Minor field study
15 hp

How the educational system in China is designed

A study to see how education departments in Hohhot, China, educate pre-service and in-service teachers for teaching and which factors contribute to the students mathematical results

Hur utbildningssystemet i Kina är utformat

En studie för att se hur utbildningsdepartement i Hohhot, Kina, utbildar sina blivande och nuvarande lärare och vilka faktorer som påverkar elevers resultat

Felicia Andersson
Emelie Nordström

Teacher education, 270 hp
Mathematics and learning
Seminar: 2014-11-04

Examiner: Leif Karlsson
Supervisor: Per-Eskil Persson
Preface

Through the writing of this thesis, our view of learning has changed. We are now increasingly aware that a versatile education is the best for both the students and the teachers, and we have gotten a great insight in China’s school system. We will be grateful for this experience for the rest of our lives. We would like to send our thanks to Sida and Malmö University for giving us the MFS-scholarship that made this study possible, and to Per-Eskil Persson at Malmö University for his guidance and help through the writing process. We would also like to thank Narisu, Wu and Surina for arranging all the practical things, and that they welcomed us warm-heartedly to their university and the Mongolian culture. Last but not least we would like to thank a couple of students at Inner Mongolia Normal University for their time, help and kindness; Olivia, Li, Linda and Wendy.

Throughout this study we have in a large range as possible done everything together, and we have both been helping each other through the writing-process. We have both transcribed the interviews, making the observation schedules, the chapters “The PISA survey”, “Education in China” and “Focus group”. But to make the most of the time, one person has been more responsible than the other in some chapters.

Emelie has been responsible for the writing of “Qualitative research – observations”, “Implementation”, “Reliability and ethical requirements”, “Aims and research questions”, the result and analysis of “The teachers’ education” and “Education and further training of in-service teachers”, the discussion of the methods, to compile the transcript from the interviews and “Future research”.

Felicia has been responsible for the writing of “International studies – other studies”, “Education in Sweden”, “Curriculum reform in China”, “Qualitative research – Interviews”, the results and analysis of “The Chinese school system” and “Factors for mathematical achievement”, the discussion of the results, the conclusion and “Our own development”.

3
Abstract

This is a qualitative study, and the purpose is to examine and gain a deeper understanding of China’s school system. Results from international comparative studies, such as the PISA survey and the TIMSS study, show that Chinese students have the highest mathematical scores. This evoked our interest and led to the beginning of this study. The research material comes from observations at three schools and interviews with in-service teachers, pre-service teachers and a head teacher in Hohhot, China. The results and the conclusion of this study shows that the content in the Chinese curriculum is comprehensive and does not give much time to individualize the lessons. The Chinese school system is very exam-oriented, and together with the pressure from the society and their parents, the students are forced to spend a lot of time to study. Another conclusion to this study is that pre-service teachers in China do not have much teacher practice at schools, but they study a lot of mathematics and methodology separately at the university.

Keywords: Chinese school system, China, PISA, TIMSS, mathematics education, teachers education, Minor Field Study.
# Table of Contents

1. Introduction ........................................................................................................... 10

2. Aims and research questions ............................................................................... 11

3. Background ........................................................................................................... 12
   3:1 International studies ....................................................................................... 12
      3:1:1 The PISA survey .................................................................................. 12
      3:1:2 Other studies ....................................................................................... 14
   3:2 Education in China ......................................................................................... 16
   3:3 Education in Sweden ..................................................................................... 19
   3:4 Curriculum reform in China .......................................................................... 20

4. Methods and implementation ............................................................................... 23
   4:1 Implementation .............................................................................................. 23
   4:2 Qualitative research ...................................................................................... 24
      4:2:1 Interviews ............................................................................................. 25
      4:2:2 Observations ......................................................................................... 27
   4:3 Focus groups .................................................................................................. 27
   4:4 Reliability and ethical requirements ............................................................. 28

5. Results and analysis ........................................................................................... 30
   5:1 The Chinese school system .......................................................................... 30
   5:2 The teachers’ education .............................................................................. 33
   5:3 Education and further training of in-service teachers .................................. 36
   5:4 Factors for mathematical achievements ..................................................... 38

6. Discussion ............................................................................................................ 42
6:1 Results ........................................................................................................................................ 42
6:2 Methods ..................................................................................................................................... 45

7. Conclusion ...................................................................................................................................... 47
   7:1 Further research ...................................................................................................................... 48
   7:2 Our own development ............................................................................................................ 48

8. List of references ........................................................................................................................... 50

9. Appendix
   Appendix 1 – A snapshot of the PISA survey
   Appendix 2 – A snapshot of the PISA survey
   Appendix 3 – A snapshot of the TIMSS study
   Appendix 4 – A snapshot of the PISA survey
   Appendix 5 – Interview questions for teachers at IMNU
   Appendix 6 – Interview questions for students at IMNU
   Appendix 7 – Interview questions for in-service teachers
   Appendix 8 – Interview questions for head teacher
   Appendix 9 – Observation schedule at a Mongolian school
   Appendix 9 – Observation schedule at a Chinese school 1
   Appendix 10 – Observation schedule at a Chinese school 2
1. Introduction

By examining how the mathematics education and the teacher education at a university in China are getting prepared for their future occupation, a clearer picture and a deeper understanding of teaching methods will be gained. Factors that contribute to the good mathematic results in China also examined. This study is based on the results from a previous PISA survey, which shows that China outperformed all western countries, including Sweden, in all parts of the test (Skolverket, 2012).

It was the PISA survey’s result that was the starting point for this study. We wanted to see how the students are taught in China and get a real insight in the Chinese school system.

The purpose of this study is to gain an understanding of how teacher education at Inner Mongolian Normal University, IMNU, are prepared for their future profession and how they are educated as in-service teachers. This hopefully contributes to a deeper understanding of our future profession.
Aims and research questions

The purpose of this study is to get a better understanding of the Chinese school system and the good mathematic achievements shown in international surveys, and through observations and interviews get to see how it is to be a student and a teacher in China. As well as to note how Inner Mongolia Normal University (IMNU) in China is preparing their pre-service teachers for their profession.

The main questions are:

- What are the general aspects of the Chinese educational system?
- International surveys shows that Chinese students have good mathematical achievement. Which factors contributes to this?

Some supplemented questions are:

- What are the pre-service teachers’ and in-service teachers’ views on teaching?
- How does the university prepare their pre-service teachers for their future profession? What opportunities are given to in-service teachers for further development within their profession?
3. Background

Statistics done by the OECD’s Programme for International Student Assessment (PISA), and other international surveys, show that China has gained high ranking in many subjects and especially in mathematical performance (See Appendix 1).

3:1 International studies

International studies regarding the school have gained increasing interest during the last decade. The two largest international studies are the PISA survey and the TIMSS study.

3:1:1 The PISA survey

The PISA survey is an international study carried out every three years, and started in 2000 on behalf of the OECD (Organization for Economic Co-operation and Development). According to OECD, the international contractor selects the schools that are participating in the PISA survey at random. Tests are conducted on 15 year old students and try according to OECD to measure how well prepared they are for their future education and how well the students can apply what they have learned, after about nine years of compulsory school, to real-life challenges. The competencies that the PISA survey are reading, mathematics and science literacy. The emphasis on the tests varies with each survey. In the latest survey the selected students, in addition to the three main topics, implement electronic tests that tested further skills in reading comprehension and problem solving (OECD, 2014).

In the survey done in 2012 there were 65 economies participating. The PISA Governing Board approve participating countries/economies that apply at least two years in advance. To be approved by the board the countries must meet certain criteria such as technical expertise, and also that they have the amount of money it takes to implement this survey. Representatives from all of the countries are included in the PISA Governing Board (OECD, 2014).

Sweden has been involved in the study since 2003, and comparing the first study to the 2012-year survey, the country has impaired its performance. Level 1 is the lowest level and
corresponds to having a few correct answers at the test. *Figure 1* shows the Swedish students' performance in PISA from 2003 to 2012 in percentiles.

The Swedish National Agency for Education’s report (2012) shows that the proportion of students who are performing at Level 1 and 2 has increased by ten percentage points (from 17% to 27%), and the proportion of students who are high achievers, level 5 and 6, have been reduced by half (from 16 % to 8 %).

The picture shows that the mean number of points that the Swedish students received is lower at the test performed in 2012 compared to the test performed in 2003. The total points gained by the highest scoring students, as well as the lowest scoring students has also declined.

![Figure 1: The Swedish students' performance in the PISA survey in percentiles. 2003 results compared with 2012 profit. Source: Skolverket (2012)](image)

Appendix 1 shows that Sweden’s mean point in the survey has decreased, but mostly in the mathematical part, whereas China did better compared to their results from their previous tests.

PISA is designed to provide comparable data across a wide range of countries. Considerable efforts are devoted to achieving cultural and linguistic breadth and balance in assessment materials. Stringent quality-assurance mechanisms are applied in the test design, translation, sampling and data collection. An age-based rather than a grade-based target population is used to ensure valid international comparisons of educational performance (OECD, 2014).

However, Goldstein’s (2004) analysis of the PISA survey shows that cross-sectional data used to implement the nation ranking in PISA make it almost impossible to do reliable
conclusions about the participating countries’ school systems. Fertig (2004) mean that conclusions from the national rankings only can be drawn if there exists strong similarities in the studied countries educational system.

Dancis (2014) also critique the problems given in the PISA survey, because there are so many levels to the mathematical problems. He writes that the students first of all must be able to read and fully comprehend the text, and then break the problems apart. He compares this to the exercises in USAs’ textbooks, where these kinds of problems rarely occur. He therefore blames the textbooks, more than the students and the teachers, for the bad results in the PISA survey. Another critique that he stresses is the inaccurate “difficult levels”. He writes that many mathematical problems that are of level 5 or level 6 does not require high level of mathematical knowledge – it only requires that the students are good readers. Dancis (2014) also describes the validity of the PISA survey. He starts by saying that:

There is little significance to PISA showing that Grade 10 students of Country A do better on a Grade 6 math test than Grade 10 students of Country B. It certainly does not mean that Grade 10 students of Country A would do better on a Grade 10 math test than students of Country B. (Dancis, 2014)

He also criticise that there are no high school math in the survey, and therefore he thinks that the results are misleading. Knowledge such as arithmetic and pre-algebra are not required by PISA, but knowledge such as mathematical literacy, everyday life mathematics and including problems is a very big part of the test.

3:1:2 Other studies

There have been other international studies that compare the mathematical competence in a country, for instance the TIMSS study. TIMSS, Trends in International Mathematics and Science Study, is a study that is implemented by International Association for the Evaluation of Educational Achievement, IEA. The Assessment Frameworks for TIMSS 2011 was developed collaboratively with the participating countries. In difference from the PISA survey, the TIMSS study collects its data from two age groups. The age groups are students from fourth grade and eighth grade (IEA, 2011).
The same trend with decreasing results on other international mathematics tests is shown in the TIMSS study (see Appendix 3). Sweden performed as the 15th best country in 2007, and in 2011 the placing had dropped to 18th place.

Apart from these larger international studies, smaller studies have been made which have included interviews with students. Van Harpen, X. Y., Sriraman, B. (2012) and Van Harpen, X. Y., Presmeg, N. C. (2013) made two studies that compared students’ results in China and USA. These studies also compared how well the students in both countries solved mathematical problems. Both studies showed that Chinese students performed much better than the students from USA in both mathematical content tests and problem posing tests. These studies tested knowledge from many different areas within mathematics.

The 2012 study compared the relationship between mathematical problem posing and creativity. The students were given three tests: one is a basic mathematics knowledge test, one is a problem solving test and one test is where the students have to create their own problems. The test groups in this study were: one group from Shanghai in China, one group from Jiaozhou in China (a small city) and one group from Illinois in USA. In addition to the test, the authors selected some students to interview. The meaning of the interviews was to gain an understanding of how the students own problems were generated. The study showed that Jiaozhou students scored better than both Illinois and Shanghai students on all tests (Van Harpen et al., 2012).

The 2013 study compared the relationship between the students’ mathematical content knowledge and problem posing abilities. This is a follow up to the 2012 study. The test groups and the test were the same. In this study they tried to see if there is a relationship between the two factors mentioned above. The content test showed that Shanghai students and USA students performed at the same level, and Jiaozhou students outperformed them. The tests showed that the Jiaozhou students were able to face problems with a wider range, and that the USA and Shanghai students lacked ability to face problems in such a range (Van Harpen et al. 2013).

A critique to these studies is that the focus groups only consist of students from advanced mathematic classes. Another critique to the studies is that the different focus
groups had different amount of prerequisites. The authors also mention that it is difficult to do cross-cultural studies, because there are many factors contributing to learning and understanding (Van Harpen et al. 2012; 2013).

3:2 Education in China

The school education in China is 12 years long. The first six years is elementary education, followed by three years in middle school and another three years in secondary school. It is mandatory by law that the children complete elementary and middle school (Li et al., 2008). The normal age for children to start elementary school is at age 6, but it is very common that the children starts before they are six years old. The children graduate from middle school at the age of 15.

In 2001 the Ministry of Education issued a trial version of the Mathematic Curriculum Standards for Full-time Compulsory Education. Three years later, in 2004, the Mathematics Curriculum Standards for High Schools was announced. With these new mathematics standards came research about the reform such as the learning and teaching of mathematics and the debate on the reform itself (Xu, 2010). The curriculum in China is based on the beliefs in mathematics and mathematics education. This is what Chinese scholars concluded:

 [...] mathematics should service the public, mathematics is a supplement of natural language and is a tool that people need for communication, and mathematics should become an indispensable part of every citizen’s cultural preparation. (Xu, 2010)

Xu points out that some scholars have concluded that mathematics education should be individualized and connected to everyday life and that the teachers should take back mathematics to its origins. Other scholars believe that the teachers should be careful not to make the connections with everyday life a goal, because it could prevent students’ development instead of helping them (Xu, 2010).
Criticism that the new curriculum has received is for instance that it abandons the greater functions of traditional Chinese education, that it is difficult to handle and that it has caused confusion (Zhang, 2003; Yang, 2002).

The two areas that the Chinese mathematics teachers are focusing on are the “two basics” in mathematics. They are: memorizing basic knowledge and mastering basic skills (Zang, 2005). Zang (2005) says that if the students do not have a solid foundation nor a basic knowledge, individual development is not possible. Xu (2010) believes that teaching the “two basics” is a teacher-controlled and effective model.

Every lesson has specific instructional tasks and objectives, including knowledge and skill topics that the teacher needs to cover, the teacher’s objectives for the lesson, the basic training that students need (problems that they need to solve), students’ objectives for the lesson, to what extent are these objectives achieved (for example, the rate of problems correctly solved). The teacher organizes the lesson and controls class activities around these objectives (Xu, 2010).

In 2003 a new model for the in-service teachers in China was implemented. The purpose of this new model, "Keli", is to update the ideas of teaching, formulate new learning situations and to find a way to optimize the teaching lessons (Huang & Bao, 2006).

The process itself is that a cooperation of teachers and researchers is established, into a "Keli-group". A relevant field is selected, a research question is raised and the process of developing an exemplary lesson begins. There are various steps, which consist of real lessons that the Keli-group observes and the lessons are followed by an immediate discussion. The teacher makes changes in the lesson structure after each discussion. This is one way to optimize the teaching lessons, and since 2004 there are 30 cities that have adopted the Keli-model (Huang & Bao, 2006).

There are many ways to become a teacher in China, depending on which level one wants to teach. For being able to teach at high school (the students are normally 15-18 years old), the education is four years long. To become a teacher at primary school and a preschool teacher, the education is three years long at a different teaching institute. The teacher education is controlled by the government, and has been approximately the same since 1976 (Liang, S., Glaz, S., DeFanco, T., Vinsonhaler, C., Grenier, R., Cardetti, F, 2012).
The programme structure to become a high school teacher is the same in all universities in China. Each subject is studied separately; meaning advanced mathematics courses and pedagogy courses is taken separately. Courses such as philosophy and internship are also included in the programme. Figure 2 shows a graphic overview of the way to become a teacher in China. (Liang et al., 2012)

At work, all teachers attend to Teacher Professional Development (PD). The PD is a great part of the personal and professional development for the teachers in China. It includes activities such as classroom observation, one to one mentoring and open classes.

(Figure 2: The preparation of 7-12 mathematics teachers. Source: Liang et al., (2012))

Open classes is when a teacher invites the other teachers at the school to observe the class and evaluate it. From this, less successful moments of the class can be taken away, and future classes become more optimized. One to one mentoring is when a less experienced
teacher gets guidance from a more experienced teacher. *Teaching research* is when a group of teachers plan a lesson together, which is tested in a class. After the class, the group of teachers assembles, evaluates and optimizes the lesson. When the lesson is fully optimized, it is stored in a database that is available for all teachers to use (Liang et al., 2012). All teachers also need to attend seminars to develop their teaching skills.

Apart from the PD, a teacher in China is also encouraged to do some *Self-directed Learning*. This includes individual studies in teaching, self-reflection after each lessons and individual research. (Liang et al., 2012)

3:3 Education in Sweden

The mandatory school education in Sweden is nine years long, and must be completed before the student turns 18 years old (Skolverket, 2012).

The newest curriculum change in the Swedish school was in 2011. Previous changes was in 1994. The purpose of the new curriculum is to get more students that passes the compulsory school, and to raise the standards in the Swedish school. Other changes in the new curriculum are that a new grading scale has been introduced, and that students get grades earlier, i.e. in class 3 and 6 (Regeringen, 2012).

The Swedish National Agency for Education (2013) stresses how important it is that all students feel that they are in control of their education, that the students continually receive feedback, and that the teacher constantly uses various formative assessments in order to give students the best opportunities to develop.

The government does not strictly control the Swedish teacher education, meaning each university can form the education in its own way, within a clear framework. A new teacher education was introduced in 2011, with the purpose to have a higher quality.

Malmö University prepares its pre-service teachers for teaching with a variety of methods and styles, and to adapt their teaching to each student's needs. The pre-service teachers have a total amount of 25 weeks of practice at a school. The practice is supervised by a mentor at the university, and by a supervisor at the practice school. The purpose of the
practice at a school is to get professional experience and to get feed-back/feed-forward from the mentor and supervisor (Malmö University, 2014). After graduation, each teacher student must apply for a Teacher Certification.

The biggest difference between the teachers educations in China and in Sweden is that the pre-service teachers major in one subject and the education is longer in China. Another big difference is that the pre-service teachers needs to arrange their practice on their own, and that they only have practice in the last year of the education. The table below shows a systematic comparison between Sweden’s and China’s educational system.

Table 1: A comparison between Sweden’s and China’s educational system.

<table>
<thead>
<tr>
<th>Education in Sweden</th>
<th>Education in China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children starts school when they are 7 years old</td>
<td>Children starts school when they are 6 years old</td>
</tr>
<tr>
<td>The compulsory education is 9 years long</td>
<td>The compulsory education is 9 years long</td>
</tr>
<tr>
<td>The education is goal-oriented</td>
<td>The education is exam-oriented</td>
</tr>
<tr>
<td>Pre-service teachers have 25 weeks of practice at a school</td>
<td>Pre-service teachers have 2-6 weeks of practice at a school</td>
</tr>
<tr>
<td>Teachers plan lessons and tests according to the curriculum</td>
<td>Teachers are given a teacher’s guide for each lesson and test</td>
</tr>
<tr>
<td>Teachers at school are given opportunities for further development if the school can afford it</td>
<td>Teachers at schools are given further training in some extend</td>
</tr>
<tr>
<td>Teachers teach in two or more subjects</td>
<td>Teachers teach in one subject</td>
</tr>
</tbody>
</table>

3:4 Curriculum reform in China

For over a thousand years, Chinese education has evolved around centralized tests from the government (Dello-lacovo, 2006). Teachers focus on students that achieve good academic results and favour those who work hard (Thogerson, 2000). China’s big population and "One Child"-policy contributes to the pressure on the children to work hard and while China’s population keeps on growing, more and more students wants to continue their studies after the compulsory education. However, there are not enough schools for all
students to continue their further studies (Wen & Yang, 2005), and the selection of the students going to secondary school and college is made from the exam results.

For the last 30 years, the Chinese school system has gone through a number of curriculum changes to decrease the burden and workload on the students (Dello-lacovo, 2006; Xiaowei, 2012). When the reform started, the Chinese Ministry of Education had a Soviet model as preference. The school system was standardized, and all schools in China were named and given grades by the government. Resources were given to a small number of schools, which was supposed to function as examples of education quality. This education reform was later criticised because the teachers spoke through the whole lessons and the knowledge that was taught could not be used in real life (Pepper, 1996).

The latest wave of curriculum reform started in the beginning of the 21st century. This curriculum has gradually been introduced in the schools in China. The education now exists of “Three-dimensional targets”, which are “knowledge and skills”, “processes and methods” and “emotions, attitudes and values” (Ministry of Education, 2001). The curriculum reform also focuses on helping students “learn to learn”, and give the students skills to learn, learn through experience, and remove the memorizing part which has been the most common used technique so far (L.N. Wong, 2012). With the new curriculum, the students have the chance to improve their problem-solving ability; however, L.N. Wong also enlightens the problems with this reform as an additional burden to the students:

Curriculum reform requires teachers to use inquiry-based and students-oriented teaching, all of which are not only completely new to the teachers studied, but also add to the burden of their already exam-focused workloads (Wong, 2012).

The new reform involves teacher training and is free of charge in all parts of China. It involves school-based training, seminars and teacher research (Ministry of Education, 2001). However, there is a big difference between the cities and the rural areas of China in education, health care and standard of living (Lu, 2009). In the countryside there are not a lot of chances for teacher training, and the introduction of the new curriculum has been aggravating (Wang and Chai, 2009; Dello-locavo, 2006).
The Ministry of Education have the western countries, such as USA and Germany, as role models for teaching. The institution also gets a lot of inspiration from the Japanese school system. Changes are being made in the curriculum, in the way of teaching and in the outlay of textbooks used in the Chinese schools. However, Dello-lacovo (2006) enlightens that the country has a long way to go to get away from the exam-oriented focus and to have a somewhat equal standard all over the country.
4. Methods and implementation

During the research, interviews with teachers and pre-teachers was held. To gain a greater understanding for students’ results, observations at a high school in the local area is of importance. Therefore observations at a high school was performed, to see how the lessons are designed.

These methods have been chosen for this study because we want a greater and deeper understanding of the Chinese educational system than is given in already conducted researches. Questionnaires were not used partly because of the reason above but also because of the translation of all the questionnaires that would be needed. That kind of resources was not available. A quantitative research would only help to see statistics of different results in China, and a deeper understanding would not be gained.

Qualitative research is a research strategy that usually emphasizes words rather than quantification in the collection and analysis of data. As a research strategy it is broadly inductivist, constructionist and interpretivist [...] (Bryman, 2012).

4:1 Implementation

This study started with an interview with the head teacher in Hohhot, Inner Mongolia, China. The head teacher has a twelve-year teaching experience and he is now responsible for administration for the teachers in middle school. This interview was followed by three observations. One observation of a mathematics lesson at a Mongolian school with students from age 14-16. The other two observations took place at two different Chinese schools were the students were between 16-17 years old in the first class and 15 years old in the second class.

In China the students start school at different ages depending on where they live, family situation or other reasons. With that in mind, it is easier to talk about the students’ ages instead of which year in school they were attending.

After the observation at the Mongolian school, an interview was arranged with the same teacher that held the mathematics lesson. This teacher has been teaching for 17-years at this
school, ever since he graduated from Inner Mongolia Normal University, IMNU. The same procedure was conducted at the second Chinese school and the teacher that was interviewed has been a teacher for more than ten years. During this interview another teacher, in English, was also present and answered the questions. All interviews were recorded on a mobile phone and have later been transcribed.

This was followed by three separate interviews with three teachers/professors at the IMNU. The teachers have connections to mathematics and have lessons with the students who are studying to become mathematics teachers. The three teachers/professors have worked as teachers for 25 to 30 years.

The last interviews were with students who studies to become mathematics teachers. The study used two group interviews with students to get as many opinions as possible from them. The first interview was with seven students that are studying their third or fourth year and the second group interview was with two students that are studying their second year at the university. In total, eight interviews and three observations were conducted.

During this study questions have been asked to the interpreters. The answers to these questions have not been transcribed but this information is essential to the study because it complements the interview data and observation data.

4:2 Qualitative research

The sequence of a qualitative research according to Foster (1995) is presented in figure 3, it shows a similar picture of the way this study was performed.

*Step 1* is the starting point of a study, i.e. the main questions are created. *Step 2* is the selection of relevant sites and subjects. In this study, this means teachers at the university and pre-service teachers. *Step 3* is to collect data, and extended interviews might be needed. *Step 4* is to interpret the data, and draw conclusions. *Step 5*, new findings in the study might need new theoretical work to be done. If so, *Step 5a/5b* must be performed. *Step 6* is to do final conclusions (Foster, 1995).
The way data is collected and analysed in a study can vary a lot from research to research (Hartman, 2004). In this study, the data is collected by interviews and observations.

A qualitative study is considered as research to understand a subject deeper. However, the critique against this line of methods is that it can be “messy” and “unstructured” (Hartman, 2004). According to Hartman (2004) it is also harder to find a selection to a qualitative research compared to a quantitative research. He continues to say that qualitative research is a way to define the nature of what’s being studied, where the writers and observers of the study do the definition.

“Qualitative research is characterized by the attempt to reach an understanding of the living of an individual or group of individuals” (Hartman, 2004).

A qualitative research cannot give answers to the questions: ”how much” and ”how many”. Instead, the examiner tries to reach an understanding of different persons living and the way they see themselves in this world (Hartman, 2004).

4:2:1 Interviews

According to Hartman (2004), interviews are the most used technique to collect data in a qualitative study. The table below shows the differences between structured interviews (quantitative research) and qualitative interviews (qualitative research).
Table 2: Differences between structured interviews and qualitative interviews (Bryman, 2004).

<table>
<thead>
<tr>
<th>Structured interviews</th>
<th>Qualitative interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>A structured approach to maximize the reliability and validity of the research concept. Structured to answer questions.</td>
<td>Greater generality in the formulation of the research, and on the interviewees’ own perspective.</td>
</tr>
<tr>
<td>The interview reflects on the researcher concerns.</td>
<td>The interview reflects on the interviewees’ point of views.</td>
</tr>
<tr>
<td>Inflexible, standardized questions.</td>
<td>Considered more flexible. Interview can turn into any direction.</td>
</tr>
<tr>
<td>Short and generalized answers.</td>
<td>Detailed answers to the questions.</td>
</tr>
<tr>
<td>Interviewees interviewed on one occasion.</td>
<td>Interviewees tend to be interviewed on more than one occasion.</td>
</tr>
</tbody>
</table>

The two different types of interviews in a qualitative study are unstructured and semi-structured interviews.

An unstructured interview is when the interviewer does not have a structured interview guide. Instead, the interviewer has a general theme that they talk about. It is often performed in the moment and is most of the time followed up with further questions. This technique is considered to be most similar to a real conversation (Burgess, 1984).

A semi-structured interview is when the interviewer has a number of questions that the interviewee needs to answer. These questions are designed to be so called “open questions”, to which there is no direct answer, nor right or wrong answer. During the interview, additional questions might be added.

During our research both individual and group interviews was held. Individual interviews was held with the in-service teachers and two group interviews was held with the pre-service teachers.

A critique of individual interviews is that the interviewees are rarely challenged, i.e. answers might be inconsistent to the previous answers or not as developed, and the critique
against group interviews is that not all of the individuals are comfortable with speaking their mind in groups (Bryman, 2012).

4:2:2 Observations
This method is based on a theory that Hartman (2004) calls a naturalistic observation. This is one of the most usual and prominent methods to collect data in qualitative studies (Becker and Geer 1957; Trow 1957; Hartman 2004). The observations will take place in the in-service teachers work environment at two schools in Hohhot, China. Qualitative observations are often done without a hypothesis (Hartman, 2004) and in this study we was using open passive observations. This means that the observers will openly explain to the participants that a study is being made and ask for their permission. The observers was passive throughout the observations and will not participate in the classroom activities.

An advantage with open observations rather than closed is that the observers easily can step aside and take notes. A disadvantage is the risk of affecting the persons, who are being observed, but Hartman (2004) means that the observers do not have to tell everything about the study to the people involved and what the observers are looking for.

In this study, the observations performed was open observations and the persons observed were informed about the general aspect about this study, and why the observation was performed at their lesson. The observed persons did not get any specific information about what was being observed.

During the observations, the interpreter continuously translated the events in the classroom, which made it possible to keep track of what the teacher and students did and said during the lessons.

4:3 Focus groups
In a study, both quantitative and qualitative, a selection of focus groups must be made. The selection of included individuals and where the study should take place is crucial. One difference between quantitative and qualitative studies is that there are a lesser number of individuals and places studied in a qualitative study (Hartman, 2004).
This study relies partly on one individual, a contact person at Inner Mongolia Normal University, who selects the persons that was interviewed and which classes that was observed. This person is an inhabitant of the city, is working at the university and knows teachers at the two high schools and at the university. By letting her choose the interviews and the observation classes, the results will hopefully be more reliable. On the other hand, because the person might be choosing the ones she thinks are the most suitable, it could also result in distorted interview data.

4:4 Reliability and ethical requirements

The previous studies that have been made, for example the PISA survey, were performed in Shanghai. This study is performed in Inner Mongolia, which is a minor region in China. Even though, we think that the information is relevant because we have seen that the Chinese school system is developing the schools in both rural and urban areas, but mainly in rural areas, to be better and get away from this exam-focus. The government in Hohhot is investing a lot of time and money to develop their in-service teachers to get to the level as Shanghai, and they have come a long way.

This region is a developing area and the differences in education and other aspects are substantial between Shanghai and Hohhot. It is also important to point out that a large proportion of the population in this area consists of a minority group in China. The results may reflect tracks of a minority population’s mind-set. Therefore it is of importance to take into consideration that this is a small-scale qualitative study and that no generalization can be made from the study.

The results from the interviews and observations have been translated by the interpreters. This could lead to a misleading result, since some information might have been excluded during the translation.

The Swedish Research Council (2002) writes that research is important and necessary for the development for both societies and people, but there are requirements and ethical considerations a study must consider, which are called individual protection requirements. The basic individual protection requirements can be summarised by four general
requirements for research. The first two are to inform the participants of the purpose of the study, and that the researcher also must obtain the participants’ consent. The final two ethical requirements are that the participants have the right to determine their involvement without any negative consequences, and that a dependency relationship should not exist between the researchers and the prospective study participants.

In this study, all of the ethical requirements have been taken into consideration. The head teacher, in-service and pre-service teachers have all been informed of this study’s purpose and the researchers have obtained the participants consent. The participants have had the right to determine their involvement without any negative consequences and no dependency relationship has existed. All of the participants are anonymous in this study and the collected data will only be used for this particular study.
5. Results and analysis

This section describes the results from the observations and the interviews. The interviews provided information regarding the Chinese school system, and the observations provided information regarding the Chinese education. Teacher 1-3 are the teachers at Inner Mongolia Normal University, located nearby Hohhot. The in-service teachers work at a middle school and secondary schools in the area. The students that participated in the interviews are from Inner Mongolia Normal University. Observations were performed at one Mongolian school and two Chinese schools in Hohhot. All of the schools follow the Chinese curriculum.

5:1 The Chinese school system

The Chinese educational system consists of three parts. The first part is primary school and middle school, which is compulsory. The second part is secondary school and the third part is college or university. The compulsory education is financed by the government, but the two later education parts is not. The interviewees informed us that there are not enough secondary schools in China; this means that not all students get to continue their education even if they wanted to.

Teacher 1 explains that the Chinese school have gone through changes in the last 30 years, and the most dramatic change was in 2003. From the beginning, the school was influenced by a Soviet education style. Zhang (2003) and Yang (2002) writes that the new curriculum has received a lot of criticism because it abandons the traditional Chinese education, and that it has caused a lot of confusion, but according to teacher 2 the new curriculum is an improvement. Teacher 2 continues to say that the government pays a lot of attention to the Chinese educational system, the new curriculum and the students. The government is also beginning to pay more attention to the teachers’ further training. However, teacher 2 says that a lot of minority regions or rural regions do not have the resources or equipment to improve their teaching.
Every fourth or fifth year the government publishes a new curriculum for primary school, middle school, secondary school and universities. In addition to the national curriculum some areas have a local curriculum, which has led to huge differences in teaching quality and methodology in different parts of China. Dello-lacovo (2006) and Xiaowei (2012) explains the curriculum reform in the same way as these teachers, and writes in their reports that the government felt that the curriculum reform was necessary to decrease the burden and the workload of the students. The in-service teacher at the Mongolian school agrees with this, and says that the students are very exhausted, but it is a little bit better nowadays. Even if these changes have been made, he still thinks that the students have too much to do.

The head teacher explains that the latest contribution to the curriculum reform is the research in ethnic education. To improve the school in the rural areas, Wang and Chai (2009) and Dello-locavo (2006) writes that the new reform involves teacher training that is free of charge. The teacher training involves, among other things, seminars and teacher research. This agrees with the head teacher’s statement. He says that the government invests a lot of money in the school infrastructure, i.e. building bigger campuses to be able to give every student the chance to go to school for as long as they want to. Every third or fourth year there will be a big opportunity for teachers and supervisors at the schools to get together and improve their knowledge. To improve the education in the area, teachers at the research institution are sent to other regions in China to learn new methods and improve their teaching skills. In return, these teachers introduce the new methods to the other teachers in their area. There will also be meetings at universities, and the knowledge taught could be about education with multimedia, new teaching theories or new knowledge about the teachers’ individual subjects.

Teacher 3 points out that the educational system in China is very exam-oriented. The students’ interests are ignored in the compulsory education, but are a little bit better at the university. The teacher from the Mongolian school agrees with this statement and adds that the education is based on getting the students through the exam. He continues to say that the education is not based on the teachers’ and students’ needs. Another teacher at the Mongolian school explains that the education should be based on the students’ needs. If the
students’ level of knowledge is low, then the education should start there. But if the students’ level of knowledge is high, the teacher can follow the course books. She explains that the teachers are given an instruction on how every lesson should look like, and that the teachers are allowed to change some of the lessons, but are recommended to stay to the plan and the course books. During the observations there was a clear pattern of how the lesson was structured, even though it was in different schools with different teachers. The teacher spoke most of the time, the students copied and on a few occasions, some students were assigned to solve problems on the blackboard. Sometimes, the students were given time to solve one problem in the textbook, but it was a very limited amount of time. If the teachers asked the students a question, they had to stand up when answering it.

The students at the local university agree with the teachers and say that the education is very exam and score oriented. One of the students at the university explains that the mathematical part in the exam is a big part of the final score. If the students don’t get a good score in the mathematical part, the final score is going to be really low – despite the scores in the other parts of the exam being good. Some students also point out that teachers assess every student according to the student’s scores, a student is good if he or she works hard and get good scores on the exam. These statements emphasizes with what Dello-lacovo (2006) writes in her article. She writes that the Chinese education has evolved around centralized tests from the government for a long time, and that the teachers focus on students that achieve good scores (Thogerson, 2000). All students get the chance to the compulsory part of the education, but not all can continue their education at secondary school. The in-service teacher at the Chinese school says that because of this, every student have to work hard to get a good score at the examination. The score on the examination decides which students are accepted into secondary school and college. A couple of students and the in-service teacher from the Mongolian school agree with this statement.

If the students don’t get high scores at the exam, then the teacher has failed to do his or her job. Most of the persons interviewed see the western countries as role-models when it comes to education. They argue that the western countries are freer in their education, the students are taught according to their abilities and interests, and that they would like the
Chinese school system to be more like that. This is something Dello-lacovo (2006) writes about in her report; she also writes that China has a long way to go to get away from the exam-oriented focus. She writes that China is trying to be a little bit more like the western countries, and this is what the interviewed teachers at the local schools think as well.

A summarize of this part of the chapter is that the in-service teachers agrees that the Chinese school system is very demanding of the students. Even though the curriculum has changed, more schools are built and the teachers are getting further training, the interviewed teachers and pre-service teachers think that China still can get better to ease the workload of the students. The teachers also stresses that they want the education to get away from being exam oriented, and instead be more scientific and more about the students’ needs and their previous knowledge. Just like the schools in the western countries.

5:2 Teacher education

In China, the education to become a high school teacher is four years long. Teacher education at universities around China is controlled by the government and, according to Liang (2012), has been approximately the same since 1976. The math teacher at the Chinese school thought that the teacher education at the university was helpful for her. She pointed out that the teacher education pays more attention to the teachers now so they can become professional. The universities also have resources to train a lot of post-graduates and doctors. In the teachers opinion the teacher educational system is very scientific and well organised.

The teacher at the Mongolian school said that during his four-year teacher education at Inner Mongolia Normal University he did not get any practice at a middle school or high school. He said that the university did not pay attention to the teacher-students practical training. When the teacher had graduated from the university and started teaching at the Mongolian school he had much to learn about for example teaching, teaching methods and practical things. Both of the teachers thought they got help from the schools where they got their first job. When the teacher from the Chinese school first started working at this school, about ten years ago, there was a teacher that helped her and guided her to become a better
and more experienced teacher. This is what Liang (2012) call *one to one mentoring*, when a less experienced teacher gets guidance from another who is more experienced.

The English teacher at the Chinese school thinks it is important, as a teacher, to know who you are teaching, i.e. the students. He means that there are differences between teaching students in primary school or students in middle school and as a teacher, you have to think about what challenges you are about to approach. The mathematics teacher at the Chinese school mentioned three points that she thinks is important when you are a teacher. The first is that the teaching should be based on the students. For example if the student's level is poor the teacher should care about the previous knowledge. The second point is that when a teacher gets a new job he or she should learn how to teach from a master at that school. She mentioned a third and last point, which were that there are differences between studying to become a teacher at the university and the practice at an actual school.

Four of the students have a dream to become college math teachers and when they got the question how they prepare for their future they answered that they take every possible time to study. Academic and teaching skills are also very important.

At the Inner Mongolia Normal University one of the teachers said that the teachers at the university still pays a lot of attention to the math, how the students think about math and how they set up their mathematical thoughts. Liang (2012) writes that the high school teacher educations structure looks the same in all universities in China and that the students study each subject separately. For example, the advanced mathematics courses and methodology courses are taken separately. The university teacher pointed out that he wants the students to know the course standards and the mathematics textbook very well, because he thinks that it can help them to become excellent teachers.

The other two teachers said that the university let their students practice what they are learning in their education in a middle school or high school. Teaching skills lesson is one kind of lesson that the university have and there the students get the chance to teach a mathematics lesson in front of both students and a teacher. After the lesson the students and the teacher will give the teaching student some advice on how he or she could improve
himself/herself. They also encourage the students to watch some video lessons of great teachers in China and to learn directly from them.

One of the teachers at IMNU said that the teacher education is divided into two parts. The first part is about math, teaching methods, how to teach and how to teach efficient as well as scientifically. In this part of the education the students study very hard. After the first part they will have five weeks of practice at a middle school. The teacher also mentioned that during the five weeks of practice the students would go to the junior or senior high schools to listen to other teachers’ lessons.

Courses such as philosophy and internship are included in the teacher education (Liang, S. et al., 2012) but the teachers at the university was not unanimous on how many weeks of practice the students have in their four year education. They answered two weeks, five weeks and six weeks. In contrast to the teacher education at Malmö University, were the students have a total of 25 weeks of teaching practice at a school (Malmö University, 2014). The teacher that mentioned six weeks also said that the students in China have twelve weeks of internship at the campus. When the students have their practice, one of the teachers said that for some students it is the first time they will be asked to give a lesson. According to the teacher the students have been looking forward to the lesson and have also prepared themselves thoroughly in advance.

To summarise, the Chinese universities did not have any practices for the pre-service teachers twenty years ago but today the universities pays more attention to the students and they have two to six weeks of practice. In contrast to Malmö University that have 25 weeks. The teacher education in China starts with a three year bachelor degree in mathematics, and methodology courses are given separately after that. The Inner Mongolia Normal University also provides the students with teaching skills lessons. At Malmö University, the methodology is mixed in to the mathematic courses, which are spread out over the 5 years of the teacher programme.
5:3 Education and further training of in-service teachers

Two of the teachers at IMNU said that one chance to develop their teaching skills is to learn from each other, through discussions about the course and how to teach. One teacher said that the university sometimes asks professors or experts to come to the university and give lectures to the teachers and also the students at the university.

Liang (2012) writes that teachers in China attend Teacher Professional Development, PD, and it is a great part of their personal and professional development. The PD includes activities such as classroom observation, one to one mentoring and open classes (Liang, S. et al., 2012). All teachers at the university mentioned that they could get further education in schools with higher educational standards. For example schools in Beijing, Shanghai or other developed cities. By getting further education in a university, the teachers can get more knowledge and learn scientific methods about how to teach and be a better teacher, they said. One of the teachers also mentioned that he has gotten the chance to visit some foreign countries such as Russia and Mongolia, and he still has that chance.

A big difference he saw between the schools in Russia and Mongolia was that the students are freer than the Chinese students. He also pointed out that the students in some European classrooms are more energetic and esthetical then in China, from what he had heard from radio shows from Europe. The Ministry of Education in China is making changes in the curriculum and they have countries like USA and Germany as role models for teaching (Xu, 2010). By changing the curriculum, the way of teaching and the outlay of textbooks used in the schools, China is trying to be less exam-oriented with an equal standard all over the country (Xu, 2010). However, in Dello-lacovo’s (2006) opinion China has a long way to go. Through the three classroom observations in this study it became clear that the teachers follow the teacher manual very carefully. All the lessons that were observed in this study had the same structure. First is knowledge teaching, second is problem solving and the third is the summary of the lesson. Xu (2010) points out that some scholars have concluded that mathematics education should be individualized and connected to everyday life. Some scholars believe that teachers should be careful and not
make the connection with life into a goal because it could prevent the students’ development instead of helping (Xu, 2010).

The new reform involves teacher training, school-based training, seminars and teacher research (Ministry of Education, 2001). According to Lu (2009) there are big educational differences between the cities and other rural parts of China. This emphasizes with answers from the interviews that have been made in our study with teachers at the IMNU, middle school and secondary school. For the in-service teachers at the Mongolian secondary school, the teacher said that the Inner Mongolia region arranges a teacher training education for the teachers in Hohhot every semester. The Mongolian school are sending some of their teachers to this education, where the teachers get the chance to go to a province with more advance school to learn new teaching methods and methodologies.

Apart from the PD, a teacher in China is also encouraged to do some Self-directed Learning. This includes individual studies in teaching, self-reflection after each lesson and individual research (Liang, S. et al., 2012). One of the teachers at the Chinese middle school said that she gets further education from her own teaching experiences. She keeps a teaching diary from every class, semester and year. Because the teachers have their students from the first year in middle school until they graduate three years later, she can reflect on the whole three-year cycle with the same students. The male teacher at the Chinese school said that everyone make mistakes, both teachers and students and he thinks that if the teachers and the students want to make fewer mistakes they have to reflect on them. He additionally stated the importance of self-development for teachers. For example, the teachers need to read books, on their own, about their subject to get new knowledge. Teachers can ask their colleagues and exchange ideas with them.

Another experience, that the two teachers at the Chinese school mentioned, was for teachers to observe other teachers and their lessons. There may be some points of importance which the observant teacher can use in his or her lessons. This is what Liang (2012) calls open classes. It is when a teacher invites other teachers at school to observe the class and evaluate it. From this, less successful moments of the class can be eliminated, and future classes become more optimized. Conferences, competitions and lectures can be good
occasions for teachers to get new teaching ideas and to exchange experiences from their colleagues, the teachers said. They also said that the government gives the teachers this opportunity to meet and develop once a month or once every two-month. The school send different teachers so that everyone gets the chance. The math teacher pointed out that she thinks it is not good to be stuck at one school and should instead go to other schools to get new ideas.

To summarise, teachers in China can get further education in other schools that have higher educational standards and some teachers also have the chance to go to foreign countries. The Chinese government and the Inner Mongolia region also arrange teacher-training education for the teachers. The universities in China sometimes asks professors or experts to come to the university and give lectures, both to teachers and students. The in-service teachers, themselves, said that they could get further education and develop their teaching skills by learning from each other through discussions but also to observe each other’s lessons. A teacher pointed out the importance of self-development. All the lessons that were observed in this study had the same structure but China is making changes in the curriculum, the textbooks, and the teacher education program. They are trying to be less exam-oriented and with an equal standard all over the country.

5:4 Factors for mathematical achievements

A teacher at the university says that one important factor for the mathematical achievement in China is that the government and the education department pay a lot of attention to teaching skills within mathematics. Another teacher at the university and some in-service teachers at secondary school says that the reason is because the students have to learn it to pass the exam and this motivates the students. The teacher at the Mongolian school thinks it is because the textbook is hard, so the students are forced to learn the content to pass the exam. He also thinks that the reason for the mathematical achievements is because mathematics is a compulsory subject in kindergarten, primary school, middle school and secondary school. The students practice a lot, and if they don’t understand the knowledge – they memorize it. The mathematical content at the schools that were observed was very
difficult, and a lot of mathematic symbols were used (see appendix 9-11). When the
students were allowed to solve problems in their textbooks, some were struggling and
asked for help from the teacher. According to our interpreter, a lot of students are afraid to
do mistakes or to show that they do not understand, because they are afraid to get punished.
The students do everything to pass the exam, this is so that they get the opportunity to go to
secondary school. The students at the university says that the reason to the high scores in
international studies is because Chinese students practice a lot to get better and because the
teacher has given them a task. The head teacher says that the students need to have a good
score on the exam, because it decides which education the students get, and which job they
will have in the future. This empathises with Dello-lacovos (2006) article.

The teacher at the Mongolian school says that not all students in China have good
mathematic scores. He explains that in international competition, such as the PISA survey,
China always selects the best out of the best to take part. This does not consolidate with the
way schools are selected to participate in the PISA survey. A teacher at a Chinese school
says that there are great differences in knowledge between different areas in China. He
explains that this is because some schools have better teachers, better equipment and better
textbooks. This is something that Van Harpen et al (2013) did not experience in their study.
Their study showed that students in a smaller region in China (Jiaozhou) performed just as
well as students in Shanghai at the mathematical tests in their study. However, teachers at
other schools in Inner Mongolia empathises with the teacher at the Mongolian school and
his statement, and a teacher at a Chinese secondary school says that the government are
beginning to pay more attention to schools in rural areas to improve the standards. He
explains that the government have adjusted the required scores to pass the exam for the
developing areas, meaning that the students in the rural areas are allowed to have more
errors in the exam than the students in the cities to pass.

A teacher at the Mongolian school says that the Chinese curriculum makes the students
very exhausted and unhappy, because they have to do a lot of exercises at home. Just to get
a high score. He continues to say that Chinese students cannot use their knowledge to solve
real life problems. This does not consolidate with the results of the PISA survey, where the
Chinese students have high scores. The head teacher explains that a factor to the knowledge differences in China is because of the parents. A lot of parents in rural areas do not have a high education. They do not have the ability to help their children to develop their knowledge. He says that there are also a large difference in knowledge and exam scores between the two ethnic groups in the area – the Han-people and the Mongolian people. But this difference is getting smaller and smaller.

The head teacher explains that the students in China do not have a lot of freedom in the educational system. They are not very free to show any interest in what they want to learn or what they want to do in class. They have to do what the teacher tells them to do, meaning that they have to follow a pattern and learn different methods depending on which mathematical problem they are facing. He gives an example of his opinion of the differences between the Chinese, Japanese and the American way, of teaching students how to draw an apple. He says that the Chinese teacher explains exactly how the students should do it by drawing one on the blackboard. The Japanese teacher brings an apple to the class to let the students see one and try to draw from real-life perspective. He continues to say that the teachers from USA maybe will give each student an apple, to see it or just to eat it. From this he concludes that the Chinese students are not so free to do or to explore in the classroom. They just imitate. This description of the education in the Chinese school is consistent with the observations that were performed in this study. At the lessons that were observed, all students did as they were told to. Copied what the teacher did, and followed a pattern that the teacher had given them to solve the mathematical problems. Van Harpen et. al (2012) tested creativity in their study, and their study concluded that students in China was very creative within mathematic and that the USA students were not. This is the opposite of what the teachers in this area think.

The teachers interviewed in this study did not know about the PISA-survey, but when it was explained for them, they simply said that there is a very large knowledge difference between Shanghai and this area. Every teacher interviewed in this study is very curious and wants to learn more about European style of learning and the way the school system is structured. They are saying that China is reforming its ways of teaching by looking at
lessons from foreign countries and to send experts to Japan, Europe or USA to learn new methods.

The summary of this part of the chapter is that the Chinese school system is very limiting for the teachers and the students. Teachers have no time to help each student or adapt the education to fit the students’ need, because there are so much content to the curriculum. The interviewed persons agree that the knowledge differences between the rural areas and the cities are big, and that the level of the education of the students’ parents may be a reason. Another reason is that the students are forced to learn all of the course content to pass the exam. If they do not understand the content they have to learn, they memorize it. Students at the university say that they are forced to get a good score because there are so many people in China that they have to compete with. If they get a good score, they can have a good job and a better future.
6. Discussion

In this part we discuss the results and methods of this study.

6:1 Results

In the beginning of this study we expected the school system in China to be controlled a lot by the government, and that the school system has been the same since the mid-20\textsuperscript{th} century. We also thought that all students in China were hard working students, and that they did everything the teacher said and asked for. Further, we thought that these two factors, among other things, would contribute to the good mathematical results in China.

We also expected to see teachers doing the same job and using the same teaching methods as they had been doing since they started working, and that the teachers used the same methodology in every lesson – "lectern teaching".

The results and the analysis from this study have provided us with information about our main research questions: What are the general aspects of the Chinese educational system? and International surveys shows that Chinese students have good mathematical achievement. Which factors contributes to this?

The results from the interviews and the observations confirmed some of our expected results, some were the opposite of what we though and some results were new to us. To be able to answer the research questions, supplemented questions have to be answered: What are the pre-service teachers’ and in-service teachers’ view on teaching? How does the university prepare their pre-service teachers for their future profession? What opportunities are given to in-service teachers for further development within their profession?

The answers to these questions are that the general aspects of the Chinese educational system consist of one compulsory part and one part that the students have to apply for. From the analysis we have understood that every student gets to go to the compulsory part, and that students have to apply to secondary school and university. The interviewees
informed us that there are not enough secondary schools in China; this means that not all students get to continue their education even if they wanted to.

When we had a conversation with our interpreters they told us that there are still many children that don’t start the compulsory education. Some children have to stay at home to help their parents with their farm or to take care of their younger siblings. They also said that the students that go to school have a lot of pressure from their parents, teachers and the society. The interviewees informed us more about the One-Child-policy in China, and because of this a lot of parents get really competitive and want their children to be the best. Our interpreters told us that the children of China nowadays have to be competitive in so many areas, not just school. And, we believe, because of this One-Child-policy and the job-opportunities related to their grades, a lot of students in school feel the pressure to make outstanding scores at exams. This is also a part of the answer to which factors that contribute to the good mathematical achievements. But even though there are a lot of hard-working students and the scores on both the PISA survey and other international studies show that Chinese students get the best results, the analysis showed that there are great differences within the country. Therefore, we think that it would be interesting to do a deeper study about how the selection to the PISA survey in China is performed.

The teachers at the university informed us that the teacher education at IMNU consists of three parts: the first part is about the content where the pre-service teachers learn all about their teaching subject. The second part is when the pre-service teachers study methodology, and the third part is their post-graduate exam. We were surprised to hear that the students that are becoming teachers at IMNU only had practice their last semester before their post-graduate. Another thing that surprised us was that China is trying to change the way of teaching, and that they are learning from western countries. This surprised us because China showed good results in international studies, and that the results are getting better. Meanwhile, a lot of western countries that they are trying to learn from are having poor results in the PISA and TIMSS studies and the results are getting worse (OECD, 2012; IES, 2007; IES, 2011).
When we had a conversation with the interpreters, they told us that when they have practice at a middle school or a secondary school, they have to sit in the back and take notes of what the teachers is doing. The most common task for the pre-service teachers is to help the in-service teachers to check the homework assignments and help the children when they are solving problems. This is to us a very different experience. We think that, as a pre-service teacher, you need to have a lot of practice and experience of how it is to be in front of a group of students to develop and find your own teaching style. Even though the results are good, a lot of the interviewed teachers wanted to be able to plan their own lessons. To be able to do that, we think that practice is needed.

The students and the teachers at the university told us that there are methodology lessons at the university. At these lessons, the pre-service teachers learn about other countries’ methodology, how the text book is planned, how to use the text book and how to follow the included instructions from the text books. From further conversations with the pre-service teachers we learned that they also have to learn about the curriculum reform and how the text books have changed over the last decade. The teachers at the university stresses how important it is for a teacher to have a lot of knowledge about the subject they are teaching, but that the teacher should be able to present it in many ways for the students. This is something that we agree with. To be a good teacher, you need both good knowledge and have many ways to explain it to the students; otherwise you are just a very knowledgeable person.

To answer the final question, *What opportunities are given to further development for in-service teachers?*, we need to discuss the great difference in the education standard in the different parts of China. Almost every person that we interviewed told us that the cities, such as Beijing and Shanghai, have a very developed educational system with a lot of resources, and that the schools in the rural areas are lacking in both resources and educational styles. However, the head teacher informed us that there is a lot of research in the areas that have minorities. These studies began when the latest wave of curriculum started in 2003. In addition to these studies, a lot of teacher training of in-service teachers started. However, the analysis told us that only a few teachers are sent to these seminars or
lectures, and they have to pass on this information to the other teachers at the school. We think that it would be better if all in-service teachers got to go to the further training. This is because different teachers apprehend different things. If they only send one teacher from each school, some information might get lost on the way.

The lectures that the in-service teachers have are given each year, the head teacher told us. And these lectures are compulsory. This is something that we think the Swedish schools can learn from, because the teachers get the chance to learn some new methods or knowledge about their subject, or learn about the latest research projects that are going on in the school. We think that if this was compulsory in Sweden, a lot of teacher would develop further and learn how to use different methods, and this would lead to an improvement of the school and the results.

6:2 Methods

This is a qualitative study with both interviews and observations. It was performed in a developing area in China and is a minor study and therefore we cannot make any generalised conclusions. After this study we have come to a couple of conclusion considering our method. We observed three lessons at different schools in Hohhot. One of the schools is a Mongolian school and this could lead to an error in the results in this study because there could be some differences between the two schools. Through the interview with the Mongolian teacher we found out that the Mongolian school has the same curriculum as the Chinese schools and by the observations at both the Mongolian school and the two Chinese schools we could see a similar way of teaching.

We could see, from our observations, that all the teaching methods were similar and in the interviews the teachers at the schools said that the teachers don’t have so much freedom to teach in the way they want to because the government plans every lesson. We only observed one class in each school so no personal attachment was obtained, which made it easy for us to be objective in our observations and interviews in this study. This corresponds to the interviews done at the Inner Mongolia Normal University with the teachers and students.
Our interviews with the pre-service teachers were group interviews. This could have led to an error in the result because everyone did not get the chance to speak out his or her mind as well, as if it had been an individual interview. At the same time, our own opinion and feeling is that, the students did express their mind without caring about what the other students had said or thought. After this knowledge we would still have liked to do group interviews but instead of a group of seven and a group of two we would have wanted to have student groups of three or four. In that way all the students would have the chance to speak their mind and have the time to develop their answers without the interview taking too long. Another way to reach a wider span of people would have been to make questionnaires but we felt that we would not get the same personal contact nor the same developed answers.

In this study we needed to have an interpreter in all collection of our research. The interpreters that we had are English majors and are doing their postgraduate thesis at the IMNU. The translation could be difficult to do and to interpret everything the interview person is saying. This could lead to errors in the results in this study.
7. Conclusion

After analysing the results in this study, we have come to the conclusion that China is doing a lot of changes in their educational system. The school is still controlled by the government, but it is a little bit freer nowadays. Also the government is investing a lot of money to develop the schools and to build more schools.

The general aspect of the Chinese school system is that there is one compulsory education, middle school, and there is an electable school, secondary school. A crucial part of the Chinese school system is the final exams, and from our observations we can make a conclusion that the education revolves around this. From this we can also make the conclusion that the factors of the good results in China are the pressure that comes from the exam, parents, teachers and the society. Since the exam score is closely linked to the students’ future jobs, they feel that they need to achieve a very high score.

From the analysis of the interviews, we can make the conclusion that there are few opportunities for further development for in-service teachers. The chances for further development are given to a few teachers at the school, and these teachers will bring the new knowledge back to their colleagues. However, since 2003 when the latest reform of the curriculum took place, the government is investing a lot of time and money to educate teachers in developing areas. The further education for in-service teachers is for example multimedia-training and methodology training.

Both the in-service teachers and the pre-service teachers strongly agreed that the way the teaching in Chinese schools is right now is very bad. They think that the students in class are only doing what the teachers ask them to, or they imitate the teachers’ solutions. The in-service teachers wished the education was a little bit freer, so the students could have more discussions in groups, or solving more problems in class, but the interviewed teachers said that this is hard to do because the amount of students in each class is very large or that the number of things they have to teach before the end of the year are too many. From this we can make the conclusion that the teachers would like to use a lot of different techniques and learning styles, but the practical things in schools makes it difficult.
7:1 Future research

Future research within the mathematic education in China could be to look into larger and more developed cities like Shanghai and Hong Kong. Cities were students have performed very well in international studies, in for example the PISA survey. But not only to look at the developed cities, but also at the rural areas in China that is less developed than Hohhot, and make a comparison between them. This research could for instance give a better understanding of the students’ knowledge differences across China.

We have found out through our research that the Chinese government have reviewed the textbooks that are being used in all schools around China. The government in both South Korea and Japan has an extensive revision of the textbooks used in the schools in each country (Ostu, 2000). Switzerland and Germany are two countries in Europe where the government also has to approve the textbooks before it can be used in the schools (Johnsson Harrie, 2009). All of these countries; China, South Korea, Japan, Switzerland and Germany have students that perform very well in mathematics in the international PISA and TIMSS studies. Sweden and Norway are countries which do not have textbook revision, and these two countries have a declining trend of their results in the PISA and TIMSS studies. However, this is not the case for Finland, which have good results in the international studies, but do not have textbook revision anymore. By doing textbook and observation research in some of the Asian countries as well as some of the European countries a comparison could be made. This research could be valuable for the participating countries but also for other countries.

We think that more research can and should be made within the school-world. Countries all over the world should learn from each other.

7:2 Our own development

Through our study we have gained an understanding and better knowledge about China’s school system and the teacher profession in this country. The study has also brought new
thoughts and ideas to us about the Swedish school system and other countries school systems, and will engage us in school development questions regarding mathematics in our future profession. We think that teachers and education departments in Sweden and other countries around the world can learn a lot about teaching skills and learning methods, from each other.

From the preparatory work to this study, we have gained a greater understanding about the Chinese school system and the reason to the curriculum reform. We have also learned to be critical to the results in international studies, and we have realised that results from studies such as the PISA survey or the TIMSS study cannot be generalized for a big country like China. We have come to realise that you, in general, always should be critical to results in international studies.

We think that this study will help us in our future profession because we have seen so clearly how students from different families and different cultures learn in different ways. This made us realise on a new level how important it is to use different teaching methods in the classroom, and how important it is to let the students be involved in different learning activities.
8. List of references


Appendix 1

A snapshot of the performance in mathematics, reading and science in the PISA-survey, ranked in countries (OECD, 2012).

<table>
<thead>
<tr>
<th>Country</th>
<th>Mathematics</th>
<th>Reading</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD average</td>
<td>Mean score in PISA 2012</td>
<td>Share of low achievers (below Level 2)</td>
<td>Share of top performers (Level 3 or 4)</td>
</tr>
<tr>
<td>United States</td>
<td>524</td>
<td>510</td>
<td>505</td>
</tr>
<tr>
<td>Canada</td>
<td>535</td>
<td>530</td>
<td>525</td>
</tr>
<tr>
<td>Japan</td>
<td>545</td>
<td>540</td>
<td>535</td>
</tr>
<tr>
<td>Korea</td>
<td>555</td>
<td>550</td>
<td>545</td>
</tr>
</tbody>
</table>

Source: (OECD, 2012)
Appendix 2

A snapshot of the performance in mathematics in the PISA survey, how well the countries performed compared to the OECD-mean, and which countries performed approximately the same.

Source: (OECD, 2012)
Appendix 3

A snapshot of the performance in mathematics in the TIMSS study from year 2007 and 2011.

<table>
<thead>
<tr>
<th>Country</th>
<th>Grade 9, 2007</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>China, People's Rep.</td>
<td>596</td>
<td></td>
</tr>
<tr>
<td>Korea, Rep. of</td>
<td>597</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>593</td>
<td></td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>572</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>556</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>England</td>
<td>513</td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td>511</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>508</td>
<td></td>
</tr>
<tr>
<td>Lithuania</td>
<td>506</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>Slovenia</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>Armenia</td>
<td>499</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>486</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>481</td>
<td></td>
</tr>
<tr>
<td>Malta</td>
<td>488</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>487</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>486</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>486</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>474</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>469</td>
<td></td>
</tr>
<tr>
<td>Cyprus</td>
<td>463</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>466</td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>463</td>
<td></td>
</tr>
<tr>
<td>Ukraine</td>
<td>466</td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>464</td>
<td></td>
</tr>
<tr>
<td>Estonia and Latvia</td>
<td>456</td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>448</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>441</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>442</td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>441</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>452</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>Iran, Islamic Rep.</td>
<td>422</td>
<td></td>
</tr>
<tr>
<td>Bahrain</td>
<td>368</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>385</td>
<td></td>
</tr>
<tr>
<td>Syrian Arab Republic</td>
<td>395</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>395</td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>387</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Oman</td>
<td>375</td>
<td></td>
</tr>
<tr>
<td>Palestinian Natl Auth.</td>
<td>377</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>264</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>254</td>
<td></td>
</tr>
<tr>
<td>El Salvador</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>307</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Grade 9, 2013</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMSS scale average</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Korea, Rep. of</td>
<td>514</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>511</td>
<td></td>
</tr>
<tr>
<td>Chinese Taipei-CIV</td>
<td>509</td>
<td></td>
</tr>
<tr>
<td>Hong Kong-CIV</td>
<td>505</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>505</td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td>501</td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>515</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>469</td>
<td></td>
</tr>
<tr>
<td>England</td>
<td>472</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>493</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Slovenia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Lithuania</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Ukraine</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Armenia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Malaya</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Macedonia, Rep. of</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Bahrain</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Palestinian Natl Auth.</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Syrian Arab Republic</td>
<td>498</td>
<td></td>
</tr>
<tr>
<td>Montenegro</td>
<td>377</td>
<td></td>
</tr>
<tr>
<td>Oman</td>
<td>366</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>366</td>
<td></td>
</tr>
<tr>
<td>benchmarking education systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mozambique, USA</td>
<td>555</td>
<td></td>
</tr>
<tr>
<td>Minnesota, USA</td>
<td>551</td>
<td></td>
</tr>
<tr>
<td>North Carolina, USA</td>
<td>557</td>
<td></td>
</tr>
<tr>
<td>Quebec, CAN</td>
<td>552</td>
<td></td>
</tr>
<tr>
<td>Indiana, USA</td>
<td>552</td>
<td></td>
</tr>
<tr>
<td>Colorado, USA</td>
<td>514</td>
<td></td>
</tr>
<tr>
<td>Florida, USA</td>
<td>513</td>
<td></td>
</tr>
<tr>
<td>Ontario, CAN</td>
<td>512</td>
<td></td>
</tr>
<tr>
<td>Alberta, CAN</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>California, USA</td>
<td>493</td>
<td></td>
</tr>
<tr>
<td>Dubai-UAE</td>
<td>476</td>
<td></td>
</tr>
<tr>
<td>Alabama, USA</td>
<td>466</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>449</td>
<td></td>
</tr>
</tbody>
</table>

Source: (IES, 2007), (IES, 2011)
Appendix 4

A snapshot of students’ engagement, drive and self-beliefs in 2012 PISA survey.

Source: (OECD, 2012)
Appendix 5

Interview questions for teachers at the IMNU

Quick questions

1. How long have you been a teacher?
   您当老师多长时间了?
2. How many years have you been a teacher at this school?
   您在这所学校教书有多长时间?
3. Where did you teach before?
   您以前在什么地方教书?
4. What subjects are you teaching at the university?
   您在大学教授什么课程?
5. Why did you become a teacher?
   您为什么想成为一名教师?

Detailed questions

6. How is the Chinese school system structured?
   - What are the general aspects?
     中国的教育体系结构是什么样的?
   - What impact has the state on the school system?
     - 总体上?
   - What is your view on the Chinese school institute/system?
     - 国家对于教育体系的影响?
     - 您对于中国的教育体系的看法?

7. Which are the main elements of IMNU’s curriculum for math-teacher education?
   内蒙古师范大学数学师范教育课程大纲的构成要素有哪些?

8. What is your view on learning?
   - Which learning methods and learning styles do you teach to your pre-service teachers?
     您对于学习的看法?
   - Do the teachers at the IMNU show different learning methods?
   - How much influence does the government have?
     - 针对师范类学生您教授什么样的学习方法，培养学生什么样的学习风格?
     - 内蒙古师范大学的教师在授课中是否教授不同的学习方法?
9. How does the university prepare their pre-service teachers for their future profession?
   - Does the university provide them with practice at other schools?
   - Or are they responsible for their own practice?
   - Do you have mentoring sessions at the university?

学校在师范生未来职业发展上都做了哪些工作？
   - 学校是否给学生提供在其他学校专业实习的机会？
   - （或者）学生是否认真对待专业实习？
   - 在大学期间是否开设了与专业实习有关的课程？如果有，有哪些课程？

10. What opportunities are given to further development for you within the teacher profession?
    在您的教师职业生涯中，有哪些机会帮助您进行职业发展？

11. What do you think is the factors for the good mathematic achievements of Chinese school students?
    - Do you feel that there are knowledge differences between the students across China?
    - What can Sweden learn from your school and the Chinese school system?

您认为中国学生数学水平较高的因素有哪些？
    - 您认为在中国，不同地方的学生在知识水平上是否存在差异？
    - 您认为瑞典教育能够从中国教育体系中学习到什么
Appendix 6

Interview questions for students at the IMNU

Quick questions

1. How long is your teacher education?
   您接受了多长时间的师范教育？
2. How many years have you studied to become a teacher?
   为了当老师您学习了多长时间？
3. What subjects will you be qualified to teach?
   您能教什么科目？
4. Why do you want to become a teacher?
   您为什么想成为一名教师？

Detailed answers

5. How is the Chinese school system structured?
   - What are the general aspects?
   - What impact has the state school?
   - What is your view on the Chinese school institute/system?
   中国的教育体系结构是什么样的？
     - 总体上？
     - 国家对于教育体系的影响？
     - 您对于中国的教育体系的看法？

6. Which are the main elements of IMNU’s curriculum for math-teacher education?
   内蒙古师范大学数学师范教育课程大纲的构成要素有哪些？

7. What is your view on learning?
   - Explain the methodology lessons at the university?
   - How much influence does the government have?
   - What are the best methods for knowledge learning according to you?
   您对于学习的看法？
     - 您怎么看待大学的教学法课程？
     - 政府的相关政策对于学习有多大影响？
     - 您认为最好的学习方法是什么？

8. How do you prepare for your future profession?
   - Do you have training or mentoring sessions at the university?
- Or are you responsible for your own practice?
您为未来的职业做了什么样的规划？
- You during school period receive professional internship training?
- 您在学校期间是否接受了专业的实习培训？
- Do you view your own professional internship seriously?
您是否认真对待自己的专业实习？

9. What do you think is the factors for the good mathematic achievements of Chinese school students?
您认为中国学生数学水平较高的因素有哪些？
- Do you feel that there are knowledge differences between the students across China?
- 您认为在中国，不同地方的学生在知识水平上是否存在差异？
- What can Sweden learn from your school and the Chinese school system?
- 您认为瑞典教育能够从中国教育体系中学习到什么？
Appendix 7

Interview questions for in-service teachers

Quick questions

1. How long have you been a teacher?
   您当老师多长时间了?
2. How many years have you been a teacher at this school?
   您在这所学校教书有多长时间?
3. What subjects are you teaching at the school?
   您在学校教授什么课程?
4. Why did you become a teacher?
   您为什么想当一名教师?

Detailed questions

5. How is the Chinese school system structured?
   - What are the general aspects?
   - What impact has the state on the school system?
   - What is your view on the Chinese school institute/system?
   中国的教育体系结构是什么样的？
   - 总体上是什么样的？
   - 国家对教育体系的影响有哪些？
   - 您对于中国的教育体系的看法？

6. What is your view on learning?
   - Which learning methods and learning styles do you teach?
   您对于学习的看法？
   - 您教给学生什么样的学习方法和学习风格？

7. How did the teacher education prepared you for your teacher profession?
   师范教育对于您的教师职业生涯有什么样的帮助？

8. Which help did you get from the first school you were employed at after graduating?
   在您刚毕业后工作的一所学校，您积累了什么样的相关工作经验？

9. What opportunities are given to further development for you within the teacher profession?
在教师的职业生涯中，有哪些机会帮助您进行职业发展？

10. What do you think is the factors for the good mathematic achievements of Chinese school students?
   - Do you feel that there are knowledge differences between the students across China?
   - What can Sweden learn from your school and the Chinese school system?

您认为中国学生数学水平较高的因素有哪些？
   - 您认为在中国，不同地方的学生在知识水平上是否存在差异？
   - 您认为瑞典教育能够从中国教育体系中学习到什么？
Appendix 8

Interview questions for head teacher

Quick questions

12. How long have you been the head teacher?
   您在教研室工作多长时间了？
13. For how many years did you work as a teacher before?
   您之前在学校工作多长时间？
14. Why did you become a teacher?
   您是怎么成为一名教师的？

Detailed questions

15. What does your job look like? An ordinary day.
   您平常一天的工作是什么样的？

16. How is the Chinese school system structured?
   - What are the general aspects?
   - What impact has the state on the school system?
   - What is your view on the Chinese school institute/system?
   中国的教育体系是如何构成的？
   - 总体上是什么样的？
   - 政府对于教育体系有什么样的影响？
   - 您对于中国教育体系的观点？

17. What is your view on learning?
   - Which learning methods and learning styles do you prefer?
   - How much influence does the government have?
   您对于学习的观点？
   - 您倾向于哪一种学习方法和学习风格？
   - 政府对于这些有多大影响？

18. What opportunities are given to further development for you within the teacher profession at the schools?
   对于您作为教师的职业发展，有哪些机会？

19. Have you heard of the PISA-survey?
   您听说过 P I S A 调查吗？
20. How do you work on improving students’ mathematical results in China?
   对于中国学生的数学成绩的提高您是如何努力的？

21. What do you think is the factors for the good mathematic achievements of Chinese school students?
   - Do you feel that there are knowledge differences between the students across China?
   - What do you think can Sweden learn from your school and the Chinese school system?
   您认为中国学生数学水平高的影响因素有哪些？
   - 您觉得中国不同地区的学生有知识差异吗？
   - 您认为瑞典从中国的教育体系或学校能够学习到哪些？
## Appendix 9

Observation schedule at a Mongolian school

<table>
<thead>
<tr>
<th>Date: 110914</th>
<th>Name of the observers: Emelie Nordström &amp; Felicia Andersson</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1</strong> (Context)</td>
<td>School: Mongolian School</td>
</tr>
<tr>
<td>Class: Mathematics.</td>
<td>Year: Secondary school.</td>
</tr>
<tr>
<td><strong>Part 2</strong> (Data and media)</td>
<td></td>
</tr>
<tr>
<td>Numbers, figures, formulas etc. observed at the lessons</td>
<td>1a) The board and pen.</td>
</tr>
<tr>
<td>Kind of material used in the education:</td>
<td>1b) Books, pen and paper.</td>
</tr>
<tr>
<td>(1a) Prose text</td>
<td>1c) Notebooks to take notes what the teacher said and do the tasks he asked them to do during the lesson.</td>
</tr>
<tr>
<td>(1b) Overview text</td>
<td>2a) Supplied task paper, pen, math book, notebook, and boards.</td>
</tr>
<tr>
<td>(1c) Fill in-text</td>
<td>2b) 45 minute lesson.</td>
</tr>
<tr>
<td>(2a) Concrete material</td>
<td>2c) Teacher spoke most of the time, students took notes and solved tasks.</td>
</tr>
<tr>
<td>(2b) Time</td>
<td></td>
</tr>
<tr>
<td>(2c) Processes</td>
<td></td>
</tr>
<tr>
<td>* (material collected/copied)</td>
<td></td>
</tr>
</tbody>
</table>

### Part 3 Chronical record of the observation in three dimensions

1) **Media** (written/verbal material and information; concrete material or processes)
2) **Activities** (counting, measuring, location, designing, playing, explaining – and other activities)
3) **Mathematical skills and understanding**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
<th>Mathematical skills and understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.10</td>
<td>The teacher came in to the classroom and all students stand up to greet the teacher.</td>
<td></td>
</tr>
<tr>
<td>9.12</td>
<td>All students writes in their notebooks, teacher writing on the board.</td>
<td></td>
</tr>
<tr>
<td>9.14</td>
<td>Teacher walks around the classroom, students silent. Teacher speaks, some students repeats it loud.</td>
<td>Relationship between A and B.</td>
</tr>
<tr>
<td>9.17</td>
<td>Teacher writes $A \cup B = {x \mid x \in A \lor x \in B}$</td>
<td>Mathematical abbreviations and symbols, ex. $\cup$, $\cap$, $\in$</td>
</tr>
<tr>
<td>9.18</td>
<td>Teacher asks the students if A belongs to B or B belongs to A</td>
<td>What the relationship between A and B is when A is expressed in the term of x as well as B. When x is $\geq$, $&gt;$, $\leq$ or $&lt;$ than a number.</td>
</tr>
</tbody>
</table>
| 9.21 | Teacher writes $A = \{x \mid x \geq 1\}$  
$B = \{x \mid x > 3\}$  
$A \cup B = \{x \mid x \geq 1\}$ | Mathematical abbreviations and symbols, ex. $\cup$, $\cap$, $\in$ |
| 9.25 | Teacher writes $A = \{x \mid 1 < x < 4\}$  
$B = \{x \mid 2 < x < 5\}$  
$A \cup B = \{x \mid 1 < x < 5\}$ | What the relationship between A and B is when A is expressed in the term of x as well as B. When x is $\geq$, $>$, $\leq$ or $<$ than two numbers. |
| 9.27 | Students stand up and answer the teachers’ question. | |
| 9.28 | Teacher writes $A \cap B = \{x \mid x \in A \land x \in B\}$  
Students answer out loud. | |
| 9.31 | Teacher writes $A = \{x \mid x > 1\}$  
$B = \{x \mid x < 3\}$  
$A \cap B =$  
Students get time to think then the teacher | Knowledge point is summarised by the teacher. |
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.34</td>
<td>Students work with a ask paper they have gotten. Teacher walks around the classroom helping students.</td>
<td></td>
</tr>
<tr>
<td>9.39</td>
<td>Two students writes what they think is right on the board. (Answers to two different tasks/questions)</td>
<td></td>
</tr>
<tr>
<td>9.40</td>
<td>Two other student writes what they think is the answer to two different questions/tasks.</td>
<td></td>
</tr>
<tr>
<td>9.41</td>
<td>The teacher goes through the answers.</td>
<td></td>
</tr>
<tr>
<td>9.45</td>
<td>The teacher summaries the lessons knowledge points at the same time the students are working on the task paper.</td>
<td></td>
</tr>
<tr>
<td>9.52</td>
<td>Teacher writes (because the students had asked him if he could give them a harder question/task on the board).</td>
<td></td>
</tr>
<tr>
<td>9.53</td>
<td>The teacher asks the students a question and they answer out load.</td>
<td></td>
</tr>
<tr>
<td>9.55</td>
<td>Music starts playing ➔ the lesson is over. The students stand up and shout something like “Bye” in Chinese.</td>
<td></td>
</tr>
</tbody>
</table>

**The structure of the lesson:**
1) Knowledge teaching
2) Problem solving
3) Summary of what the students have learned

Teacher reason and explain the task.
## Appendix 10

Observation schedule at a Chinese school 1

<table>
<thead>
<tr>
<th>Date: 110914</th>
<th>Name of the observers: Emelie Nordström &amp; Felicia Andersson</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1 (Context)</strong></td>
<td>School: Chinese School 1</td>
</tr>
<tr>
<td>Class: Mathematics.</td>
<td>Year: 2\textsuperscript{nd} year of secondary school.</td>
</tr>
<tr>
<td><strong>Part 2 (Data and media)</strong></td>
<td></td>
</tr>
<tr>
<td>Numbers, figures, formulas etc. observed at the lessons</td>
<td></td>
</tr>
<tr>
<td>Kind of material used in the education:</td>
<td></td>
</tr>
<tr>
<td>(1a) Prose text</td>
<td>(1a) Black board and drawing chalk.</td>
</tr>
<tr>
<td>(1b) Overview text</td>
<td>(1b) Books, pen and paper.</td>
</tr>
<tr>
<td>(1c) Fill in-text</td>
<td>(1c) Notebooks to take notes when the teacher is speaking, and to solve problems during the lesson.</td>
</tr>
<tr>
<td>(2b) Time</td>
<td>(2b) 40 minutes lesson.</td>
</tr>
<tr>
<td>(2c) Processes</td>
<td>(2c) Teacher spoke most of the lesson. Students took notes and solved problems.</td>
</tr>
</tbody>
</table>

* (material collected/copied)

### Part 3 Chronical record of the observation in three dimensions

1) **Media** (written/verbal material and information; concrete material or processes)
2) **Activities** (counting, measuring, location, designing, playing, explaining – and other activities)
3) **Mathematical skills and understanding**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
<th>Mathematical skills and understandings</th>
</tr>
</thead>
</table>
| 17:35 | The teacher is speaking to the students. Give mathematical examples on the black board. 
\[ a, b \in \mathbb{R}^+ \]  
\[ ab = a + b + 3 \iff a + b = ab - 3 \] | Mathematical abbreviations and symbols, ex. \( \mathbb{R}, \in \)  
Basic equation solving abilities.  
How to solve a function with |
71

17:40

\[ a + b \geq \sqrt{ab} \iff \sqrt{ab} = t \rightarrow t^2 - 2t3 \geq 0 \iff (t - 3)(t + 1) \geq 0 \]
\[ t \leq -1, t \geq 3 \]
\[ \rightarrow \sqrt{ab} \geq 3 \iff ab \geq 9 \iff a = b = 3 \]

The class answers out loud, together to the teachers questions. If some students get the wrong answer, other students object.

17:45

The teacher makes sure that every student understands the previous problem. The teacher gives a new example from a teacher instruction-book. Students writes down in their textbooks.

\[ x, y \in \mathbb{R}^+ \]
\[ xy = 2x + y + 6 \]
\[ xy_{\text{min}} = \quad \]
\[ 2x + y_{\text{max}} = \quad \]

The students solve the problem alone. The teacher tells them to use the same routine that was used in the previous example. Expects the students to finish quickly.

The teacher solves the problem on the black board.

\[ 2x + y = xy - 6 \]
\[ \sqrt{2xy} \leq xy - 6 \]
\[ \sqrt{2t} \leq t - 6 \]
\[ t^2 - \sqrt{2t} - 6 \geq 0 \]
\[ (t + \sqrt{2})(t - 3\sqrt{2}) \geq 0 \]
\[ \sqrt{xy} \geq 3\sqrt{2} \]
\[ xy \geq 18 \quad \rightarrow xy_{\text{min}} = 18 \]

Continues with solving the example

\[ 2x + y \geq \sqrt{2xy} \]
\[ \frac{(2x+y)^2}{4} \geq 2xy \]
\[ \frac{(2x+y)^2}{8} \geq xy \]
The students say a chant.
\[
\frac{(2x+y)^2}{8} \geq xy = 2x + y + 6
\]
The teacher asks the students if they have any questions regarding the problem. One student has a question. Teachers and other students answer to the question. The teacher shows the students that they can solve the problem by guessing, but they will not get any scores on the final exam if they do that.

New example: \[ a^2 = 2a + 3 \]
\[ a^2 - 2a - 3 = 0 \]
\[ (a - 3)(a + 1) = 0 \]
The teacher asks questions to the students.

Two students solve problems on the blackboard. Examples from the course book.

Ex. 1
\[ x^2 + y^2 + xy = 1 \]
\[ x + y_{\text{max}} = \_\_\_\_ \]
\[ x^2 + y^2 + xy = 1 \]
\[ (x + y)^2 - xy = 1 \]
\[ xy = (x + y)^2 - 1 \]
\[ xy \leq \frac{(x+y)^2}{4} \]
\[ (x + y)^2 - 1 \leq \frac{(x+y)^2}{4} \]
\[ (x + y)^2 = t \]
\[ t^2 - 1 \leq \frac{t^2}{4} \]
\[ t \leq \frac{2}{\sqrt{3}} \]
The teacher supervises the students when they solve the problems.

How to solve a second degree-function.
Basic equation solving abilities.
The difference of two squares.

Mathematical abbreviations and symbols, ex. \( \mathbb{R} \), \( \in \)
Basic equation solving abilities.
How to solve a function with two variables.
How to solve a second-degree function.
How to apply a new variable.
Square root-functions.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:05</td>
<td>The teacher take a look at the other example. The wrong solution. The teacher solves the problem how it should be. $x + y + \sqrt{x^2 + y^2} = 2$ $x, y \in \mathbb{R}^+$</td>
</tr>
<tr>
<td></td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>$x + y \geq \sqrt{xy}$ (1) $\sqrt{x^2 + y^2} \geq \sqrt{2xy}$ (2) $x + y + \sqrt{x^2 + y^2} \geq \sqrt{xy} + \sqrt{2xy}$ Students sais a chant. $S = \frac{1}{2}xy$</td>
</tr>
<tr>
<td>18:10</td>
<td>The teacher reads out loud from the teacher instruction-book. Reads an example that is a classical exercise from a college entrance test. The students are given a couple of minutes to solve the problem. The teacher asks the students a couple of questions, the whole class answers as one.</td>
</tr>
<tr>
<td>18:15</td>
<td>The teacher continues with the problem. The school bell rings, all students stay in their places. The teacher solves the problem and summarizes the lesson.</td>
</tr>
<tr>
<td>18:20</td>
<td>The lesson ends.</td>
</tr>
<tr>
<td></td>
<td>Mathematical abbreviations and symbols, ex. $\mathbb{R}$, $\in$ Basic equation solving abilities. Pythagoras’ theorem. How to solve a function with two variables. How to solve a second-degree function. How to apply a new variable. Square root-functions.</td>
</tr>
</tbody>
</table>
Appendix 11

Observation schedule at a Chinese school 2

<table>
<thead>
<tr>
<th>Date: 120914</th>
<th>Name of the observers: Emelie Nordström &amp; Felicia Andersson</th>
</tr>
</thead>
</table>

**Part 1 (Context)**

- School: Chinese School 2
- Class: Mathematics.
- Year: Middle school

**Part 2 (Data and media)**

<table>
<thead>
<tr>
<th>Numbers, figures, formulas etc. observed at the lessons</th>
<th>a) Black boards and pen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind of material used in the education:</td>
<td>1b) Books, pen and paper.</td>
</tr>
<tr>
<td>(1a) Prose text</td>
<td>1c) Notebooks to take notes what the teacher said and do the tasks she asked them to do during the lesson.</td>
</tr>
<tr>
<td>(1b) Overview text</td>
<td></td>
</tr>
<tr>
<td>(1c) Fill in-text</td>
<td></td>
</tr>
<tr>
<td>(2a) Concrete material</td>
<td>2a) Supplied task paper, pen, math book, notebook, and black boards.</td>
</tr>
<tr>
<td>(2b) Time</td>
<td>2b) 45 minute lesson.</td>
</tr>
<tr>
<td>(2c) Processes</td>
<td>2c) Teacher spoke most of the time, students answered the teacher, took notes and solved tasks.</td>
</tr>
<tr>
<td>* (material collected/copied)</td>
<td></td>
</tr>
</tbody>
</table>

**Part 3 Chronical record of the observation in three dimensions**

1) *Media* (written/verbal material and information; concrete material or processes)
2) *Activities* (counting, measuring, location, designing, playing, explaining – and other activities)
3) *Mathematical skills and understanding*

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
<th>Mathematical skills and understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.15</td>
<td>Applauds when we came in. We were five minutes late.</td>
<td></td>
</tr>
</tbody>
</table>

74
The teacher talks about the number line. 

2 > 0, 0 > 2, 2 > −2, −2 > −3

The teacher asks questions and the students' answer out loud.

−(−1) > −(+2)

The teacher writes knowledge points on the black board.

The teacher tells a student to repeat the knowledge points, the student stands up and answer.

The teacher writes

\[
\frac{8}{21} = \frac{3}{7}
\]

The teacher points to one student that answers.

The teacher writes

\[
\frac{3}{7} = \frac{9}{21}
\]

A student stands up and explains the following, with some help from the other students:

\[
\left| \frac{3}{7} \right| = \left| \frac{-9}{21} \right| = \frac{9}{21}
\]

\[
\left| \frac{8}{21} \right| = \frac{8}{21}
\]

\[
\frac{8}{21} < \frac{9}{21}
\]

\[
\left| \frac{-8}{21} \right| < \left| \frac{3}{7} \right|
\]

\[
\frac{-8}{21} > \frac{-3}{7}
\]
The teacher asks a student if there is another way of solving this task.

The students are solving tasks in the math book. Tasks that are solved in the same way the teacher just proved them with.

The teacher walks around the classroom and help the students. She points to one student who gets to solve a task on the white board in the back of the classroom.

The teacher tells the team leader of each table to check if the students need help and if they have correctly answered the task.

The teacher explains the solution to the task on the white board.

The teacher tells the students to do similar tasks in the second math book and to do fine calculations just like she had done on the black board.

A student is writing done her solution on the black board after the teacher had told her to.

The teacher checks the student's calculations.

The teacher writes
\[-|-(+5)| \text{ and } -[-(+5)]\]
and asks the students which is the biggest.

\[-|-(+5)| = -5\]
The students answers out load:

\[-|-(+5)| = 5\]
\[-5 < 5\]
\[-|-(+5)| < -[-(+5)]\]

Other ways of solving a task.

Number line
Mathematical symbols, ex. >, <
Negative numbers
Absolut value.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.48</td>
<td>The teacher gives the students homework and some tips on how to solve them.</td>
</tr>
</tbody>
</table>
| 9.49  | New example on the black board.  
|       | $|a| = 4, \ |b| = 3$  
|       | $a = \pm 4, b = \pm 3$  
|       | $x \therefore a < b$  
|       | $a = -4, b = \pm 3$ |
| 9.52  | The teacher gives a summary of the lessons knowledge points. |
| 9.54  | The teacher goes through yesterday's homework. |
| 9.55  | Music starts playing $\rightarrow$ the lesson is over. The students stand up and shout something like “Bye” in Chinese. |