could never be analysed with the interconnected model they were not transcribed.

The interviews were analysed utilizing the method concentration of meaning; this method consists of dividing the interview into natural passages and formulating the central theme of each passage (Kvale, 1997). The interviews were divided into parts corresponding to reflections or enactments. Reflections are instances when the teacher actively considers changes in one of the domains; this consideration leads to a change in another domain. Dewey’s definition of reflection is used: “active persistent and careful consideration” (Dewey, 1910, p. 6). Enactments are when teachers act to change one domain encouraged by a change in another domain. To identify what type of reflection or enactment the teachers had experienced the definitions of these processes were utilized (see Theoretical framework). The central themes of these parts were extracted; so as to get an overview over the pathway in the interconnected model.
Results

In this chapter the results of the interview-analysis are presented. Five cases were chosen from the eight interviews; these cases were selected because they could be analysed with the interconnected model. Not all the interviews could be studied with the model as the teachers did not talk about instances in which they had changed their beliefs or practices.

All cases start with the overall story of the teacher being told, to give the reader a general view of the course of events. Subsequently, the case is described in a table utilizing the model; that is, the instances of reflection and enactment making up the growth network are accounted for. Lastly, some important characteristics of the professional development in the case are described.

In the first three cases the teachers (Alejandro, Brayan and Carlos) talk about professional development inspired by methodological work sessions. In the cases of Alejandro and Brayan, they changed the education in their schools together with others thanks to the methodological work sessions. In the case of Carlos, he tried a new methodology encouraged by the coordinator of the methodological work session.

In the last two cases the incentive to the development came from further education where the teachers Diego and Brayan had written master’s theses. The results of their theses led them to change their practices.

All names are feigned.

Case A: Alejandro - Exercises for teacher students

Alejandro is a mathematics teacher with 17 years of experience. He works in an upper-secondary school in the outskirts of Havana. Alejandro has written a doctoral thesis and worked with professional development for emergency teachers. He also leads methodological work sessions in the school.

The upper-secondary school is specialized in educating teachers. Alejandro explains that the teachers therefore wish the students to learn practices like correcting and grading exercises; however, the usual exercises for upper-secondary schools did not fit these goals. During a methodological work activity this problem was addressed and work groups were formed to elaborate new exercises.

The exercises are elaborated by the teachers and discussed during meetings every three months. Alejandro says the new exercises have increased the percentage of students passing a particular test from 37 % to about 60 % over the years and that the quality of the students’ work also has increased. One of the teachers of the school has written a thesis concerning digitalizing the exercises.
### Growth network 1

*The Change Environment*

#### Domain/process

<table>
<thead>
<tr>
<th>Domain/process</th>
<th>Analysis</th>
<th>Excerpt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External domain</strong></td>
<td>Methodological work activity, material (exercises)</td>
<td>...it was a methodological reunion which led to a methodological activity.</td>
</tr>
<tr>
<td><strong>Reflection 1</strong></td>
<td>The methodological work activity gave the teachers a forum to reflect over the bad results of the students being a result of the deficiency of material.</td>
<td></td>
</tr>
<tr>
<td><strong>Personal domain</strong></td>
<td>The teachers see a need for new material.</td>
<td></td>
</tr>
<tr>
<td><strong>Enactment 6</strong></td>
<td>In groups the teachers elaborate new exercises, that is changes the external domain, the exercises.</td>
<td>...they made the work groups. And every work group did workshops; workshops to discuss the exercises they were creating.</td>
</tr>
<tr>
<td><strong>External domain</strong></td>
<td>New exercises.</td>
<td></td>
</tr>
<tr>
<td><strong>Enactment 7</strong></td>
<td>The teachers try the new exercises in class.</td>
<td></td>
</tr>
<tr>
<td><strong>Professional experimentation</strong></td>
<td>Test of exercises.</td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 5</strong></td>
<td>The teachers notice a quality increase in the work of the students as well as an increase in the number of students passing the tests.</td>
<td>...the achievement of the students has increased, both in quality and in quantity approved.</td>
</tr>
<tr>
<td><strong>Salient outcomes</strong></td>
<td>Better results of students.</td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 4</strong></td>
<td>Alejandro, and possibly other teachers as well, reflect over the quality increase and believes the exercises are the reason of the increased quality.</td>
<td>This knowledge that they achieve, that could not be achieved by the first students [when the school was newly opened] as the material did not exist...</td>
</tr>
<tr>
<td><strong>Personal domain</strong></td>
<td>Increased belief in exercises.</td>
<td></td>
</tr>
</tbody>
</table>
In this example growth network 1 was inspired by a methodological work session. During this session it was decided that new exercises would be elaborated to meet the need for exercises better suited for teacher students. Work groups were formed which were supposed to elaborate new exercises in a certain field, workshops were also organized for the work groups to discuss the proposed exercises.

Collective growth

The methodological work sessions induced collective growth for the mathematics teachers of the school. That is, many teachers experienced growth because of the activity started during the methodological work session and they also experienced more growth than they would have done had they elaborated exercises individually.

The elaboration of the exercises being a part of an obligatory session for the teachers encourages this type of collective work. Probably few teachers would have worked on developing the exercises had they not had the methodological work session as an incentive to do so. In this excerpt Alejandro explains the way the work was organized during the methodological work sessions:

*The idea first came from a methodological activity; it was a methodological reunion which led to a methodological activity. And in this methodological activity the different work groups were brought about, every work group has a determined responsibility; you will do calculus exercises... [The exercises] were presented, validated and approved. Not all the exercises that were presented was validated and approved.*
Work groups were formed which made it possible for the teachers to discuss the exercises thereby increasing the quality of the final exercises. In the excerpt the teacher says that the work groups were brought about during the session indicating that the organization of work groups was a collective decision; in any case, the existence of a methodological work session rendered this decision possible. Thus, we can conclude that the existence of methodological work sessions helped the teachers organize the work with the exercises.

**Continuing development**

The work with elaborating more exercises has continued for several years as Alejandro explains in this excerpt:

> [The methodological work session] was realized in September two years ago. (...) It is a process which hasn’t stopped, we keep contributing exercises.

It is probable that the regular meetings (the methodological work sessions) helped the teachers to keep the work going for such a long time. Also the assistance from the methodology experts in organizing the work and coordinating the teachers could have helped the work to proceed for a long time.

Growth network 2 was produced as a side effect of growth network 1: the work with elaborating exercises resulted in a teacher pursuing a doctoral degree where he investigated how the exercises could be digitalized. That shows that the collective growth initiated by the methodological work session could lead to the type of individual growth that a doctor’s thesis normally brings with it.

**Case B: Brayan – Error identification exercises**

Brayan is one of the emergency teachers educated in Cuba in the beginning of the 21st century (see Emergency teachers). As the emergency teachers began to teach full-time from their second year of studying Brayan has four years of experience as a student-teacher; apart from that he also has five years of experience as a graduated teacher. He first taught in secondary school but is currently teaching mathematics in the upper-secondary school. Brayan has written a master’s thesis and is now pursuing a doctoral degree. In the upper-secondary school where Brayan is working he leads methodological work sessions. The school is the same as in the previous example.

During a session of methodological work the teachers brought exercises and the collective of teachers selected the ones they found most useful. One teacher brought an exercise where the students were meant to identify an error. When Brayan tried this exercise he found the result positive; the exercise created a debate and the students were able to discover their own errors.

Later the same type of exercise was utilized teaching other mathematics content. This was first discussed during the subject meetings. The exercise was slightly varied according to the mathematics content; for example, in geometry the students had to put a solution in order or fill in blank spaces instead.
## Iterative growth network

![Iterative growth network diagram]

<table>
<thead>
<tr>
<th>Domain / process</th>
<th>Analysis</th>
<th>Excerpt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External domain</strong> Methodological work session where the teachers were asked to bring exercises.</td>
<td>...all the teachers bring exercises and we select and multiply exercises from there (inaudible) and it was a teacher who brought this exercise.</td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 1</strong> During the methodological work the teachers evaluated the exercises and selected a type of exercise involving the students identifying errors in equations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Personal domain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enactment 8</strong> It is decided that the exercise will be utilized in class. Probably this decision was imposed upon the teachers.</td>
<td>Being subject [responsible] teacher, there are exercises I impose upon the teachers to utilize in some moment, be it in class or as homework or in a laboratory lesson...</td>
<td></td>
</tr>
<tr>
<td><strong>Professional experimentation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 5</strong> Brayan reflected upon the result and found it positive; the exercise created a debate and the students discovered their own errors.</td>
<td>Yes, the result was very positive. (inaudible) a debate was established between the students. Many, practically made this error themselves, therefore they didn't see it. And it is a way to begin to notice...</td>
<td></td>
</tr>
<tr>
<td><strong>Salient outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 4</strong> The teachers reflected upon these results and tried using the same type of exercises with other mathematics content too.</td>
<td>- Have you tried this exercise more than once? - Yes this type of exercise, after we did it there [in equations] we...</td>
<td></td>
</tr>
</tbody>
</table>
The methodological work sessions acted as an incentive for the teachers to evaluate and utilize new exercises. This is an example of an iterative growth network inspired by the methodological work sessions.

Imposed change

The interview indicates that the first test of the exercises was imposed on the teachers; that is, the teachers might have tried the exercises before they believed in them. This excerpt supports the conclusion that the test of the exercises was imposed on the teachers:

- You chose some exercises which all the teachers do or every teacher choose what they want to do in their class?

No, there are exercises that are of interest for the subject and are obligatory in all classes. Being subject [responsible] teacher, there are exercises I impose upon the teachers to utilize in some moment, be it in class or as homework or in a laboratory lesson. But they have to use it because of the type of question it represents, which is a type of question that also is interesting to evaluate if they master.

This indicates that professional experimentation is sometimes imposed upon the teachers during methodological work sessions. As we can see in this example the teachers took part in the growth network by further developing the exercises together even though the initial use of the exercises was imposed upon them, indicating that imposing change might be successful way of promoting professional development.

Iterative work extended in time

The regular methodological work sessions acted as an incentive for the teachers to realize that the type of exercise that they first elaborated with equations could be utilized with other mathematics content too. The teachers also developed error identification exercises with other mathematics content together.

- Did you try this same exercise again?

- Yes, this type of exercise after we did it [in equations] we have done it with other content of the subject. (...) Of course, we have varied it some. In geometry what we have given is the procedure, and they have put the procedure in the right order. The error identification
exercises we haven’t used that much in geometry, not like blank spaces: that they complete the blank spaces in an exercise which is developed but missing parts. They complete it from the properties of the figure.

- This about doing it differently in geometry is it something you talked about in...?

- Yes, we talked about it in the collective of the subject.

In this excerpt Brayan talks about developing the same type of exercises for other mathematics content too. These exercises were developed during the collective of the subject; that is, not during the methodological work sessions. Nevertheless, the first idea of the new type of exercises was developed during methodological work sessions, thus the rest of the iterative growth network can be said to be inspired by the activities of the methodological work session.

**Case C: Carlos - Solving method**

Carlos is a mathematics teacher with 34 years of experience. He has earlier worked in a rural upper-secondary school but started working in Havana two years ago. Carlos has not studied a master’s program but is thinking about matriculating next semester. It is difficult for a teacher working in a rural area to study a master’s program as the university might be far away and the teacher is expected to work while studying.

During a session of methodological work another teacher, Luis, proposed a new method to step-by-step carry out an induction proof. Luis was the collaborator of the session and had written a master’s thesis on the theme. The problem with the old proof method was that it was very mechanical and was not mathematically rigorous; the new method, on the other hand, was more logical to the students and not forced.

In the methodological work session a consensus was reached that the new method was better and should be utilized. Carlos said the method caused trouble for the students in the beginning; however, after some time they got used to it.

**Growth network**
<table>
<thead>
<tr>
<th>Domain / process</th>
<th>Analysis</th>
<th>Excerpts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External domain</strong></td>
<td>The collaborator of the methodological work session, Luis, proposes a new method to solve a type of mathematical problem. (This was the subject of Luis’ master’s thesis.)</td>
<td>We discovered, or they discovered that steps of knowledge were omitted [with the old method to solve the problem]</td>
</tr>
<tr>
<td><strong>Reflection 1</strong></td>
<td>During the methodological work session Carlos and the other teachers familiarized themselves with the new method.</td>
<td>We got used to the method as such, as all worked in the old way.</td>
</tr>
<tr>
<td><strong>Personal domain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enactment 8</strong></td>
<td>Carlos utilizes the new method in class.</td>
<td></td>
</tr>
<tr>
<td><strong>Professional experimentation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 5</strong></td>
<td>Carlos notice that the method causes trouble for the students at first but that they acclimatize with time.</td>
<td>In the beginning it caused them trouble, but after some time they begun to adapt. (...) The objective was to develop the logical thought with this type of exercise.</td>
</tr>
<tr>
<td><strong>Salient outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reflection 4</strong></td>
<td>Probably Carlos’ belief in the method increased when he noticed the students got used to it with time.</td>
<td></td>
</tr>
<tr>
<td><strong>Personal domain</strong></td>
<td></td>
<td></td>
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</tbody>
</table>

This is an example of a growth network initiated thanks to the methodological work sessions. At the same time the postgraduate courses was a secondary facilitating factor of the growth network as the collaborator Luis developed the idea writing a master’s thesis.

**Trying something new**

Here we can see that the methodological work session can be a forum where the results of a thesis can be distributed. In this case the coordinator of the session had written a thesis and shared the result with the other teachers.

It is not altogether clear to what extent Carlos believed in the method before trying it in the classroom. From what he said about the methodological work session it seems the teachers were obliged to utilize the method. For example when asked what more happened during the session than the collaborators teaching the method Carlos does not mention that the merits of the new method were discussed nor that it was discussed whether the method should be utilized or not. As the new method was a product of a master’s thesis of one of the collaborators its supremacy was probably seen as proved.
- And these persons who knew [the method] taught it [during the methodological work session]?
- Exactly.
- Did you do other things as well?
- Yes, we practiced. We got used to the method as such, as all worked in the old way.

However, it seems that Carlos was satisfied when the students were able to adapt to the method, even though they found it more difficult than the old method. He also adds that the aim of the exercise was to develop logical thought. It seems Carlos agreed that the new method would develop the logical thought of the students; and thought this ultimate goal was more important than that the students easily adapted to the method.

   Well the students generally are prone to doing it mechanically. In the beginning it caused them trouble, but after some time they begun to adapt and to acclimatize to the procedure. The objective was to develop the logical thought with this type of exercise, because it was mutilated by the way it was treated before.

The growth network was not iterative as the second method was not further refined after incorporated in class. Possibly it was hard for Carlos to refine something which has not been developed by him but introduced by someone else.

Case D: Diego - Question system

Diego was an emergency teacher and has thus worked four years as a teacher before graduating. Apart from these four years Diego has seven years of experience as a graduated teacher. Diego has written a master’s thesis and has recently matriculated for a diploma. He teaches mathematics in an upper-secondary school and leads the mathematics department. Diego earlier worked in a rural school but a year ago he started working in an upper-secondary school in the outskirts of Havana.

In his master’s thesis Diego investigated how to improve the teaching of functions in 11th grade utilizing the heuristic method. This theme he found in the problem bank of the municipality. Diego searched for information about the heuristic method question-system and tried it in class. The idea of the method is planning the class based on a system of questions. According to a questionnaire Diego did, the students liked the method and this motivated him.

At present Diego use the question-system method in all his classes, it is a characteristic of him as a teacher. He thinks this method is dynamic and encourages interaction between students. Furthermore, the method can be utilized by the students as a problem solving tool.
### Domain /Process | Analysis | Excerpts
--- | --- | ---
**External domain** | Master’s program, problem bank of the municipality | The master’s program in the educational sciences was based on the problems of the educational centres. (...) I chose [the theme] from the problem bank.
**Reflection 1** | The master’s program causes Diego to do a thesis trying to solve one of the problems in the problem bank (how to better teach the concept of functions in 11th grade). | So I gave myself the work of searching for a way to solve this problem [the student’s difficulties in understanding the concept of functions]. This was the alternative I found [the question-system method]. (...) So I dedicated myself to gather information and accepted the theoretical basis. And then I elaborated a strategy.
**Personal domain**
**Enactment 6** | The teacher searched for information about better ways to teach the concept of functions. | **Professional experimentation**
**Enactment 7** | Diego tried the question-system method in class and did a questionnaire afterwards. | And when I applied it I began to see results, this served more or less as a bit of motivation.
**Reflection 5** | Diego believed the answers to the questionnaire were positive. | I did a questionnaire of what [the students] thought of the class, what
it had brought to them and some other questions. And when I tabulated it more than 90 % were satisfied.

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<th>Salient outcomes</th>
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<td>Reflection 4</td>
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This is an example of a master's program resulting in an iterative growth network for the teacher. In this case the master's program resulted in the teacher learning more about a teaching method and utilizing it more.

**Extended to other mathematics content - extended in time**

The master's thesis only aimed at utilizing the method while teaching functions in 10th grade; however, Diego decided to utilize it in the teaching of other subjects later. This is a type of iterative growth network where the teacher decides to extend the use of the method without incentive form an external domain to do so. Instead of an external domain Diego is inspired by the salient outcomes he sees while using the method to teach functions. In this excerpt Diego describes that he utilizes the method in all his classes.
Now I hardly give lessons without a question system, without this collaborative elaboration method, in this case heuristic, without dialogue with the students, it is a part of me as a teacher. Now the students think of me as giving this type of classes.

In addition to utilizing the method with other mathematics content than was originally intended, Diego taught the students to utilize the method independently; that is, to ask themselves the questions while solving exercises. According to Diego this made the students more independent since they could utilize the question system as a study mechanism.

The students succeed in creating a study mechanism, which they had not created before, with a register of questions. And if the students follow this register of questions, it can help them in all parts of their lives.

Teaching the students to apply the method independently is another example of a way to utilize the method in a way that was not initially intended. This refinement of the method constitutes an iteration of change; that is an iterative growth network. This shows that the master’s program can cause growth networks with changes taking place even after the course has ended and with growth which was not initially foreseen from the scope of the master’s program.

**Case E: Brayan - Preparation for gifted students**

The teacher in this case is the same as in case B with the error identification exercises.

When Brayan initiated his master thesis he was working with organizing a course for gifted students who would enter in national and American mathematics contests. Therefore he chose to write the thesis about how to prepare these students.

As a result of the course the students felt more motivated and several won contests. Now, five years later these students still maintain the contact with Brayan.
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<th>Domain / process</th>
<th>Analysis</th>
<th>Excerpts</th>
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<tbody>
<tr>
<td>External domain</td>
<td>In the workplace there was a need for someone to develop a course for gifted students.</td>
<td>And why did you choose this theme for your thesis? Well firstly because there was a need.</td>
</tr>
<tr>
<td>Reflection 1</td>
<td>Therefore, Brayan chose to write his thesis on this subject.</td>
<td>They challenged me to improve [the course], and starting out from that I started to investigate.</td>
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<tr>
<td>Personal domain</td>
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<tr>
<td>Enactment 6</td>
<td>He started to investigate on gifted students.</td>
<td></td>
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<tr>
<td>External domain</td>
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<tr>
<td>Enactment 7</td>
<td>Brayan planned and executed the course with this knowledge.</td>
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<tr>
<td>Professional experiment</td>
<td>Brayan notice the students felt more motivated and wanted to maintain contact with him for years, signalling their satisfaction.</td>
<td>...many of them still call me. Still there is a relationship. It was 5 years ago, still there is a student-teacher relationship which needn't remain such a long time; but they feel recognised in this way, because they hadn't received this type of exercises before.</td>
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<tr>
<td>Salient outcomes</td>
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<tr>
<td>Reflection 4</td>
<td>Brayan increased his belief in that the techniques of the course are successful because of the positive results.</td>
<td>Several students became winners of national and American competitions, so they could see that my training gave result.</td>
</tr>
<tr>
<td>Personal domain</td>
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This is an example of a growth network inspired by a master’s program.

Non-iterative growth network

This growth network was not found to be iterative as no proof was found to suggest that Brayan iteratively changed the way he taught gifted students due to reflection on e.g. salient outcomes. As the students were so satisfied with the course as it was, Brayan probably saw no need to change it; furthermore, he was not giving the same preparative course more times even if he kept teaching gifted students.

- During this time in which you have worked with helping the gifted students, has the manner in which you work with them changed?

- Yes, of course. Because it depends of the student too, there are gifted students who are shy, and there are gifted students who are very hyperactive. And it is not the same working with shy students as with hyperactive.
In this excerpt we can see that Brayan refers to treating students different according to their characteristics. However, nothing suggests that this is something he learned because of the salient outcomes he saw when first trying the course or a change in another domain. Therefore we must conclude that Brayan did not experience an iterative growth network where the changes were ongoing; but rather just one lasting change, a growth network.

Scientific solutions for practical problems

In this example the master’s thesis of Brayan was utilized to develop a scientifically well-founded solution to a practical problem of the school. The course for gifted students would have been developed even without the master’s thesis, since this course was needed; however, developing the course in a master’s thesis probably resulted in a better prepared course and with a more solid base in pedagogical theories. In this excerpt Brayan talks about how the courses of the master’s program were relevant to his work with developing the course for gifted students:

The master’s program is a short version of the educational sciences plus psycho-pedagogy. This is fundamental, because gifted students are a more psycho-pedagogic theme, and one that reveals itself during some of the courses. Therefore the master’s program was very important, the courses we did, the modules we studied, to get a general notion...

Thus, Brayan believes that the courses of the master’s program gave him a general knowledge of psycho-pedagogy which was relevant to the subject of gifted students. Furthermore, he would have found more incentive to develop the course when it was also his master’s thesis. Writing a master’s thesis Brayan also had the support of a tutor to help him organize the work. Consequently, there are many advantages of utilizing the master’s thesis to solve a practical problem in the school.
Discussion and conclusions

The first research question is whether the strategies to develop teaching quality in Cuba result in change sequences, growth networks or iterative growth networks for the teachers. In four of the eight interviews change sequences and growth networks could be seen that were inspired by methodological work sessions or further education. The methodological work session inspired collective growth networks where the teachers improved the education during a long time. The further education, on the other hand, inspired the teachers to solve school-related problems individually and in a scientific way.

The second research question was what characteristics of the models promoted the change or growth observed. Below it will be discussed what features of the methodological work sessions inspired collective and long-time growth and what characteristics of the further education encouraged the teachers to solve school problems in a scientific way.

Methodological work to organize long-time collective efforts

For the interviewed teachers the methodological work sessions most often acted as an incentive to start and persist in working on developing the education together. In two of the cases (A and B) the teachers talked about the methodological work sessions inspiring them to work together to reach a goal. The methodological work sessions actually have many traits which indicate that the teachers form learning communities. The teachers work together, reflect on their practice, learn together and try to improve their teaching - all important factors in forming a learning community (Stoll & Louis, 2007). As discussed in the introduction it is desirable to form a learning community since there is evidence of learning communities promoting the learning of the teachers as well as of the students (Louis & Marks, 1996; Lee & Smith, 1996).

In this chapter it is discussed which characteristic in the methodological work sessions was most important to encourage the teachers to develop professionally.

Time dedication

Firstly, it seems apparent that the mere existence of a time slot dedicated to methodological work inspires the teachers to work on methodological questions. During this time the teachers can talk to each other and they have a chance to develop new ideas, or to further develop old ideas, together. For example in case B Brayan talks about the collective of teachers all trying error identification exercises after this idea had been discussed during a methodological work session. In case C another idea, a new solving method, is distributed during a methodological work session. The fact that the Cuban education system earmark time for methodological work in group gives the teachers the possibility to discuss methodology and to share ideas.
Organization

So the mere existence of time dedicated to methodological work probably inspires the teachers to develop professionally. However, there is also evidence that the content of the sessions encourages the teachers. One factor is the organization of the work during the sessions. Alejandro in case A mentions that the collaborators of a session organized workgroups. That is, the collaborators had a planning role for the group of teacher; he helped them create the working environment that encouraged them to develop the education. As the work was organized by an authority it might have felt more serious to the teachers than if it had been arranged by the teachers themselves. This might have resulted in a more thorough work and more substantial results.

Bringing the teachers together

As we could see from the results, the methodological work sessions often resulted in the teachers changing together as a group. This type of collective growth has the advantage that although not all teachers have the strength to initiate the change or are in conditions to experience all of the changes, the teachers as a collective experience a growth network. An example of this is case A where the teachers develop exercises together. It is probable that not all teachers would have noticed the problem with the old exercises and the need to develop new ones; however, as some teachers noticed this need and brought the problem to the methodological work session, in the end all teachers participated in the development of the new exercises. In the same way only one teacher wrote a master’s thesis on how to digitalize the exercises; nevertheless, this idea would not have been possible had the new exercises never been developed.

Expectations

Another reason for the methodological work sessions acting as an incentive for development might be the way the expectations of the work become more explicit. Alejandro for example talks about work groups being formed during the methodological work sessions, work groups of course are expected to work together and deliver results. Because of the organization of the projects during the methodological work sessions and by the subject responsible teacher goals are probably set up and it is monitored how these goals are complied with. Even the collective responsibility felt by the group of teachers to meet the goals they set up together could encourage them to continue and finish the work. Brayan in case B mentions the expectation from him as the subject responsible teacher that the other teachers try certain exercises in their class:

Being subject [responsible] teacher, there are exercises I impose upon the teachers to utilize in some moment, be it in class or as homework or in a laboratory lesson...

Further, the new solving method introduced during a methodological work session in case C seemed to be expected to be utilized by the teachers. These expectations encouraged the teachers to try new methods in their classrooms, that is change their practice.

Collective growth in the interconnected model

The inventors of the interconnected model of professional growth (Clarke & Hollingsworth, 2002) did not utilize it to describe the growth of a collective of teachers. However, as long as
it is not important which teachers experienced which mediating processes the model could be utilized for a collective of teachers. In that case the model describes the growth of the collective as a whole. The model has been utilized in this way in case A and B.

**Further education to solve problems**

If the methodological work sessions encouraged the teachers to work together to solve problems, the university education rather acted as an incentive for them to change their practices because of the results of their theses. Writing a thesis is an opportunity for thorough reflection which is a learning process that has been found to facilitate change in teacher’s beliefs (Opfer & Pedder, 2011). Below it will be discussed what other characteristics of the further educational programs were important to encourage the teachers to develop new practices and use them for a long time.

**Solving practical problems**

The reason the teachers developed the new practices was that this was the theme of their theses. The theses in Cuba are often very practically oriented; the teachers write them to solve practical problems in their schools. Two of the teachers interviewed for this investigation, for example, wrote about a method to teach functions in 11th grade and a course for gifted students. Diego from case D writing about a method to teach functions found this theme in a bank of problems of the municipality. Brayan who developed the course for gifted students did this because such a course was needed in the school and later he also held the course. There is also scientific evidence that learning processes that results in applied knowledge, such as the changing of one’s practices, facilitate the change of teachers’ beliefs (Opfer & Pedder, 2011).

**Expectations of a scientific solutions**

One of the advantages of solving school-related problems by writing a thesis about how to solve them is that the solution might be more scientific. As the work is a part of a thesis there are expectations of a scientifically well-founded solution. Diego in case D and Brayan in case E developed new teaching methods on the basis of pedagogical theories which they had studied. Understanding the theory behind the method might make it easier for the teacher to refine the method iteratively or utilize it in a broader way; as Diego does when he utilizes the question-system method in all his classes after having first applied the method only on functions in 11th grade. The master’s theses also carries with it expectations of a structured work and that the teachers actually finish the work.

**Individual growth in the interconnected model**

The use of the interconnected model in describing how the teachers grow individually thanks to the further education is in line with the type of change Clarke & Hollingsworth (2002) studied to develop the model. In their article the authors give example from the empirical data of teacher change, this data is mainly derived from teachers having participated in different programs of professional development. Just as the teachers interviewed for this thesis, the teachers studied by Clarke and Hollingsworth were inspired to change individually by the new insights they acquired during the professional development program or further education (in the case of the Cuban teachers).
Interaction between the two strategies

In two of the cases (A and C) we see examples of methodological work sessions and further education interacting with each other. In case A the activities during the methodological work sessions leads to a teacher writing a doctoral thesis and in case C the results of a master’s thesis are spread during a methodological work session.

In case A the elaboration of new exercises results in a teacher writing a doctoral thesis on digitalizing these exercises. In this case the work of elaborating exercises, initiated by the methodological work sessions, is developed in a thesis. This shows that the theses can be a way to further develop projects started during the methodological work sessions in a scientific way. The thorough analysis of the problem the master’s thesis entails would probably not have been carried out had it not been for the opportunity to write a master’s thesis about it.

In case C an idea developed in a master’s thesis is spread during a methodological work session. In this case the sessions acted as a forum where the results from the thesis could be distributed. Thus, the methodological work sessions rendered it possible for more teachers to change their practices on the basis of the scientific results from the thesis. Possibly the personal relationship between the thesis writer and the other teachers attending the methodological work session made the teachers more inclined to want to utilize the results of the thesis. It should also be noted that the teacher who had written the thesis was the collaborator of the methodological work session and thus had a leading role. This might have resulted in the new teaching method being proposed with more force than if one of the attending teachers had proposed it, as the collaborator sets the agenda of the sessions. Still, it is probably possible for the attending teachers to spread the results of their own theses during the methodological work sessions as well, although this investigation have not resulted in any example of it. Whether or not it is custom to spread thesis results or results of other scientific research during the methodological work sessions were not investigated. Nevertheless, the sessions seem to be a possible forum to spread such results.

These two examples show possible interaction between methodological work sessions and further education. This interaction can be described as an interaction between theory and experience; the scientific theses are connected to the more practical and experience based reality in the schools and during the methodological work sessions. Connecting these two ways of looking at education results in a more thorough understanding of learning processes founded in both theory and experience.

Learning organization

In a review of investigations on teacher development (Opfer & Pedder, 2011) the importance of a learning organization is pointed out. According to the authors one of the characteristics of a learning organization is that it has a system of knowledge management. Such systems “leverage resources, core capabilities, and expertise of staff and pupils” (Opfer & Pedder, 2011, p. 391). The organization of methodological work sessions at municipal and school level could be characterized as a system of knowledge management; the methodological work expert teaches the teachers about methodology, which is their expertise, whereas the
teachers discuss how to adapt this knowledge to their schools and students, which is where they have the most experience.

Another of the characteristics of a learning organization is that it nurtures a learning environment on all levels. This is especially true for the Cuban system since the teachers are expected to participate in further education and obliged to participate in methodological work sessions. That is, they are not considered fully skilled when they graduate, but expected to continue their training all their working life.

The review on the investigation of teacher development (Opfer & Pedder, 2011) also discusses two other characteristics of a learning organization: promoting self-evaluation and examining implicit beliefs underlying institutional practices. Data supporting that the Cuban system has these two characteristics have not been found in the interviews.

**Methodological work developing everyday lessons**

The teachers in the interviews talked about the long-time school development they had participated in as a part of the methodological work sessions. However, during these sessions they also discuss how to teach the lessons of the week. None of the teachers talked about something they had tried in their classroom because of these more regular discussions. The reason for this might have been that the methodology they discuss when talking about lessons is mostly based on methodology they already know about. Like one teacher said:

*In the methodological work they give us the outline of the work, how to treat the content. Something that many of us already know, but it is not pointless to be reminded, it is not pointless to stress it.*

Therefore, they might not have thought about the methods discussed and tried in class as new, since they had already used the same methods in very similar ways before. However, this quote from a teacher with 34 years of experience shows that the teachers thought the methodological work sessions worthwhile, even if they already knew about the methodology discussed.

**The growth networks**

**Iterative growth networks**

Of the five examples of growth networks presented in this thesis two were iterative (case B and D). In case B Brayan and the other teachers first introduced a new type of exercise (error identification) on equations. However, after noticing positive salient outcomes they decide to develop similar exercises with other mathematics content. This is an example of teachers refining a new practice (the error-identifying exercises) iteratively instead of being satisfied with utilizing it in the originally intended way. In case D Diego similarly decides to utilize the question-system method in all his classes instead of just when teaching functions as was the initial aim of his master's thesis.

I believe that both the group of teachers from case B and the sole teacher Diego from case D by reflecting about how their new practices could be utilized in more ways gave proof of a
more advanced form of growth. By refining their practices they could use them in more ways and spread the positive results to more students. To distinguish this form of growth the term iterative growth network was introduced. In these two iterative growth networks the teachers utilized their creativity and made use of their practices in new ways.

**Imposed change**

In two of the growth networks the change was imposed on the teachers. In case B the collective of teachers were asked to try error identification exercises and in case C the teachers were asked to incorporate a new solving method. In both these cases the growth network starts off in a way resembling the conventional model of professional development (see Figure 1 under *Analysis of teacher professional development*). This model represents an old way of seeing the teacher as a passive receiver of knowledge and learning as knowledge transfer (Sprinthall, Reiman & Thies-Sprinthall, 1996). Still, it does seem that showing teachers new methods and even asking them to utilize them can have a positive effect on their growth. In case B the collective of teachers even develops the error identification exercises they were told to use; they experience an iterative growth network. To develop the exercises the teachers had to reflect on the positive salient outcomes of the initial exercises (reflection arrow 4), this means the teachers went from passive executers of the new method to active developers of the same. In this example we can see the strength of the interconnected model: that many different pathways to change can be described with it.

**Reflection on action**

The importance of reflecting on actions is emphasised by, among others, Donald Schön (1983) who sees this as an important process in professional development. In the interconnected model reflection on action would be represented with reflection arrows 2 and 5. To reflect on ones actions is a prerequisite to experience an iterative growth network.

In all the growth networks, apart from the second one in case A, reflection arrow 5 is represented. This arrow symbolizes that the teachers reflect on their actions, or more specifically about what salient outcomes they see as results of their actions. To reflect on the salient outcomes of ones actions is also a prerequisite of an iterative growth network building on improving a practice on the basis of the student outcomes.

Reflection arrow 2, on the other hand, represents a reflection on how accurate the teachers own reproduction of a method was. None of the interviewed teachers talked about reflecting on their actions in this way. However, theoretically an iterative growth network could build on the teacher refining her execution of a model without considering the outcome of the students. In the work of Clarke and Hollingsworth (2002) one of the teachers quoted experienced this type of growth.

**Comparisons to the Swedish system**

In Sweden new regulations to motivate teachers to carry out research while working were introduced in 2011. In this year both new titles for teachers and a teacher certificate were introduced. The aim of introducing the new titles was to strengthen the connection between school and science. The lecturers (one of the new titles) are supposed to constitute this link and incorporate results of up-to-date research into the teaching. (Skolverket, 2013)
In Sweden the increase in salary for a teacher with a title is considerable and could motivate the teachers. In Cuba, on the other hand, the major reason for the teachers to take part in further education seemed to be the expectations of those around them. Nevertheless, many teachers also expressed an interest in growing as people and teachers and even happiness for being able to take part in high-quality further education (interview with secondary teachers studying at the pedagogical university of Havana, March 2013).

Many theses in Sweden are very theoretical; however, when working teachers begin to write theses to a greater extent the practical connection will probably be stronger. In a Swedish thesis the writer needs to familiarize with the field of research; in this way the thesis is put into context and overlapping is avoided. The characteristics of Cuban theses were not investigated; however, it seemed that they were more practically connected than Swedish theses. It can be discussed whether the theoretical or the practical approach is better. A practical approach may be more efficient in solving a school related problem; nevertheless, a theoretically oriented thesis might give the teacher a broader knowledge, applicable in multiple situations. Still, a combination of the two should be of the most use, both to the school and to the teacher’s development.

Lessons from Cuban strategies

As explained above efforts are made to increase the number of Swedish teachers studying during their working life; that is, the focus on further education is increased. However, the attention to the methodological knowledge of the teachers is not at all as pronounced as in Cuba. In Sweden the teachers are left rather alone in developing the methodology of their classes. To introduce methodological work sessions could be a way to encourage the teachers to work more with methodological questions.

In Cuba there are two types of methodological work sessions; on municipal and school level. The meetings on municipal level are led by a methodology expert; this person explains how the lessons of the week should be taught. As all teachers of Cuba teach the same material at approximately the same time it is easier to give such a lesson than it would be in Sweden. Another difference is the view on teaching methods; in Sweden a lesson on the methodology of a class would normally be very abstract as the lecturer would want to stress that there are countless ways to teach a good lesson. In Cuba on the other hand I got the impression that the general view was that methodology can be taught in a more practical way. This view might be challenged in Sweden, where it could easily be seen as normative.

The methodological sessions on school level, on the other hand, are more focused on the teachers discussing how to teach lessons and planning together. I believe this sort of meetings would be beneficial in Sweden too where teachers today are left rather alone in the planning of their lessons. To give structure to the meetings a coordinator would have to lead them like in Cuba, for example the subject responsible teacher. As noted above it could be a problem to talk about practical examples methodology as teachers in Sweden often do not teach the same theme at the same time. Nevertheless, more general pedagogy, methodology and cooperation between teachers could still be discussed. The optimal content and setup of the methodological work sessions can be discussed; for example to what measure the coordinator should lead or invite the teachers to decide the proceedings of the meetings. However, I believe that methodological work sessions on the schedule constitute a great opportunity for the teachers to discuss methodology and develop professionally.
Comparison to lesson study

The methodological work sessions carry some similarity to lesson study, a Japanese professional development method which is also becoming increasingly popular in Sweden. Lesson study is an integrated part of the teachers’ work in Japan just like the methodological work is integrated in the Cuban teachers’ work. During lesson study the teachers form groups, often divided by grade level, and in these groups the teachers develop a lesson. The Cuban teachers also form groups divided by grade level and discuss the methodology of the upcoming lessons which is comparable to developing a lesson.

Lesson study further involves one of the members of the group teaching the lesson in their classroom, whilst the other teachers observe and question the students to understand their thinking. Afterwards, the teachers analyse the collected data and analyse how the lesson can be improved (Podhorsky & Fisher, 2007). This type of observations is not a part of the methodological work in Cuba.

To incorporate lesson study as a tool in the methodological work sessions could be a way to develop them. Furthermore, it could be a way to give the teachers time and incentive to work with the lesson study method. Should methodological work sessions be introduced in Sweden lesson study could be one of the features of them, as the method is already well-known and also scientifically supported.
Further investigation

It would be interesting to investigate more closely the Cuban methodological work sessions, i.e. what the teachers do in the sessions and how they develop because of the sessions. Especially how the methodological work influences the teachers’ ordinary lessons needs further investigation, since the teachers interviewed in this investigation only talked about changes related to broader school development. Furthermore, the origin of methodological work and how the system for it functions could be researched. It would also be interesting to investigate whether the methodological work sessions mostly are based on knowledge from experience or from research.

How the idea of methodological work sessions could be utilized in Sweden and other countries are another subject for further investigation. The idea of methodological work sessions could be adapted to the Swedish context and tried in Swedish schools. Further, the teachers’ thoughts about the trial sessions and how they changed because of them should be studied; possibly their professional development could be investigated with the interconnected model.
References


Curriculum for mathematics-physics teacher students, Instituto Superior Pedagógico Enrique José Varona, Havana. Private photo.


Museo de la Alfabetización, La Habana, Cuba.


Appendix 1: Interview plan

Show the information leaflet. Let the teacher ask questions.

Tell the teacher about the project. Explain the confidentiality and ask if it is ok to record the interview.

- **Background questions**: How long have you worked as a teacher? Which subjects? Have you participated in further education? Methodological work sessions?

Stress that the interview will treat *changes* in the teachers work with the students. Show the table of teacher knowledge for inspiration of such changes.

**changes due to methodological work sessions:**
- If you think about the methodological work sessions. Has something you have done there resulted in that you have changed something in how you work with the students, tried something new for example.
- Now I’d like you to tell me about why you tried this.
- Had you other reasons for trying this?
- And when you tried this; what was the result?
- Have you tried it again?
- Had you changed anything between the times?
- Would you like to add something?

**changes due to further education:**
- If you think about the master’s /doctorate program you did; has anything you did there resulted in that you have changed something in your work with the students.
- Same follow-up questions as above.

**Table of teacher knowledge areas**

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<tr>
<td>Pedagogy</td>
<td>Used a way of leading the class or teach that you haven’t used before.</td>
</tr>
<tr>
<td>Didactics</td>
<td>Used a way of teaching a mathematical theme that you haven’t used before.</td>
</tr>
<tr>
<td>Educational material</td>
<td>Used an educational material that you haven’t used before.</td>
</tr>
<tr>
<td>Social context</td>
<td>Changed your opinion of how the society, community or the characteristics of the students influences the teaching.</td>
</tr>
<tr>
<td>Aims</td>
<td>Changed your opinion about the aims or values of teaching.</td>
</tr>
</tbody>
</table>

Appendix 2: Information leaflet for Cuban teachers
Información sobre la entrevista

Esta entrevista es parte de la investigación para mi tesis de máster. El objetivo de la tesis es describir cómo funcionan las estrategias cubanas de perfeccionamiento profesional.

La entrevista
La entrevista durará aproximadamente 40 minutos y será grabada. Hablaremos sobre ocasiones en los cuales usted ha probado un método que no usaba antes en su enseñanza o cambiado su concepción de algo relacionado a la enseñanza. Sería bueno si usted antes pudiera pensar un poco sobre qué aspectos le gustaría hablar (ver parte de atrás del papel).

Redacción
El resultado de las entrevistas será una tesis de máster sobre cómo funcionan las estrategias de perfeccionamiento profesional en Cuba. Esta tesis puede contribuir al conocimiento y mejora del perfeccionamiento profesional en general y las estrategias cubanas en particular.

Consentimiento y confidencialidad

- Es voluntario participar en la entrevista y usted puede terminar la entrevista en cualquier momento.
- Usted es anónimo y datos personales no va a ser dispersado. Su nombre, datos personales o su lugar de trabajo no serán mencionados en la redacción.

La entrevistadora y el proyecto
Mi nombre es Helena Buchberger y estudio para ser profesora, en la universidad de Estocolmo en Suecia. Las entrevistas son una parte de la exploración para mi tesis máster. Si quiera está muy bienvenida a contactarme en teléfono de casa 83 17 425, móvil 53 05 08 26 o helenabu@kth.se.

Mi contacto en Cuba es Dr. C. Amanda Altavaz Avila, doctora en Ciencias Pedagógicas y especialista de la Dirección de Relaciones Internacionales de la Universidad de Ciencias Pedagógicas "Enrique José Varona".
Para hacer este proyecto en Cuba he recibido una beca de la Agencia Sueca de Cooperación Internacional para el Desarrollo (la beca se llama Minor Field Studies).

Deja su dirección si quiera recibir la redacción en inglés ( ) o un resumen en español ( ).

____________________________________________

____________________________________________ ¡Muchas gracias por su participación!

____________________________________________

/Helena
Preparación

Durante la entrevista le voy a preguntar sobre cambios en cómo usted trabaja con los estudiantes.

Esta tabla muestra **ejemplos de cambios**:

<table>
<thead>
<tr>
<th>Campo</th>
<th>Explicación</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pedagogía</strong></td>
<td>Usado una manera para dirigir la clase y enseñar que no ha usado antes.</td>
</tr>
<tr>
<td><strong>Didáctica</strong></td>
<td>Usado una manera de enseñar algún tema de la matemática que no ha usado antes.</td>
</tr>
<tr>
<td><strong>Medios de enseñanza</strong></td>
<td>Usado un material de instrucción que no ha usado antes.</td>
</tr>
<tr>
<td><strong>Medio social</strong></td>
<td>Cambiado su opinión de cómo la sociedad, la comunidad y las características de los estudiantes influyen en la enseñanza.</td>
</tr>
<tr>
<td><strong>Metas</strong></td>
<td>Cambiado su opinión sobre los objetivos y valores de la enseñanza.</td>
</tr>
</tbody>
</table>


Sería beneficiario si usted pensaba antes de dos cambios. No tiene que ser grandes cambios.

**Cambio 1: Por trabajo metodológico**

Algo que ha probado en su aula o cambiado su opinión sobre (ver ejemplos en la tabla), como un resultado de los encuentros de trabajo metodológico.

**Cambio 2: Por superación profesional** (Si usted hace cursos de superación profesional)

Algo que ha probado en su aula o cambiado su opinión sobre (ver ejemplos en la tabla), como un resultado de la superación profesional.

Durante la entrevista le voy a preguntar sobre estos cambios para entender que le estimulaba para hacer estas cambios, y cuáles resultados los cambios han incitado en su enseñanza.
Appendix 3: Information leaflet for Swedish teachers

Information om intervjun

Den här intervjun är en provintervju inför senare intervjuer som jag kommer att göra under mitt examensarbete. Målet med denna intervju är alltså att förbättra förutsättningarna inför de senare intervjuerna; därför får du gärna komma med kritik, både på frågorna och på genomförandet.

De senare intervjuerna kommer att göras med gymnasielärare i Kuba för att ta reda på hur de kubanska strategierna för lärares professionella utveckling fungerar.

Intervjun

Intervjun kommer att ta ca 30 min och spelas in. Vi kommer att prata om tillfällen då du har ändrat något i hur du undervisar (t.ex. provat en ny metod) eller ändrat din syn på någon undervisningsstrategi.


Uppsats

Examensuppsatsen kommer att handla om hur de kubanska strategierna för professionell utveckling fungerar. Denna intervju genomförs främst för att förbättra intervjufrågorna och genomförandet inför intervjuerna i Kuba, men det kan hända att citat från din intervju används i uppsatsen. Om du är intresserad av uppsatsen får du gärna lämna din e-postadress så skickar jag den.

Samtycke och konfidentiell behandling

- Det är frivilligt att delta i intervjun och du kan när som helst avsluta den.
- Du är anonym och dina personuppgifter kommer inte att spridas. Varken ditt namn, dina personuppgifter eller din arbetsplats kommer att nämnas i uppsatsen.

Intervjuaren och projektet

Jag heter Helena Buchberger och studerar "Civilingenjör och Lärare" som är en kombinationsutbildning på KTH och SU. Jag fått ett stipendium från Sida för att samla in data till mitt examensarbete i Kuba (stipendiet heter Minor Field Studies). Om du har någon fråga får du gärna kontakta mig på helenabu@kth.se.

Underskrift

Tack för din medverkan!

/Helena
Appendix 4: Pictures

Upper-secondary school class doing an exam.

Upper-secondary school class.
Upper-secondary school with mural painting.

Faculty of Science, Pedagogical University.
Student teachers eating lunch.