
THE UNIVERSITY *of* EDINBURGH

# Factors Impacting the Integration of One-to-One Computing Initiative into Learning and Teaching in Azerbaijan

Samir Mammadov


Doctor of Education

The University of Edinburgh

2016

This thesis has been submitted in partial fulfillment of the requirements for a postgraduate degree of Doctor of Education at the University of Edinburgh.

I declare that this thesis has been composed solely by me and the work is my own, except where otherwise indicated. This thesis has not been submitted, neither in full nor in part, for any other degree or professional qualification, except for this EdD programme. Any publications included throughout the thesis are my own, except where indicated otherwise.

Samir Mammadov
June, 2016
Signature: 

# Contents

# Acknowledgements

I would like to express my gratitude to all those who have been involved in conducting this research and have helped me complete the thesis from the initial phase to the very end.

I gratefully acknowledge the support and the tireless labor my supervisors Dr. Charles Anderson and Dr. Hamish Macleod have invested in this piece of work. I am especially thankful for the constructive criticism and guidance provided throughout this research, without which it would have been impossible to undertake this study and fine-tune the final report.

I thank everybody whose support and insights have proven invaluable for this research:

Ulkar Babayeva for finding this doctoral programme, which was an extraordinary learning experience; for helping me to design the research plan; and for her valuable contribution to the design of the thesis. I wish Ulkar success with the Ed.D. program she is currently undertaking at John Hopkins University.

The research assistant, Sabina Savadova for pursuing the research aims with me; for her patience, accuracy, kindness and punctuality towards research participants during data collection process; for her help with data translation and transcription; and most importantly for her passion in education that helped to challenge me during data analysis process and throughout the whole thesis development. I hope Sabina's plans for PhD in education will come to fruition in very near future.

Aytaj Pashayeva for her assistance and consultations during my study years and at the early stages of this research; for the useful advice with the selection of Grounded Theory Method.

All the participants of the study, among them school principals, teachers, students and parents for providing valuable input by means of interviews and focus-group discussions.

The staff of the Bureau on ICT for Education, as well as to the management at the Ministry of Education for extending their support and providing me with the essential information on schools.

And most of all, to my parents, my wife and children for their endless patience and moral support throughout the years of hard work.

# Abstract

During recent decades the educational community around the world has witnessed an increasing interest in programmes aiming at providing teachers as well as learners of all ages with direct access to personal computing devices and the vast amount of information such provision enables. These types of programmes are known as "one-to-one computing", a term that indicates a very widespread distribution of computers in educational settings. Research into such patterns of provision has accordingly become a priority. Understandably, the realities of one-to-one programme implementation vary considerably across the nations, since cultural setting, educational system, customs of technology use and teachers' experiences are all significant aspects that influence the process. However, there can be certain commonalities across all these aspects in countries whose educational systems have a largely shared history, as is the case in the former Soviet Union states. Azerbaijan's experience in the field, as one of the countries with a post-soviet educational system going through curriculum reforms, was very attractive for a comprehensive study with the primary focus on identifying the factors influencing the infusion of one-to-one computing into learning and teaching.

The research question developed for this study was: "What factors influence the integration of one-to-one computing into teaching and learning?" Qualitative research methods were used to gather data at three purposively selected schools, two in the capital city of Baku and one in a provincial town. The research data were collected by conducting classroom observations, interviews and focus group discussions with main stakeholders of the programme allowing for investigation of students', teachers' and parents' experiences throughout the implementation process.

Using a constructivist grounded theory approach the gathered data were analyzed in two major stages: the first one employed the 'helicopter view' approach to attain a preliminary picture, followed by the process of coding, memo-writing and analysis.

The second stage of the analysis resulted in a thematic summary into teacher, student and classroom-dynamics-related categories.

The findings revealed that the students were the most enthusiastic about the changes brought to the learning process with the introduction of the lightweight, small and inexpensive devices, commonly known as netbooks. The students improved their technological skills and knowledge and applied these skills in acquiring domain knowledge. By providing students with netbooks, the one-to-one programme introduced anytime, anywhere, and individualized learning opportunities. The study also revealed that the introduction of netbooks was leading to students developing collaborative learning skills. In addition, the study found that most of the teachers were developing new teaching methods to continue the programme implementation. They invested extra time and worked hard, notwithstanding the lack of guidelines both on the integration of technology with pedagogy and on meeting newly-set National Curriculum standards. Some teachers overcame the technological challenges that arose along the way eagerly, while others used them as an excuse to discontinue the programme implementation. The parents' opinions varied considerably, some of them supported the innovation, while others considered the frequent usage of technology excessive, unnecessary and potentially damaging to their children's health. The latter group of parents expected their children to be taught similarly to them, with a primary focus on the development of handwriting and speaking skills as well as the habits of reading printed books.

The research has identified eight major factors influencing the integration of one-to-one computing into teaching and learning: embedding ICT in the curriculum, fostering of exploratory learning, student satisfaction, new learning practices, professional development, school leadership support, teacher beliefs and parental support. Most importantly, the findings have revealed the importance of addressing teacher professional development in terms of integrating technology with pedagogy and meeting curriculum standards through technology-infused teaching methods. These factors indicate the improvements needed for successful programme

implementation. It is hoped that the results can be adopted by educational leaders to inform their decisions on one-to-one programmes, thereby contributing to successful integration.

# Lay Summary

The recent decades have witnessed an ever-increasing interest among educational communities in ensuring access by both teachers, and students of all ages, to personal computing devices, such as laptops, netbooks and tablet computers. While using technology in educational institutions has a long history, the individual access to computing devices has been more accentuated in recent years, and the practice of equipping each student with a computer has taken a form of many diverse programmes with similar core characteristics that have come to be collectively known as "one-to-one computing". This general umbrella term refers to the ratio of computer distribution in the educational institutions, implying the provision of one computer per student.

With the growing popularity of such programmes across the globe, conducting adequate research to find the most efficient ways of their implementation have also become a priority. While sharing core characteristics makes one-to-one programmes somewhat similar, they still are not universal across the implementing countries, since aspects such as cultural setting, educational system, customs of technology use and teachers' experiences with technology, all heavily influence the design and introduction of such programmes. However, if the above-mentioned characteristics are shared across a number of countries, then it becomes possible to discuss these instances in a single context. Such is the case of Azerbaijan as one of the former Soviet Union states, whose experience with the infusion of one-to-one computing into teaching and learning is extensively explored in the present study. Therefore, this study is relevant not only in the context of the schools, in which it has been carried out, but its results can potentially be applicable to educational systems similar to that of Azerbaijan that are currently implementing one-to-one programmes.

This research aimed at exploring the one-to-one computing implementation process in Azerbaijani schools with the explicit purpose of identifying the specific factors

that influence the integration of the programme into teaching and learning. In order to acquire the necessary information, a total of three schools were selected for further exploration, among them two located in the capital city of Baku and the third one in a provincial town. The required data were acquired through conducting classroom observations, individual interviews with the programme stakeholders as well as by means of organizing group discussions with the teachers integrating one-to-one computing into their teaching practices and the parents of students involved in such classes.

The acquired data were analyzed in two stages, with the first one focusing on a bigger picture, (i.e. on identifying the major directions in the perceived themes) and the second, exploring more specific issues in relation to teachers, students and classroom dynamics.

The results of this inquiry illustrated that among all the stakeholders, students were the most enthusiastic towards the changes brought about through introduction of netbooks. This excitement easily translated into a favorable outcome of students' improved technological skills in terms of handling the provided technology and successfully applying it for deepening their knowledge acquisition in classrooms and outside of them. With the implementation of the one-to-one programme, students were afforded an anytime, anywhere access to information, which contributed to enhancing their independent learning opportunities. In addition to increased independent learning practices, the introduction of netbooks also seemed to encourage students to collaborate in handling common tasks.

The introduction of technology affected teachers as well, mostly in terms of urging the majority of them to develop new teaching methods. This required extra time and workload investment on the part of the teachers, which was in many cases generously allocated more through their own will than obligation, even though they did not have specific guidelines as on integrating technology into teaching or complying with the newly-set national curriculum standards. The lack of technical

support and specific guidelines resulted in a diverse range of attitudes expressed by the teachers. While some of them eagerly overcame the technological and pedagogic challenges that arose along the way, others used such challenges as an excuse to discontinue the programme implementation.

Certain discord was noticeable in parents' attitudes as well. Some of them supported the idea of implementing such technological innovation in schools, giving emphasis to the benefits the access to information can bring in terms of better learning. There were others however, who considered frequent usage of technology excessive and potentially damaging to their children's health. Another characteristic feature that set this latter group of parents apart from the former, was a more conservative attitude. Their expectation was for their children to be taught in ways similar to those that they had experienced in their own schooling, with a primary focus on acquiring handwriting and speaking skills, as well as the habit of reading printed books.
Overall, this research has identified eight major factors that tend to influence the integration of one-to-one computing, listed below, with the first four being prominent within this study yet less highlighted in the existing literature and the remainder being frequently addressed by other scholars:

1. ***Embedding ICT in the curriculum*** – the vitality of making information and communications technology an integral part of curriculum, in order to ensure its usage for education;
2. ***Fostering of exploratory learning*** – the instances when computers urge students to go beyond the information provided within textbooks and conveyed by teachers to explore, research and acquire further data about the subjects at hand;
3. ***Student satisfaction*** – the degree of students' satisfaction with the introduced technology, which in turn contributes to their increased interest in day-to-day learning with computers;

4. ***New learning practices*** – the emergence and widespread usage of new learning practices as performed by students themselves and as supported by teachers;
5. ***Professional development*** – the necessity to train teachers and develop their skills for more efficient usage of technology and for ensuring a smoother and more successful implementation of the one-to-one programme;
6. ***School leadership support*** – the significance of support allocated to teachers on the part of the school leadership, among them school principals and other administrative staff;
7. ***Teacher beliefs*** – the importance of teachers' positive attitude towards the programme and the damages a negative attitude can cause;
8. ***Parental support*** – the significance of parents supporting the programme implementation, in order for them not to limit children's usage of computers at home, the aspect which is an integral part of one-to-one computing – the "anytime, anywhere access" to computers.

In general, the factors identified within this research point out the aspects of the one-to-one computing that require immediate or long-term adjustments in order to increase the overall effectiveness of the programme. Hence, the results of this study have a potential to be adopted by educational leaders to inform their decisions when attempting to refine one-to-one programmes, which in turn is necessary for increasing the success of integrating technology into teaching and learning.

# Abbreviations

ICT – Information and Communication Technologies

ADR – Azerbaijan Democratic Republic

CMS – Classroom Management Software

CS 1 – Capital School 1

CS 2 – Capital School 2

IDP – Internally Displaced People

MoE – Ministry of Education

P – Parent

RS – Regional School

St. – Student

T – Teacher

UPS – Uninterruptible Power Supply

VSR – Video Stimulated Recall

# 1 Introduction

## 1.1 Overview

This study focuses on the integration of technology into education and aims to explore the factors that affected the integration of one-to-one computing into learning and teaching in selected schools in Azerbaijan. Currently one-to-one computing is understood to be a setting in which every student is provided with a personal digital device with wireless access to the Internet at schools and ideally at home too. The initiative is being implemented not only in the West, but in numerous developing countries as well.

Before the main theme of this research is introduced in detail, it is important that readers are provided with the background of the study. The following subsections of this chapter will provide the description of the Republic of Azerbaijan, where the data collection has been carried out, including a brief history of the country, the development of the educational system, as well as the introduction of Information and Communication Technologies (ICT) into education.

Since the present study is about the introduction of the one-to-one computing initiative in Azerbaijani schools, I will then present the overall concept of the programme and its implementation strategies both as they tend to occur worldwide and as they have been adopted in Azerbaijan. The chapter will continue by presenting the rationale for the research study, describing the reasons for addressing this particular question. In section 1.4 I will introduce the present research and introduce the data collection and analysis process. The structure of the thesis will be briefly described in the last section to familiarize readers with each forthcoming chapter.

## 1.2 Background

The Republic of Azerbaijan is situated in the South Caucasus, at the crossroads of Europe and Asia (Appendix 1: map of the Republic of Azerbaijan). The country is bordered by the Caspian Sea on the East, Russia on the North, Georgia on the Northwest, Armenia on the West, Turkey on the South-West, and Iran on the South. The population of Azerbaijan is 9.593 million with the majority living in urban areas (State Statistical Committee, 2015). Azerbaijan is a secular Muslim nation and 96.9 percent of the population follows Islam (predominantly Shia), while there are also 3 percent Christians and less than 1 percent follows other religions or are unaffiliated (2010 est.) (CIA - The World Factbook, n.d.). The President of the Republic of Azerbaijan is the head of state, on the basis of a unitary constitutional Republic.

In 1918, Azerbaijan was declared as the Azerbaijan Democratic Republic (ADR). As the first Democratic Republic in the Caucasus, the government of the ADR initiated quite a number of changes during its short period of existence that lasted only for 23 months, until the occupation by the Soviet Union, in 1920. Similar to neighboring countries in the region, Azerbaijan restored its independence after 71 years with the collapse of the Soviet Union in 1991.

The attempt of Armenia to occupy Azerbaijani territories in 1988 resulted in a war over Nagorny Karabakh that lasted for six years. Approximately 20 percent of Azerbaijan's territory, including Nagorny Karabakh and seven big regions surrounding it, were occupied by Armenian troops and remain under the control of Armenia to this day. One of the main consequences of the war was the displacement of nearly one million Azerbaijanis from their homes. The conflict is regarded as one of the long-standing conflicts in the region, which still remains unresolved.

Since re-gaining its independence in 1991, Azerbaijan has faced several political and economic upheavals. The economic development of the country is divided into three

stages: 1) years of economic decline and chaos (1991-1994), 2) a transition period (1995-2002) and 3) rapid economic development and oil boom (since 2003 till now) (Bayramov, Ibrahimova, & Babazadeh, 2014). Going through these phases Azerbaijan has managed to overcome a number of challenges and start a new development phase in its economy mainly due to the exploitation of oil and gas.

In 2012 Azerbaijan's government approved a framework of the country's future development - "Azerbaijan 2020: Look into the Future". In general, the framework aims at making use of existing opportunities and resources for attaining a higher level of socio-economic growth in the country, alongside growth in other important sectors by the year 2020. Among them are: effective state management, supremacy of law, protecting human rights and freedoms, and promoting the active status of civil society. Among the many goals set out in the framework that are aimed at diversifying the economy and promoting sustainable economic development, one of the main priorities is the development of social spheres and human capital, which is planned to be achieved through increasing the quality of education and services, strengthening social security, ensuring gender equality and developing family, youth potential and sports.

In addition to this, the framework also encompasses priorities to improve the formation of a modern education system: the computerization of the education system; the effective integration of ICT into the management of education; the integration of Azerbaijani education into world and European education. Also, the concept envisages an increase in state funding for education, developing new mechanisms to enhance the quality of education, improving the infrastructure of schools throughout the country and developing various inclusive education programmes for children with special needs (Government of Azerbaijan, 2012). A more detailed plan as to how to increase the quality of education is to be found in "The State Strategy on the Development of Education in the Republic of Azerbaijan" approved by a presidential decree in 2013. The main purpose of the strategy is to place the education system of Azerbaijan among the leading ones in the world, to

make it economically viable and compliant with the standards of the world's best educational systems (Ministry of Education, 2013).

### 1.2.1 The educational system in Azerbaijan

In the Republic of Azerbaijan, the Cabinet of Ministers and the Ministry of Education (hereinafter the MoE) are responsible for governing education. The Ministry is the central body responsible for the education system.

There are the following types of educational institutions in Azerbaijan:

- pre-school education institutions;
- general education institutions;
- out-of-school educational institutions;
- institutions of primarily vocational/professional education (vocational schools, vocational lyceums);
- institutions of secondary vocational/professional education (colleges);
- institutions of higher education;
- in-service training educational institutions (Education Law of the Republic of Azerbaijan, n.d.).

Table 1.1 summarizes levels of education and number of students enrolled in Azerbaijan.

| Education Level | Sub-Level | Ages | No. of students | No. of teaching / pedagogical staff | No. of schools / institutions |
|---|---|---|---|---|---|
| **Pre-school** | *Nurseries*<br>*Kindergartens* | *0-3*<br>*3-6* | 116,049 | 15,651 | 1,706 |
| **General** | *Primary*<br>*Secondary*<br>*General Secondary* | *6-10*<br>*10-15*<br>*15-17* | 1,322,182 | 147,000 | 4,475 |
| **Vocational** | | Adult | 25,414 | 1,684 | 113 |
| **Secondary Professional** | | Adult | 60,478 | 6,008 | 61 |
| **Higher** | | Adult | 158,212 | 15,023 | 53 |

*Table 1.1 Summary of educational statistics by levels 2014-2015*

While the MoE contributes to the development as well as the implementation of the state policy on education, the Cabinet of Ministers is the body which makes decisions on the education strategy, alongside certain proposals on the development of the general budget and specific funds related to the education sector. The Cabinet also oversees the implementation of the Law on Education as well as other relevant legislative documents and acts.

In Azerbaijan the origins of education trace back to the third century B.C., however the first educational system was developed in the eighth century (UNESCO, 2005). After the spread of Islam to Azerbaijan, in the eighth century, madrasas[1] started emerging to promote the religion throughout the country. During this period the languages of instruction were mostly Persian and Arabic, however starting from the 11th century the Azerbaijani language entered schools and during the rule of the khanates[2] (the 18th century) its use as a language of instruction increased. In 1919,

[1] Madrasa, (Arabic: "school"), Turkish medrese, madrasa in Muslim countries, an institution of higher education. Madrasas functioned until the 20th century as a theological seminary and law school, with a curriculum centered on the Qurʾān. Arabic grammar and literature, mathematics, logic, and, in some cases, natural science were studied in madrasahs in addition to Islamic theology and law.

[2] The second half of the 18th century saw a period of decline of central authority in Iran, a condition that allowed the emergence of indigenous centers of power in the Azerbaijan periphery. These took the form of khanates (principalities), including Karabagh, Baku, Shirvan, Ganja, Derbent, Kuba, Talysh, Nakhichevan, and Erivan in the northern part of the country, and Tabriz, Urumiyeh, Ardabil, Khoi, Maku, Karadagh, and Maragin in the south (Swietochowski & Collins, 1999).

during its short-lived independence, Azerbaijan established the first university – Baku State University. Within the same period many students were sent to study in Europe as well. During the Soviet rule (1920-1991), together with the Azerbaijani language, Russian became the language of instruction in educational institutions. As such, new Russian schools or Russian classes (in Azerbaijani schools) were opened where instruction in all subjects was conducted by ethnic Russians or Russian speaking teachers. Today, because of a trend towards state (Azerbaijani) language, the number of such schools has decreased, however, still numerous educational institutions (pre-schools and schools, colleges, universities) in the capital and in some other big cities teach in both languages, and a larger portion of the population, mostly members of the older generation, speaks Russian as their second native language.

After restoring its independence in 1991, Azerbaijan initiated several reforms in the education system. One of **t**he very first initiatives undertaken in 1992, was new not only to Azerbaijan, but to the entire former Soviet Union countries and introduced standardized testing in admission processes to universities, organized by the State Students Admission Commission (SSAC) (Drummond & Gabrscek, 2012; SSAC, 2016). It is noteworthy, that the SSAC is not an agency of the MoE and reports directly to the President of the country. Other than admission examinations to universities, the organization also administers recruitment to public service jobs (Drummond and Gabrscek, 2012) and has helped to develop the capacity of the country's educational system throughout its existence (SSAC, 2016).

Reforms aimed at enhancing the quality of the education system continued later and became more consistent. In 1999, the "Education Reform Program of the Azerbaijan Republic" was approved, which aimed at systematic reforms in the education system, and for that purpose Azerbaijan aligned with several international organizations. The Government of Azerbaijan closely partnered with the World Bank to carry out educational reforms in the country. The partnership was developed into three phases of cooperation, with respective agreements covering the period from 1999 through

2015. As a result of this close partnership, the educational system went through reorganizations by improving the logistical support of schools, the development of a new curriculum, adopting a new concept for continuous teacher training to ensure the effectiveness of instruction, applying a new textbook policy in the public education system and adopting a new national assessment concept[3] of public education (Azerbaijans.com). The co-operation with the World Bank especially impacted the introduction of a new curriculum, which presented notions of student-centered and skill-oriented education system to Azerbaijani teachers.

One of the latest reforms in education was the approval of "The State Strategy on the Development of Education in the Republic of Azerbaijan" in 2013. The state strategy sets out five main directions: (1) creating student-oriented education and targets for development of curricula for all levels of education; (2) increasing the quality of human resources in the education sector; (3) creating and maintaining transparent management mechanisms; (4) establishing a modern education infrastructure and ensuring lifelong education, including the provision of Internet access to all schools throughout the country and tablets with pre-installed e-textbooks for all the students at general secondary education level, and improving distance education; (5) establishing a new economically sustainable education financing model and also an Education Development Fund (Ministry of Education, 2013).

In addition to adopting a state strategy on the development of education, another significant initiative undertaken by the MoE has been the implementation of curriculum reform aimed at refining the teaching-learning process.

[3] Assessment Concepts for the General Education System of the Azerbaijan Republic (in short, National Assessment Concept) is a government document approved by the Decree of the Cabinet of Ministers of the Azerbaijan Republic on January 13, 2009 (Nr. 9), which is intended for use in the management of activities related to assessment issues in the national education system for the next 5-10 years. The main content of this document is dedicated to the identification of principles that ensure legality of assessment activity, identification of main areas of this activity, promotion of the social status of institutions that implement assessment activities, use of assessment in satisfying teaching and learning needs.

#### 1.2.1.1 The Introduction of a new curriculum

Currently there are several ongoing transformations addressing the implementation of a national assessment system, and in-service teacher training that supports the rollout of the new curriculum. One of the important objectives of this transformation process, treated with special attention by the MoE, was the adoption of new curriculum standards for all grades.

In an attempt to move away from the curriculum of the Soviet era to a more modern kind, suitable for an independent Azerbaijan, in the 1990s the curriculum reform mainly focused on introducing new subjects. The approach drastically changed in the 2000s and the National Curriculum approved by the Cabinet of Ministers in 2006 outlined what students should know and be able to do at particular grade levels, instead of merely determining the specific topics and facts to be taught (Karimova, Kazimzade, & Silova, 2014). The new National Curriculum affected six main areas of school level education, among them determining learning outcomes for particular subjects, and altering the methods of teaching, in terms of student achievement assessment, modification of teaching resources, teacher education and professional development (ibid.).

For example, according to the new National Curriculum, a student who completes a full course of general education is expected to speak fluently the native Azerbaijani language and know at least one foreign language, (Russian, English, French or any other language taught at schools), have information on the history and culture of the country, have respect for democratic principles, be able to use competently modern equipment and information and communication technologies (Cabinet of Ministers of the Azerbaijan Republic, 2006).

As mentioned above, among the many outcomes that students are to achieve by the end of each grade level there is an emphasis on the capability of using modern

equipment and ICT. Also in accordance with the "State Strategy on Education Development", the MoE provides schools with e-teaching resources and a number of educational e-portals (Ministry of Education, 2013). It is worth mentioning here that the curriculum reform and the efforts at integrating ICT into education have been undertaken independently of each other, never overlapping or influencing one another.

Another aspect of the education reforms that is of particular interest for the present research is the attempts to transform heavily teacher-directed classroom processes inherent in the Soviet era schools into more modern, student-centered ones, where teachers would assume the role of facilitators of learning, rather than instructors (Karimova, Kazimzade, & Silova, 2014). Even though this transformation has not yet been achieved, some studies report positive movement towards the end-goal. Karimova, Kazimzade and Silova (2014) refer to a 2011-midterm observational study (SIGMA, 2011) which has shown that teachers managed to overcome certain obstacles in terms of applying "interactive learner-centered methodology".

Alongside the reforms, education expenditures in Azerbaijan have started to increase over recent years. During 2004-2014, public spending on education dramatically increased in nominal terms from 294 million AZN in 2004 to 1.55 billion AZN in 2014, however in the face of the rapid GDP growth during this period, notwithstanding the nominal growth in funds, the share in percentage actually decreased. While in 2004 public spending on education constituted 3.4 percent of GDP, in 2014 it had already dropped to 2.6 percent, which was considered very low (World Bank Group, 2015).

### 1.2.2 ICT integration into education in Azerbaijan

In the Soviet Union, the absence of computers in schools was interpreted differently by particular authors. Some believed it was a deliberate action taken by the

Communist Party as they hesitated to provide access to a vast amount of information to the general population (Shanor,1985), but according to Velikhov, it was due to the limited number of available computers (see Lommel, 1992). Highlighting the importance of computers Ershov (1985) drew attention to computer usage as a personal tool for people of different occupations such as engineers, librarians, designers and so on. The problem was taken as an important matter by General-Secretary Gorbachev, who viewed computers as necessary tools that would accelerate Russia's entrance into the world market.

Under Gorbachev's supervision the Commission on the Reform of General and Vocational Schools was assembled, addressing the importance of students gaining computer literacy as well as teachers beginning the integration of computer usage into their teaching. With the support of the Commission, the Communist Party Central Committee adopted a resolution aiming at the creation of computer labs, the development of new software to support teachers and assistance for teachers' development in computer science. Nonetheless, these efforts aimed at creating a separate subject within which computer science would be taught. Due to the limited number of computers provided to schools, the integration of technology into the teaching of ordinary subjects was not considered.

However, it was initially not an easy task as it was revealed that there was less than one computer per secondary school throughout the Soviet Union and most of the teachers were reluctant to develop computer literacy and apply it in their teaching. Nevertheless, protagonists of technology integration were hopeful to bring computers to schools, until they faced bigger problems on the way: firstly, it was taking a lot of time to introduce computer courses to schools, and secondly, teachers with computer skills were leaving schools for higher-paying jobs.

As one of the former Soviet countries, the situation in terms of equipping schools with computers was similar in Azerbaijan. By the time that educational reforms were initiated after re-gaining independence the majority of computers dated from the

Soviet period and they were in a state of disrepair. Prior to 2005, the computer-student ratio was 1 to 1000, and there were only 1570 modern computers in several urban schools of Baku (Mardanov, 2009). There was a scarcity of e-learning materials except for the ones bought from Russia. The "Informatics" subject was being taught only in 10th and 11th grades (ages 15-17). Very few schools had access to the Internet, and only a few teachers had participated in training sessions on ICT integration (ibid.).

Soon after approving the first decree on the "Education Reform Program of the Azerbaijan Republic", the government saw that the competitiveness of the country greatly depended on the efficient integration of ICT into education and decided to carry out a rapid intervention. At the end of 2004, the first state program on "Provision of Educational Establishments in the Republic of Azerbaijan with Information and Communication Technologies" (2005-2007) was approved. The Ministry of Education was responsible for the administration of the program, which provided computer equipment to schools. Additionally, the schools were supplied with Uninterruptible Power Supply (UPS), networking equipment (switch, cables and connectors) and a laser printer. By the end of the program "computer equipment was available in 82 percent of schools and on average 1-29 computer-student ratio was reached in grades 5 to 11" (The Azerbaijan Republic Educational Portal, 2009). The ministry introduced a new Informatics curriculum as a separate subject in all grades. The program resulted in a massive supply of ICT equipment to schools and the introduction of a new notion of "ICT for Education".

The integration of ICT into education is a complex and long-lasting process combining both technology and pedagogy. Currently, ICT in education is perceived as an effective means to change educational systems and enable teachers to meet the increasing demands of 21st century education. Many countries have set a goal to build schools of the 21st century and try to move to student-centered education by applying ICT in all levels of teaching and learning. Azerbaijan as well has initiated a range of activities to achieve efficiency in technology-enhanced education.

In 2008, the "State Program on Informatization of Educational System in the Republic of Azerbaijan in 2008-2012" was approved, which focused on the improvement of education through the effective integration of ICT in schools (The Azerbaijan Republic Educational Portal, 2009). The second state program in the area of ICT integration was aimed at the provision of Internet connectivity to all schools throughout the country, the development of a national database of web and e-learning resources and the in-service training of teachers and administrators at schools.

Additionally, in order to carry out the implementation of the second state program, the Bureau on ICT for Education under the Ministry of Education was established in 2008. The Bureau was responsible for ensuring the application of ICT into education. I was appointed as the head of this Bureau, which oversees the implementation of all kinds of ICT-related projects in schools and other educational institutions, and ensures the provision of infrastructure, software, content and training. The Bureau is also responsible for the implementation of the pilot one-to-one programme alongside other technology-related educational initiatives in schools. Also, within the Bureau, the Data Resource Center – a focal point for content storage – has been created which provides the Internet access to the educational institutions, filtering age-inappropriate and unsafe content for children.

The fourth direction of the "State Strategy on Education Development" mentioned above is focused on establishing an education infrastructure that meets modern requirements and ensures lifelong education. It also includes provision of Internet access to all schools countrywide and netbooks or tablets with pre-installed e-textbooks distributed to all the students at general secondary education level. As stated in the strategy, all the educational institutions in the country, even those in the remote villages, should be provided with Internet connectivity through the Azerbaijan Education Network. Additionally, classrooms should be equipped with laptops, projectors and an interactive whiteboard, and students at general secondary

education level should be given tablets with preloaded e-textbooks. Moreover, a new e-learning system, open online educational resources and distance education centers will be created and offered to the public (Ministry of Education, 2013).

The MoE has already carried out certain activities that follow the action plans included in this strategy. As a result, by 2015, an additional 339 schools have joined the Azerbaijan Educational Network (AzEduNet); libraries in another 160 schools have been provided with computers and Internet access. In addition, the MoE has started developing and improving the e-learning system, e-textbooks and an e-testing system for students, and over 100 e-textbooks have been already placed on an e-textbook portal (The Azerbaijan Republic Educational Portal, 2016; e-resurs.edu.az, 2016).

As a result of the initiatives implemented towards the computerization of schools, by the end of 2015, the student to computer ratio at grade 5 to 11 in general education was 18 to 1, and 45 percent of the schools in the country had Internet access (Ministry of Education, 2013). The following chart gives a visual summary of the ICT infrastructure development of schools over the past years.

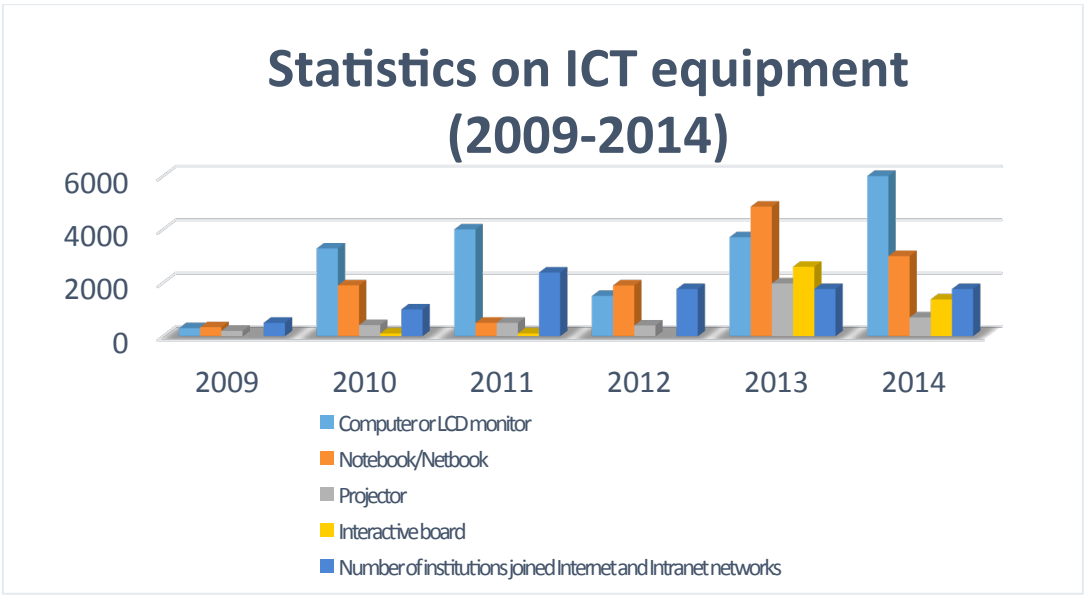



*Figure 1.2 Statistics on ICT equipment (2009-2014)*

One of the notable consequences of the reforms was developing the concept of an 'e-school', starting from 2009. The MoE has set necessary requirements for schools interested to join the project, such as the existence of appropriate infrastructure, basic ICT skills of teachers and modern computer equipment. Once a school meets the above-mentioned key criteria they would further be equipped with fiber-optic Internet connectivity, a laptop connected to the Internet in each classroom for teachers' use, as well as projectors and interactive whiteboards. Also every teacher in an e-school will have participated in a specifically designed training program and then would start using an Advanced School Management system. The latter allows parents to check on their children's attendance and performances in different subjects and receive information from teachers. Up to today, about 50 schools have joined the project, and the number of schools could potentially reach 1000 by the year 2020 (Government of Azerbaijan, 2012).

### 1.2.3 What is a one-to-one computing initiative?

Seymour Papert is considered one of the main proponents of ICT-integrated learning in the world, whose views on education were heavily influenced by the work of Jean Piaget[4] (Papert, 1980). Following Piaget, Papert (1986) describes learning not as a mere transmission of knowledge but as a reconstruction where a learner actively constructs his own conclusions through exploration and experimentation. He stresses time and again the importance of exploration vs. imposed learning and believes that particular uses of computers can support and enhance these individual journeys of exploration (Papert, 1980). In this regard, he believes that if every child at school could have a computer, learning would change with the assistance of the technology. Such a ratio of computer distribution, i.e. one computer per student, is what determined the name of these programmes – one-to-one computing.

[4] Jean Piaget - (born August 9, 1896, Neuchâtel, Switzerland—died September 16, 1980, Geneva) Swiss psychologist who was the first to make a systematic study of the acquisition of understanding in children. He is thought by many to have been the major figure in 20th-century developmental psychology (Jean Piaget, 2016).

One of the most well-known examples of a one-to-one computing initiative in the world has been the Maine Learning Technology Initiative. Based on the example of other states, the Governor of Maine in the United States of America, King, was convinced that Maine also needed to undertake investments in the field of education if his state was to compete and supersede others. Governor King remembered discussing the issue of transforming education with Seymour Papert one year before the implementation of the project in 2001, where Papert convinced him that such a transformation could be achieved only by using a one-to-one ratio of technology to students (Maine Learning Technology Initiative, 2010). Accordingly, the State of Maine started implementing the Maine Learning Technology Initiative. Within its framework, students in the seventh and eighth grades (ages 12-14) were given computers to study in the one-to-one setting. The initial evaluation of the programme deemed the outcomes successful and thus it started spreading to other parts of the USA, and elsewhere in the world. This period and the following years can be characterized as a turning point in how scholars view the frequency and efficiency of technology usage in instruction. Even though Larry Cuban, a well-known researcher in the field of technology integration into schools, has long been skeptical of highly increased computer usage in classrooms (Cuban, 1986; 2001), in a recent article with Petar Jandric (Jandric & Cuban, 2015) he admits to some of his predictions being flawed and estimates that currently, in different districts of the US, over 30% of the teachers regularly use machines for instruction, i.e. for the purpose of supporting learning and teaching, while another 30 to 40% make use of available technology occasionally. Other than that, one of the predictions he considers to have come true is that those who advocate for greater technology use in instruction would not be satisfied with the current use of machines (Jandric & Cuban, 2015).

### 1.2.3.1 One-to-one computing worldwide

The introduction of one-to-one computing programmes in education has extended to many countries, like Spain, Portugal, Germany, Italy, Turkey and the UK (Balanskat, 2013). The initiative has been implemented in many Latin American and Caribbean countries too, such as Brazil, Colombia, Mexico, Paraguay, Uruguay and Peru (Severin & Capota, 2011).

One of the other famous one-to-one computing initiatives, One Laptop Per Child (OLPC) has been started in developing countries using low-cost XO[5] laptops or netbooks designed for school children. 1,500 units or less have been distributed in countries implementing small-scale pilot projects, among them Malaysia, the Philippines, Thailand, China (UNESCO Institute for Statistics, 2014).

In a number of countries such as Hungary, Sri Lanka, and Spain, their respective governments provide students and teachers in schools implementing one-to-one computing programmes with free computers and support in their maintenance. In some other countries computer devices are locally produced and distributed to students, for example in Portugal, Georgia, Ukraine and the USA. In certain countries such as Portugal and the Czech Republic families are offered discounted laptops or netbooks to buy for their children (Yarmakhov, 2012).

Some of the former Soviet countries such as Russia, Ukraine, Georgia, and Azerbaijan have also started the implementation of one-to-one computing projects. In Georgia, the localized version of the Intel Classmate netbook has been produced by a Georgian firm (Turcano, 2012). First grade students in the Georgian schools are provided with these small laptops called 'Buki' every year. In Russia, the "Computers for Pupils" project has been implemented, and within the framework of

[5] XO - a learning tool designed and built especially for children in developing countries, living in some of the most remote environments. It is about the size of a small textbook. It has built-in wireless and a unique screen that is readable under direct sunlight for children who go to school outdoors.
http://laptop.org/en/laptop/

the initiative a two-step training program has been undertaken aimed at equipping all teachers with relevant ICT skills prior to the distribution of computers (Yarmakhov, 2012).

#### 1.2.3.2 One-to-one computing in Azerbaijan

Several educational initiatives were started within the second state programme described above, (see sub-section 1.2.2 "ICT integration into education in Azerbaijan"). The one-to-one computing project was one of them, and was first launched in 2010 in collaboration with the Intel World Ahead program managed by the Intel Corporation (Intel Corporation, 2012). The Bureau on ICT for Education was responsible for the administration of the program. In total, 15 schools (11 schools in the capital, Baku and 4 outside of the capital city) have joined the pilot project and this study is based on the data collected within this very project.

Depending on the programme design and implementation, the distribution of the type of personal digital device varies worldwide. In Azerbaijan, netbooks assembled locally in partnership with the Intel Cooperation have been distributed to about 2500 students in around 100 classes. Since this has been a pilot project the process of school selection was conducted on a voluntary basis and the school administrations themselves offered the grades in which they wanted to introduce the initiative. As a result, only grades from 2 to 7 that were also being taught with the new curriculum have been included in the programme. Yet again not all the classes in these grades have been taught in the one-to-one setting. From each grade only one or two classes, depending on the school administration's decision, have joined the initiative. Today the implementers are considering reinstating the programme on a larger scale that would include the provision of improved conditions for students and teachers.

As part of the pilot the participant schools were provided with wireless Internet connectivity. Classrooms have been equipped with a laptop for a teacher, a projector, and an interactive whiteboard, in addition to netbooks for each and every student studying in that particular class. (See the specifications of the devices in Appendix 2). Moreover, about 500 teachers have been trained in the educational use of netbooks in these schools. The training courses were designed to develop teachers' skills to use various software packages, enhancing their knowledge of computers, and refining proficiencies in browsing the Internet and using web resources. Teachers were provided with information on solutions for possible technical problems that might arise during the classes. During the training courses teachers also familiarized themselves with the e-learning software and Web 2.0 tools offered in the one-to-one setting. Web 2.0, the number itself denominating a new version of the web as is customary in naming computer software, is a term used to describe the new generation of websites that is characterized by a shift from static pages to more interactive ones, allowing the creation, collaboration, editing and sharing of content. It is not a specific tool, per se, but instead represents a way of viewing the Worldwide Web as a medium in which interactive experience takes center stage as opposed to merely accessing information. This particular defining feature, i.e. the capability for interaction with and modification of content, has become an invaluable tool for educators worldwide to enrich their teaching practices.

## 1.3 The rationale for the research study

The Republic of Azerbaijan is among the few former Soviet countries that piloted one-to-one computing at schools. Even though there had been a considerable amount of time allocated for the preparation phase, during the actual implementation process a lot of drawbacks and problems were discovered that were hindering the process. Several aspects of the programme needed to be addressed in order to improve its effectiveness. By addressing those and other emerging issues in this research I hope

this study can serve as a guide for other countries, in particular in the former Soviet region with a similar centralized education structure and long lasting influence of the socialistic system of schooling.

Although in the last 25 years the post-Soviet countries have implemented numerous reforms in the field of education, they still have not managed to entirely detach the education systems from the Soviet era practices. The present research can assist in the planning and development of similar initiatives, given these shared commonalities. I believe the research findings also can be helpful for those involved in curriculum reforms who at the same time are trying to integrate technology into education. Additionally, by gathering and analyzing extensive and reliable data, I hoped to provide trustworthy findings and a point of reference for further research related to one-to-one computing, more specifically, adding Azerbaijan to various existing country case-studies and creating an opportunity for other scholars to use the research findings for conducting comparative studies.

The study attempts to provide a detailed picture of factors that can influence the integration of this and similar programmes into teaching and learning processes. The factors that the study identifies can also serve as a baseline for assessment and evaluation, potentially providing grounds for expanding or discontinuing the programme. My professional occupation in the capacity of the head of the Bureau on ICT for Education under the umbrella of the Ministry of Education of the Republic of Azerbaijan led my interest to this subject. While my knowledge of the one-to-one programme implementation processes facilitated the work to be undertaken for this research, it also proved to be challenging in that I could not personally participate in the data collection efforts due to reasons clarified in the methodology chapter of this thesis (chapter 3, section 3.3). On the other hand, as an insider I might have an opportunity to use the results of the study for improving the project. In general, I expect that this research will add to the growing body of knowledge on the effects of one-to-one programmes on teaching and learning processes.

## 1.4 Introducing the present research

As was discussed above, considering that the initiative in Azerbaijan had not been studied before, my research set out to examine the factors influencing the integration of one-to-one computing into learning and teaching. For that purpose, initially I was interested in the factors that could potentially influence the implementation of the programme. Therefore I decided to gather data from two schools, using qualitative research methods. However, as the research progressed I found out I was more interested in, and excited about, the changes that the one-to-one programme had brought to learning and teaching taking place in the classrooms rather than issues related to the programme's implementation. In addition to this, I wanted to give a voice to students' opinions on their classes in the one-to-one setting and attempt to analyze the programme from their standpoints. Accordingly, I aimed to scrutinize how students learn with one-to-one computing and how teachers utilize its features in their teaching practices. Following my growing interest I embarked on a new journey for this thesis.

My position at the ministry limited my participation in data collection in person and that is why I worked with a research assistant who collected the data from the selected schools (I will further address the issues of my being an 'insider' and the limitations it brought, later in the 'Researcher' section of the methodology chapter).

The research was conducted in two schools in the capital and one school in one of the regions, where one-to-one classes were observed and video-recorded, and later discussed with the teachers during follow-up interviews in order to give them the opportunity to reflect on the lessons. During these interviews, the research assistant, together with the teachers, also identified students for individual interviews, which served the purpose of exploring student perspectives on the factors influencing the integration of one-to-one computing into learning and teaching.

The data collection methods included focus group discussions with teachers and parents as well. Hence two focus group discussions with teachers were conducted, one in each city school, with the teachers whose classes had been observed, and with the parents whose children had participated in individual interviews. The research methods and data collection process are discussed in the respective sections of the methodology chapter (see chapter 3, section 3.6).

## 1.5 Structure of the thesis

*Chapter 1: Introduction* has presented the background to the study, mainly focusing on the education system and ICT integration into education in Azerbaijan. The chapter also introduced one-to-one computing in a general context and in Azerbaijan. The clear definition of the research problem was outlined for the reader, explaining the reasons for undertaking this study. It concluded with an overview of the research study.

*Chapter 2: Literature Review* will briefly review the existing literature on the integration of ICT in education and examine the existing body of knowledge related to one-to-one computing programmes. This exercise will serve the major goal of identifying factors that influence the implementation of such programmes that have been identified by other scholars. The chapter will also consider the challenges that tend to arise during the integration of one-to-one programmes in teaching and learning and reflect on the role of parents, sometimes the least visible stakeholders in the programme implementation. Taking into consideration the innovative nature of one-to-one programmes and the introduction of technology into the field of education in general, the chapter will also focus on the aspects of educational change that such programmes bring about. Overall, the chapter will serve as a background to

the present research, which in itself aims at contributing to this existing body of knowledge.

*Chapter 3: Methodology* will explain the approach behind the data collection and analysis. The chapter will provide information about the researcher, and about issues and limitations related to the research and sampling of schools. Qualitative research methods have been used to collect the data, each of which will be described in the relevant subsections of the chapter. The data analysis has included two stages and they will be presented in detail. Ethical considerations relevant to the research will be outlined as well. In the last subsection of the chapter, validity, reflexivity and generalizability issues regarding this research will be considered.

*Chapter 4: Findings* will present the outcomes of the data analysis process for the reader. The chapter will start with the introduction of the results of the preliminary overview of the data, which is then followed by the findings identified through the in-depth analysis. The findings are divided into three major categories. Firstly, the Student-related category details the effects technology integration into schools has had on the learning practices of students. Namely, as to how students have started applying new approaches to information processing and homework preparation habits, how technology integration has contributed to the emergence of collaboration among students. Secondly, the Teacher-related category emphasizes the need and significance of professional development, which is already widely recognized in the existing literature. The section will also focus on the efforts of teachers to meet curriculum standards by means of using the technology provided, which in the absence of guiding documents, often called for ingenuity on behalf of teachers in terms of selecting and preparing materials for instruction. Third, findings regarding the shifts in classroom dynamics will be presented with the focus on newly emerged teaching-learning practices and the impediments technology integration into schools causes to classroom processes. The salience of these issues will be further demonstrated based on the opinions of the students who compared one-to-one classes with ordinary ones and drew out some of the distinctions between them. The chapter

concludes by presenting the findings about the parents' perceptions and attitudes towards the programme.

*Chapter 5: Discussion* will further explore the findings of the research. The findings presented in the previous chapter will be discussed in the light of the existing literature. The discussion will be conducted by analyzing how learning practices are changing within one-to-one classrooms and how teachers are individually developing new teaching methods. Moreover, the arguments concerning the philosophy of learning of the teachers and parents will be presented, focusing on the issues where their opinions oppose each other. The research question will be addressed in the last section of this chapter.

*Chapter 6: Conclusion* will summarize the present study and draw out the major issues that it has identified. It will also offer recommendations to be taken into consideration by educational leaders regarding the improvements and adjustments that can be made based on the findings of this research. Additionally, implications and recommendations for future research will be discussed.

## 1.6 Summary

The goal of this chapter was to familiarize readers with the context within which the study has been undertaken by providing general historical background in terms of the education system in Azerbaijan and recent attempts to integrate ICT into education. The chapter has also introduced the concept of a one-to-one computing initiative.

I have described here the rationale for undertaking this research, revealing my personal interest in the subject, as well as the value for practice, policy and research of studying the one-to-one programme. The essence of the present study has been introduced and the structure of the thesis laid out.

The following chapter reviews the existing literature related to one-to-one computing programmes worldwide and aims at identifying factors that influence one-to-one integration processes as discussed by other scholars.

# 2 Literature review

## 2.1 Overview

In this chapter, I will review and analyze the existing literature regarding the one-to-one initiatives worldwide in order to better understand the problematics of the field of study and to set a background for the present research. The literature I review pertains to the interests of this research and is aimed at revealing the factors that influence the implementation process of one-to-one programmes.

The scope of the literature to be reviewed was limited to publications that were exploring the issues related to one-to-one or similar laptop programmes implemented in a K-12 environment, which in a number of countries includes students from kindergarten to twelfth grade, or in terms of age – from 4-year-olds to 19-year-olds. The research related to one-to-one programmes is quite scarce; even though the first one-to-one programme was implemented in Australia, it is currently most wide-spread in the United States of America. Correspondingly, the majority of the studies undertaken originate from the US and explore the issues existing within different states of the country**.** Due to the diversity of laptop programmes, and the number of cultural, historical and economic factors that influence their implementation in each country the findings of one study are not readily generalizable to others. Since there was no particular research done in this field in Azerbaijan, this chapter relies on the studies completed in other countries of the world.

The majority of the literature reviewed is articles published in a variety of scientific journals, as well as books, reports, electronic resources and other miscellaneous publications. The results of this review will be presented in different sections. The second section offers an overview of educational change throughout the past decades and the role of computers in that context, with a particular focus on challenges and

problems associated with the introduction of technology into schools. The third section briefly touches upon the history of ICT usage in education and comments on the technology that has been used in the past, as well as the most up-to-date technology currently being used in classrooms. The section does not delve deeply into the nature of many diverse programmes that introduce ICT into schools, since one-to-one computing is one of such programmes and in accordance with the purpose of this study, the following sections all focus on the literature related to integrating technology into teaching and learning through one-to-one computing programmes. The fourth section will offer definitions of one-to-one computing as understood and generally accepted by different scholars working in the field. Then the factors that are considered to have a positive or negative influence on the implementation process of one-to-one programmes will be summarized. The next section will outline the perceived challenges in terms of one-to-one integration in K-12 environments and the section that follows will consider the role the least visible stakeholders, the parents, have in the implementation process of one-to-one computing programmes. The results of the literature review will be summarized at the end of the chapter.

## 2.2 Educational change

Any change in life, be it personal or professional, can be overwhelming and that is probably why we tend to try and maintain existing practices, remain in our comfort zone and avoid the unknown as much as possible. Schools are not an exception to this rule. Using similar methods again and again over the years probably forces teachers to think that what worked with one cohort of students, will definitely work with the next, and so, any mention of change, or innovation may become unwelcome to teachers. It also needs to be acknowledged that many models of educational change introduced serve political agendas, which are more imposed than offered, and are almost never sufficiently thought through. There are few “easy wins” when it

comes to changing schools, considering that most projects are ambitious and hardly come close to the goals set out by governments initially, and therefore certain obstacles are definitely expected along the way (Gray, 2010, p. 306).

The attempt at "fostering educational change" can in itself be a "highly risky enterprise" (Gray, 2010, p. 306). Resulting negative feelings can be evoked by any sort of change to existing teaching practices, especially when introducing computers in schools, which in almost all instances is a considerable departure from conventional teaching methods. Akker et al. (1992) claim that with the application of any change to educational settings, such as introduction of computers, crucial factors that affect this process should be taken into consideration; otherwise, this well-meaning initiative can lead to "disappointing experiences" (p. 65). In the review of the literature that follows, I will try to discuss some of the factors that can be influential in terms of educational change.

In this section, I discuss all types of educational change without limiting myself to the introduction of technology into schools, since as Grunberg and Summers (1992) suggest computer innovations and other types of innovations are affected by the same, or similar, factors. Additionally, the term 'educational change' used throughout this section should be understood in its broadest sense, covering any kind of change introduced in schools that is aimed at altering the conventional teaching methods.

I will start my discussion by reflecting on several problems of educational change identified by Hargreaves, Earl and Ryan (2003) that are similar to the factors influencing the introduction of technology in education that will be further discussed in this chapter. According to these authors, often the reason for introducing any kind of change is either not quite clearly demonstrated or poorly conceptualized as a whole; in other words, it is not obvious as to who will benefit from the introduced change or what the change will achieve for the stakeholders. Similarly, in some cases change may be too broad or on the contrary too limited, the former causing teachers

to be overwhelmed with workload and the latter making almost no difference at all. Another aspect that tends to cause complications is the lack of initial resources or their subsequent withdrawal – teachers need to plan for the change, but the limited amount of materials and time allocated leads to their inability to carry on without additional support, even though in many instances the whole effort might be "built on the backs of teachers" (p. 157). One more problem that the authors identify as being the most relevant in terms of introducing technology in schools is the lack of long-term commitment on behalf of programme implementers who are not willing to deal with the naturally occurring anxiety, frustration and despair associated with the first, experimental stages of change. Certainly, students, as very important stakeholders of any sort of change, have to be involved in the process from the early stages, because otherwise, they will avoid the unknown and adhere to the more familiar former ways of learning. The authors also recognize the significance of another group of stakeholders: due to being distanced from the processes of change, parents tend to oppose it as well, resorting to such drastic measures as negotiating special arrangements with schools and moving their children to different classes in order to protect them from the effects of innovation. On a wider scale, the significant problem is that in most cases, changes are pursued in isolation and this sort of disregard towards other related structures undermines the entire effort (Hargreaves, Earl, & Ryan, 2003). An example of this problem would be the introduction of computers into schools without making proper adjustments to the curriculum – a change in one aspect of teaching and learning may call for a change in all related ones.

Recognizing the factors influencing educational change can help to develop a systematic strategy necessary for introducing such change. To stress the importance of having a strategy Ellsworth (2000) uses an example of a theoretical classroom equipped with everything needed for learning to occur, but without a curriculum, or in other words a guiding strategy. Notwithstanding the fact that the classroom would have everything else necessary for teaching and learning, teachers would not know in what sequence to teach subjects and the learning process would not be effective.

On the other hand, having a strategy may be helpful, but schools are expected to renew their practices, continuously adopting new strategies. However, the training style of teachers, organization of schools, arrangement of educational hierarchy and political decisions create a system that is more prone to retaining old practices (Fullan, 1993). In order to resolve this dilemma, Fullan (1993) ascribes vital importance to making the goals and skills of change agentry explicit. "Change agentry" is a skill that he considers important for teachers to have in order to succeed in their profession. He then proceeds to suggest that: "to break the impasse, we need a new conception of teacher professionalism that integrates moral purpose and change agentry, one that works simultaneously on individual and institutional development. One cannot wait for the other" (Fullan, 1993, p. 12).

Being one of the most important stakeholders, teachers often end up in the spotlight of researchers involved in the field of educational change. By drawing on system psychodynamic theory, James (2010) explores psychological aspects of how change is perceived by individuals or groups. He focuses his study on the unwelcome change within educational setting and raises a notion that is interesting in the context of the present research: the way individuals treat an unwelcome change to existing practices – "they try to preserve and safeguard the predictability of life" (James, 2010, p. 49). Any change that alters familiar behavioral patterns may well result in various difficult feelings and bring anxieties. Such anxieties may have a negative effect on individuals' ability to adapt to change, their readiness and capacity to learn to adapt to a new reality (James, 2010).

Hargreaves et al. (2001) also focus on the role of the teacher in educational change when summarizing, somewhat humorously, the four perspectives on such a change:

1. **The Technical Perspective** – "If a teacher isn't able to do it, it can't be done!"

2. **The Cultural Perspective** – "If a teacher doesn't know how to do it or doesn't ultimately feel confident doing it, it can't be done."
3. **The Political Perspective** – "If a teacher won't do it, it can't be done."
4. **The Postmodern Perspective** – "If the teacher has too much to do, it won't be done well." (Hargreaves et al., 2001, pp. 116-123)

This focus on the power of teachers in terms of educational change indicates that they are the central figures in any attempt to introduce innovation into teaching. Other stakeholders also play a significant role in educational change, but the existing literature seems to indicate that the lion's share in any attempt goes to teachers. However, this does not imply that only teachers as separate stakeholders are being influenced. On the contrary, educational change affects the existing relationship between teachers and students, as well as teachers' relationship with the parents of those students and one another (Hargreaves et al., 2001).

When reflecting on children's and youth's opinions in relation to the research on educational change, Thomson (2010) dubs them "expert witnesses" (p. 810) who can provide valuable perspectives on the modes of educational change. Logically speaking, after teachers, students would be another group of stakeholders who experience educational change first-hand and have the 'inside knowledge', which not only cannot be ignored, but actually calls for special attention.

In addition, Hargreaves et al. (2001) emphasize the importance of school leadership in terms of educational change. Such an influence can actually turn out to be negative because school principals are responsible for maintaining stability in their respective schools, and therefore they might avoid any change to safeguard against unwanted complications (Ibid.).

In general, implementation of educational change implies putting into practice an idea, a programme or any set of activities that are new to the setting in which they

are being introduced or are unfamiliar to the people expected to change as a result of the initiatives. However, putting ideas into practice can prove to be far more complex than initially thought (Fullan, 2007).

## 2.3 ICT and education

It is easily observable in our everyday lives that Information and Communication Technology (ICT) is slowly taking over many aspects of daily activities, be it education, work or leisure. Even though it is almost unimaginable, particularly for the younger generation, to live a life without interacting with some sort of digital device, the integration of ICT into schools and universities still lags behind. This is especially true for developing countries.

Educational technology is a broad term that may include any resources used for the purpose of educating students (Pea, 1997). In the post-World War II era these comprised of technologies such as slide projectors, audiotapes, television, filmstrips and language laboratory equipment (Ibid.). However, from the early 1980s, the term 'educational technologies' has predominantly been used to denote computer-based learning, including all the peripheral accessories associated with computers. Correspondingly, the term includes the most advanced technologies that are used for educational purposes and are available in a given time (Pea, 1997).

Since computers were made available to the wider public, there has been a multitude of programmes implemented in schools worldwide aimed at facilitating teaching and learning through the means of technology. The very first instances of placing computers in the hands of students at schools date back to the early 1980s (Bingimlas, 2009). Computer usage for education purposes can, in fact, be traced further back to the early 1960s. However, at this stage, technology was used as a research tool and on quite a limited scale, while since the early 1980s educators

around the globe started using computers more as a teaching and learning tool (Brummelhuis, 1995).

According to Betcher and Lee (2009), while the computer is a 'revolutionary' learning tool, the interactive whiteboard is perceived as a second revolutionary teaching tool after the blackboard. In line with Beeland (2002), interactive whiteboards have been in use in classrooms since the late 1990s and their major functionality is projecting an image from a computer directly to the board with the possibility of controlling the projected image through touch, without going back to the computer. Interactive whiteboards can be used in a number of ways, but in order to make them appealing, interesting and engaging for students, they can be used through the three modalities of learning: visual, auditory and tactile learning, the latter implying controlling technology with touch (Beeland, 2002). The interactive whiteboard technology has been developed with the education sector in mind and all the producers of such products are trying to remain responsive to the needs of this market. The focus tends to stay on the board itself when discussing interactive whiteboards, but with the other rapidly evolving accessories, such as wireless slates and tablets, interactive voting devices and interactive text response systems, the focus shifts from the board itself more to its interactivity (Betcher & Lee, 2009).

In addition to interactive whiteboards, another piece of technology widely used in classrooms is the Classroom Response System (CRS). Throughout the literature, CRSs are referred to in many different ways, such as audience response systems, voting machines, wireless keypad response systems, classroom communication systems, electronic response systems and classroom response systems (Fies & Marshall, 2006). Notwithstanding the many names the system has come to be known by across the literature, the core functionality is almost the same. The way a standard CRS works is by having students send their responses to questions through transmitters, where a receiver collects these inputs and a specially designed programme installed on a computer aggregates and interprets this input (Fies & Marshall, 2006). The most practical way to use this technology is to offer students

multiple-choice tests, where answers can be provided simply, with a click of a button and quickly analyzed by a central computer.

With the gradual development of technology, the programmes introduced in schools have been becoming more and more complex in nature. Most of these programmes share certain commonalities in that they aim at making teaching and learning processes more streamlined, allowing wider access to information to students and teachers. In attempts to ensure that all students had access to computers for education purposes, one-to-one programmes emerged as the next logical step from the previously existing practice of creating computer laboratories in schools. One computer per student, or one-to-one computing initiatives, as such programmes are more commonly known, represent a widely used method of integrating technology into education. Since integrating ICT into education takes many diverse forms, the literature reviewed in this chapter focuses primarily on one-to-one programmes.

## 2.4 Defining one-to-one computing

As mentioned above, the introduction of computer technology into schools dates back to the 1980s. However, the practice was quite scarce and limited to the educational establishments that could afford the expensive equipment, which in turn led the schools to place them in computer laboratories in order to make them available to all the students (Penuel, 2006). Nevertheless, such concentrated usage of computers does not ensure the frequent access of students to the technology. Adelman et al. (2002) reported that teachers found it challenging to arrange time to take students to the computer laboratory.

Therefore, it is far more productive for each student to have access to a personal computing device, in order to use it for study purposes and have increased access to information. It is noteworthy that visionaries like Seymour Papert, were allowing for

such a possibility back in the 1980s (Papert, 1980). Roschelle and Pea (2002) suggest that wider access to computers in schools lets both students and teachers use them more frequently, integrating them in various settings, as opposed to the occasional usage when schools are provided with single computer laboratories. Such frequent access is described as "one-to-one" (Bielefeldt, 2006), which in the existing literature is perceived differently compared to "ubiquitous computing". According to the definition offered by Weiser, Gold and Brown (1999), the nature of ubiquitous computing, as opposed to one-to-one, refers to a technologically rich environment where an individual interacts with multiple mobile computing devices in different settings.

In contrast to ubiquitous computing, one-to-one programmes are meant to bring the student - laptop ratio to 1:1, hence the name of the programme. The literature I reviewed offered various definitions of one-to-one computing, however, the key characteristic feature of all those remains equipping each student with an individual computing device, be it a laptop, a netbook, a handheld device, a tablet computer, or some other such personal device. (Penuel, 2006; Zucker & Light, 2009; Center for Digital Education, 2008; Sell, Cornelius-White, Chang, McLean, & Roworth, 2012).

The first one-to-one programme was launched in 1989 at the Ladies' Methodist College in Australia (Bebell, 2005) and since then has spread to a great number of cities and countries around the globe. Notwithstanding the high costs of such programmes, educational leaders are still allocating funds to integrate technology into learning and teaching, believing that it will assist the process of educational transformation by developing students' 21st century skills.

Even though the technology has become an essential part of our everyday lives, computers did not take over the classrooms as quickly as they did within workplaces. The fact that the majority of the programmes usually emerge only in selected grades and schools of a country proves that they still remain quite costly.

Ideally, one-to-one computing programmes are meant to provide students with constant (anytime and anywhere) access to computers and the Internet, and therefore students should be owning a device. However, actual practice does not always correspond with the programmes' conception desired by the implementing authorities. For example, the issue that seems to often arise in the schools of the USA is whether students can take computers home and if computers should be leased or sold to them (Penuel, 2006). Although initially they were conceived as similar programmes, such a discrepancy in opinions and attitudes creates an environment, where one-to-one programmes take different shapes and forms even if they are being implemented within a single country or even a city.

A number of distinct features taken together in their entirety make up one-to-one computing programmes and each can be discussed extensively. These features are captured in the following summary by Sell, et al. (2012) which in itself is adapted from Penuel (2006) and Zucker & Light (2009). The following are the defining features of one-to-one computing programmes adopted for the purposes of the present study:

> - *"wireless;*
> - *accessible to the Internet and at least one local school network;*
> - *equipped with software and support for classroom instruction, homework, tests, feedback, presentations, social networking, and productivity applications (e.g., word processing and spreadsheets);*
> - *available for use 24 hours a day, 7 days a week; and*
> - *compatible with digital tools and resources such as online courses, interactive whiteboards, and probes for data collection and science experiments*." (Sell et al., 2012, p. 2)

The above definition precisely illustrates the technological part of a one-to-one programme, but there certainly are several other aspects that significantly influence technology integration into education, especially if we consider that one of the main goals is to bring change in traditional teaching methods, implying a shift from a teacher-directed to a more student-centered approach, as described in a publication called "A Complete Guide to One-to-One Computing in the K-12 Environment" authored by and Center for Digital Education (2008). Although one must assume that the document is fundamentally commercially motivated, it does provide a useful overview and summary of ubiquitous and one-to-one computing and reports on different cases from US schools. It also reflects on the issues related to teacher support within such programmes and the financial aspects of the implementation.

The goals of one-to-one programmes may vary from country to country and between different implementing institutions, but the majority bear resemblance in terms of characteristic features and aims. In addition to the provision of computers and Internet access to students, Penuel (2006) in his research synthesis has summarized four basic outcomes that such programmes try to achieve:

- Improvement of academic results;
- Closing the digital gap and increasing access to electronic resources;
- Supporting regional economic development by equipping students with necessary technological skills;
- Changing the quality of teaching by introducing a "student-centered" approach (Penuel, 2006).

The report produced by the Center for Digital Education (2008) describes a number of different aspects that may influence the implementation of one-to-one programmes and consequently the achievement of the outcomes described above, such as *"*environmental and cultural readiness, advanced planning, teacher and staff preparation, professional learning and evaluation" (p. 6).

The careful consideration of the above-mentioned factors together with the provision of laptops and access to the Internet should assist students in: using school portals for homework and assignment submission, implementing various online research projects, exchanging information and collaborating with peers, developing critical thinking skills (Center for Digital Education, 2008). Teachers involved in one-to-one programmes are expected to: give individualized assistance to students, use the online assessment tools to monitor progress, adhere to the requirements of the curriculum while integrating online learning resources into their teaching and try to expand the learning process outside of classrooms (Center for Digital Education, 2008).

The key features of one-to-one computing mentioned above explain the increasing interest in the programme. However, as important as the usage of technology in educational facilities might sound, due to the high cost, the factors influencing the development of such programmes require close attention from educational researchers.

## 2.5 Factors influencing implementation

Having the identification of factors that influence the infusion of one-to-one computing into teaching and learning as a primary focus of this research, I tried to review the existing literature to determine what kind of features of one-to-one have already been identified by other scholars. Bebell and O'Dwyer (2010) suggest that the factors potentially affecting the implementation of one-to-one programmes could be quite complex. Therefore, the task of correctly identifying the roles of different stakeholders in technology integration programmes is of central importance.

Tedre et al. (2011) criticize a wide-spread belief that one-to-one programmes should not be concerned with non-technical aspects, be it teacher training, curriculum or

content development. On the contrary, they identify nine considerations which they deem crucial for successful implementation of one-to-one:

- "pedagogical framework;
- teacher training;
- support model;
- content in local languages;
- contextual understanding;
- parental agreement and support;
- monitoring and evaluation;
- administrative and political support;
- sustainability" (p. 4).

The aspects listed above are not directly related to technology usage *per se*, but according to Tedre et al. (2011) are very important in terms of technology integration into education. Throughout my research and the review of the existing literature, I also encountered a number of issues that were not necessarily technical in nature, but at the same time carried quite as much weight in terms of their urgency and importance.

I would like to reiterate here that considering the ever-increasing integration of one-to-one computing into education around the globe currently, the existing research is not as large in its body as one would expect. However, similar themes emerge through works of different researchers. Below I explore the existing literature to reveal factors influencing the implementation process of one-to-one computing and summarize them under various sub-headings for the purposes of clarity and ease of perception:

- Frequency of computer usage;
- Student attitude;

- Shift from teacher-directed education to a learner-centered one;
- Technical assistance provided by students;
- Teacher role;
- Changes in instruction;
- Teacher beliefs;
- Professional development;
- School leadership.

### *Frequency of computer usage*

The provision of computers to students and teachers is merely the first step undertaken by educational leaders, but in order for a programme to yield any results, the technology clearly has to be used. A number of studies address the implementation of one-to-one programmes by looking at the frequency of computer usage and the purposes for which students utilize them (Daitzman, 2003; Warschauer, Grant, Real, & Rousseau, 2004; Zucker & McGhee, 2005). Some studies reveal that students involved in technology-infused classes tend to use computers much more frequently and for diverse activities than their peers in non-laptop classes (Light, McDermott, & Honey, 2002; Trimmel & Bachmann, 2004).

Students' usage of technology in classrooms depends on the availability and good working condition of the devices. If technical problems associated with computers occur frequently, this has the potential to hinder classroom processes. Donovan et al. (2010) observed three different configurations to learn how the availability of devices in classrooms affects the usage of technology. The researchers found that in the case when almost all the students brought their laptops to class and laptops were the primary tool for learning on that day, they tended to remain on-task; but in the remaining two instances, when in one many students did not bring laptops to classroom for various reasons and in another, teachers and students did not use laptops much, since students were not bringing laptops on a regular basis technology

use was limited or minimal. The authors of the study conclude that access to technology increases the motivation for technology usage, however, they state that even though technology usage may be frequent, it should not be assumed that such a usage occurs strictly for academic purposes and at times, computers are used for leisure activities such as games and casual web surfing.

Larkin (2011) employed a four-group quasi-experimental design applying quantitative and qualitative research methods to determine how different levels of computer usage affect classroom processes. The results of his inquiry are presented in Table 2.1.

| Class | Ratio | Days per week | Usage per week (hours) |
|---|---|---|---|
| A | One-to-one | 5 | 31 |
| B | One-to-two | 3 | 41 |
| C | One-to-two | 5 | 41 |
| D | One-to-one | 3 | 28 |

*Table 2.1. The frequency of computer usage described in Larkin's study*.

The study found that in the classrooms with shared netbooks the number of hours spent on them was higher. By employing qualitative methods, Larkin also found that in classrooms where students had individual access to netbooks (classrooms A and D), the devices were mostly used as "digital textbooks", but when students had to share netbooks (classrooms B and C) there arose a need for diverse types of activities for students - during netbook usage and for those who were not working on netbooks. Based on these findings, Larkin concluded that the latter configuration steered greater collaboration among students and new learning activities, and therefore he recommended that a one-to-two ratio of netbooks distribution has a greater potential to stimulate better learning outcomes.

### *Student attitude*

Additionally, a number of researchers state that the provision of laptops within a one-to-one setting contributed to an increase in engagement. (Suhr A. K., Hernandez, Grimes, & Warschauer, 2010; Lowther, Inan, Ross, & Strahl, 2012; Storz & Hoffman, 2013). Indeed, studies report that students enjoyed writing on computers, searching the Internet, working on presentations and using multimedia tools to complete assignments (Suhr A. K., Hernandez, Grimes, & Warschauer, 2010). According to teachers' reports from a study conducted by Maninger and Holden (2009), students in one-to-one classes allocated more time to working together on instructional tasks, collaborated more around technical problems and the whole teaching-learning process was more effective.

Lowther et al. (2012) conducted a mixed-methods descriptive and quasi-experimental study, which aside from direct classroom observations and student performance assessments, also used surveys to analyze students' attitude towards technology in K-12 schools in Michigan. The results of student surveys were quite positive and revealed that most students were willing to use laptops next year as well. The majority of students were happy that they had a chance to use laptops and thought that laptops helped to better their research skills, contributed to their ability to do work assigned at school, increased interest in school and belief in securing jobs in the future. Nevertheless, the majority of the surveyed students did not consider that the laptops motivated them to improve their grades, helped memorizing or improved their test results and writing skills (Lowther et al., 2012). Oliver and Corn (2008) conducted a quantitative study to understand students' viewpoints on technology before and after implementation of a one-to-one programme and found that students reported greater satisfaction with technology usage at school, as opposed to the period before implementation.

Similarly, Storz & Hoffman (2013) reported that both students and teachers had positive opinions about the one-to-one programme. Through individual informal

interviews with teachers, the researchers found that the one-to-one programme allowed students to be more creative, which in turn resulted in increased motivation and engagement. Students stated that after the implementation, they were more interested in school and reflected on the importance of constant access to information.

Some researchers also evaluated the performance of students during assessments, but the results of such studies are not straightforward (Clariana, 2009; Lowther, Inan, Ross, & Strahl, 2012). For example, Lowther et al. (2012) compared eight schools that were using laptops to eight other non-laptop schools and found that the difference in performance was not significantly definitive in favor of any of the two groups. According to this study, four laptop schools showed much better results than the other four control non-laptop schools in math and writing assessments, however, students in three of the non-laptop schools showed better results than their counterparts from laptop schools in Math, English and Writing. Clariana (2009) revealed that the laptop students performed far better on Quarterly Benchmark examinations than the non-laptop students, however, the results were not the same on the state examination.

### *Shift from teacher-directed education to a learner-centered one*

Among many diverse teaching methods, Pedersen and Liu (2003) draw a distinction between the teacher-directed and student-centered methods by explaining that in a teacher-directed approach, teachers set out objectives to be reached and then through certain activities assist students in meeting those objectives. The student-centered instruction method on the other hand focuses more on the introduction of a central problem or an issue and a teacher assumes the role of a facilitator who helps students arrive at the right answer by problematizing their expressed ideas.

The vast amount of information made readily accessible to students with the introduction of one-to-one computing serves as a tool for making classroom

processes more student-centered. With the use of technology, students are becoming free to explore diverse sources of information and they do not depend on teachers' guidance so much. Maninger & Holden (2009) have explored a one-to-one initiative in fifth through eighth grade classes in a private K-8 school in the US and found that during classes the majority of teachers' time was dedicated to directing and facilitating/coaching students. The move to student-centered environments within classrooms may be noticeable in some instances, but the existing research also points out that this is far from a universal phenomenon. In some cases, teachers are in an "adaptation stage of technology adoption" (Sandholtz, Ringstaff, & Dwyer, 1997 see Penuel, 2006, p.336). Penuel's (2006) interpretation of the statement illustrates that even though teachers are modifying traditional teaching strategies and encouraging students to learn more independently, there still remains much to be done, in order to achieve a truly student-centered environment. The reason he gives for the lack of such achievement is the fact that teachers have not yet begun implementing appropriate strategies like project-based learning. Pedersen & Liu (2003) also state that moving from teacher-directed instruction to a more student-centered environment is quite difficult to implement. One reason for this might be that generally teachers are resistant to pedagogical change (Richardson, 1990). It is also possible that particularly in the system that currently prevails in much of the US of continuous standardized assessment of students, teachers may feel obliged to 'teach to the test' rather than engage in more project-based learning.

### *Technical assistance provided by students*

Another aspect of the one-to-one environment that proved useful for programme implementation in many cases is the engagement of able students in the process of consulting and tutoring both their peers and teachers. There are a number of studies that report on technical assistance provided by students, both to their peers and to the teachers as well (Light et al., 2002; Silvernail & Harris, 2003; Silvernail & Lane, 2004; Fairman, 2004; Bonifaz & Zucker, 2004). Bonifaz and Zucker (2004) report on 'help-desks' run by students that have been established in the schools of Henrico

County, USA. In this instance, students were taking turns to assist each other at the help-desk earning community service points, which served as an added motivator. This sort of supportive environment helps the process of technology integration move along with slightly fewer problems. However, "teachers need more training and support for integrating technology when it comes to day-to-day classroom instruction so that integration is more successful across most classrooms" (Rabah, 2015, p. 27). Nevertheless, the existing research illustrates that overcoming technical problems together created a different setting in which teachers and students help each other.

### *Teacher role*

The issue of student-centeredness brings up another significant aspect of classroom processes, which can be captured within the term "teacher role". It entails the active participation of teachers in both teaching and the learning process. In the context of an innovation such as the introduction of technology in classrooms, a teacher's role gains even greater significance. Based on an analysis of four empirical studies, Bebell and O'Dwyer (2010) assert that the teachers' role in the success of the one-to-one initiatives is indispensable and that often teachers are held accountable for the success of the programme implementation. Their claim is further supported by the fact that teachers have constant control of students' usage of computers during classroom processes throughout the entire day at school.

While assessing teacher attitudes towards the programme, Lowther et al. (2012) analyzed the responses of 380 teachers and illustrated in their study that in general teachers were positive towards one-to-one and they believed that it improved the instruction in classrooms. The surveyed teachers also agreed that laptop use positively affected students' learning and achievement, increasing the level of collaboration among students, and making the teaching process more student-centered and interactive.

## *Changes in instruction*

Warschauer (2007) identified five important changes that the one-to-one programme brought in terms of instruction:

- instant availability of information;
- increase in independent learning;
- ease of research;
- increase of empirical investigations;
- better opportunities for in-depth learning.

Considering that the success of a programme to some extent hinges on teachers' beliefs and attitudes, these changes can be seen to increase the significance of a teacher's role in one-to-one classes.

## *Teacher beliefs*

A number of scholars researching the one-to-one environments agree that teachers' attitudes, or "teacher beliefs", is a significant factor that influences the frequency of technology usage in classrooms and the overall process of one-to-one programme implementation (Windschitl & Sahl, 2002; Lane, 2003; Trimmel & Bachmann, 2004; Vannatta and Fordham, 2004; Ertmer, 2005; Mouza, 2008).

Prior to commencing discussion of teacher beliefs, it is relevant to clear up the ambiguity surrounding the term. As Ertmer (2005) suggests, the difficulty in defining teacher beliefs lies in understanding how beliefs differ from knowledge. She then continues to explain the difference by stating that teachers may have good knowledge as to how spreadsheets can be used, but whether they use them for record-keeping or not depends on their belief in technology (Ertmer, 2005). This example shows that teacher beliefs supersede their knowledge in importance in terms of deciding when to use technology.

Teacher beliefs about the usefulness of technology and innovation is probably the most important factor in integrating one-to-one programmes into teaching and learning because, naturally, the success of such programmes hinges on the usage of the technology that is provided. It has been found that teachers' interrelated belief systems about best teaching practices, about learners in their school and the role of technology in students' lives influence the ways they integrate computers into their instruction (Windschitl & Sahl, 2002).

In many cases, the introduction of technology may be a large change, which is not always welcomed by all teachers, because it requires additional time and hard work. However, researchers agree that the extent to which teachers support such a change, their overall attitude and their readiness to accept a change, are all important factors that affect the successful implementation of innovations (Klieger, Ben-Hur, & Bar-Yossef, 2010).

We have spoken about the importance of teacher beliefs in terms of frequency of technology usage within classrooms and we have leaned towards indicating that positive beliefs result in more positive outcomes, but the positions of researchers are not all that straightforward. Ertmer (2005) also raises an issue of "negative beliefs" (p. 28) of teachers concerning their own technical skills. Raulston (2009) claims that not all teachers can be expected to be enthusiastic about the introduction of technology and some of them might be opposed to the idea of using laptops for instruction due to the lack of confidence in their abilities to effectively scaffold classes through those means. In other words, such lack of confidence in teachers can be interpreted in terms of "negative beliefs", in line with Ertmer's (2005) assessment.

The notion of teacher beliefs is also closely connected to the mastery of the use of technology. Some teachers might find it easy to use, while others might experience greater issues, which overall reflects positively or negatively on their attitude towards using technology for instruction. Windschitl and Sahl (2002) suggest that

technology use in a classroom requires more thoughtful consideration in relation to teachers' beliefs and correspondingly professional development programmes should not be focused merely on mastering skills with computers, but rather should be concerned with teachers' attitudes towards technology integration processes. This point becomes particularly important when we consider that technological change can be perceived quite negatively by some teachers. For example, McGrail's (2005) research conducted in middle and high schools found that in terms of instruction, teachers pointed out certain disadvantages related to computer use. They reflected on pedagogical concerns in relation to students, as well as concerns about methods of instruction and language, and spoke about administrative challenges and ethical issues. The teachers did not see how computers could aid their instruction methods within classrooms and did not know how the innovation could be integrated within the curriculum. This indicates that negative beliefs of teachers towards the usefulness of technology may have as much influence on technology integration as do the positive beliefs.

## *Professional development*

Professional development is in itself a very important factor that, as many scholars agree, has a great influence on the success of technology integration into teaching and learning (Penuel, 2006; Holcomb, 2009; Raulston, 2009; Bebell & O'Dwyer, 2010; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Fleischer, 2012; Klieger, Ben-Hur, & Bar-Yossef, 2010). Wells (2007) thinks that professional development should not be limited to mere training and that its goals should be more far-reaching**,** employing formal and informal means to help teachers acquire new skills, improve pedagogy through peer support, create their own practices, and participate in training.

As this definition suggests, professional development within one-to-one programmes encompasses several diverse components. However, the overview of the existing literature indicates that the most fundamental element of professional development is

considered to be training sessions for teachers, both prior to the implementation, as well as throughout the programme. Some researchers find it important to have teacher training conducted at the commencement of a programme (Holcomb, 2009; Bonifaz & Zucker, 2004). However, others go beyond this simplistic view and assert that exposure merely to technology training is not enough for teachers to become passionate about the use of it, and that high-quality professional development is necessary to engender such an interest (Raulston, 2009). At the same time feeling uncomfortable and uncertain about their technology skills is what prevents some teachers from actively using computers for teaching (Raulston, 2009). On the other hand, Holcomb (2009) reports that teachers involved in programmes aimed at implementing technology into teaching and learning saw an increase in technology proficiency, which could mean that it is possible to increase technology competence through practice.

Throughout the history of one-to-one implementation, professional development has always been integral to the programme success. Using a national probability sample of 1,027 teachers of math and science, Garet et al. (2001) conducted a large-scale empirical study to better understand how different characteristics of professional development affect teachers' learning. The research identified three basic features of professional development that have affected teachers' knowledge and skills, as well as brought changes to teaching and learning: "(a) focus on content knowledge; (b) opportunities for active learning; (c) coherence with other learning activities" (p. 916).

The literature cited above in relation to professional development regards it as a significant aspect of one-to-one programme implementation and success. However, Bebell and O'Dwyer (2010) go even farther by predicting that with the increase in the popularity of one-to-one programmes, the quality and depth of teacher preparation will become one of the main predictors of such programmes' success. This claim is particularly interesting for the present research, since I am aiming at identifying the factors that influence the integration of one-to-one computing into

teaching and learning, and the existing literature so far clearly confirms that professional development is already considered as a significant factor. To further support this assessment, I would like to refer to Klieger, Ben-Hur, & Bar-Yossef (2010) who state that "Teachers' PD [Professional Development] is critical when it comes to leading and assimilating change" (p. 189).

### *School leadership*

Leadership is another factor that has been found to be influential to the successful integration of technology in a classroom (Anderson & Dexter, 2000). Besides the reports of numerous scholars, it is almost obvious that school principals or other educational leaders of higher rank will have a substantial influence on technology integration. Stavert (2010) summarizes the existing research stating that technology integration is successful in schools where strong leadership established certain guidelines, polices and collaborative cultures.

Through reviewing a wide range of studies, Kim and Marshall (2009) have also come to the conclusion that leadership is very important for a successful integration of technology into teaching and learning. In the study conducted by Lin, Lin and Huang (2009) the role of the school principal in the process of technology integration into teaching was viewed as 'critical' by the programme participants.

This sort of appraisal of leadership support creates a basis to regard it as an important factor directly influencing the integration of technology into teaching and learning and lessening challenges hindering the integration process. The literature review reveals many such challenges in various one-to-one programmes around the world, which I try to summarize in the following section.

## 2.6 Challenges in one-to-one integration

Integrating technology into teaching and learning in schools is quite a large educational change and it is not surprising that it is almost never implemented as smoothly as initially envisaged. The process of integration brings a number of challenges that should ideally be addressed from the start. However, the overview of the existing literature reveals that even if in some instances certain preventive measures are taken ahead of time, technical problems still emerge during the implementation stage, which often pose a threat to the programme success. Such technical problems need to be resolved in a timely manner, but professional technical assistance is not readily available for teachers, which proves to be an enormous challenge. In addition to these issues, the existing studies point up the problems in terms of integrating one-to-one into curriculum. All these challenges have been identified by other scholars and are summarized in the literature review that follows.

### *Technical problems*

Donovan, Hartley, & Strudler (2007) found in their research that teachers were primarily concerned about their own role in adopting the one-to-one initiative and, in general, they were worried as to how the programme would affect them personally. The secondary concern was mostly about the technical side of the programme implementation: the actual use of laptops, the search for and application of e-learning resources (Donovan, Hartley and Strudler, 2007).

By surveying and interviewing students and teachers at the end of each academic year during four years, Lei (2010) found that initially laptops were used more for games and social interaction, but as the years passed the laptop usage became part of everyday life and the complexity of assigned projects increased. More complex projects required more advanced applications and with the increased usage, laptops started to break down more often. This created an increased demand on technical

support, but, as Lei observed, the provision of technical support was decreasing over time. As a result of frequent technical problems, the students started viewing laptops as more of a distraction rather than a benefit to their studies.

Bielefeldt (2006) identifies another set of issues related to laptop usage in classrooms, such as the short life cycle of batteries, the extra technical support required, wireless connectivity-related problems, teacher preparedness to manage laptop labs, and, most importantly, the integration of mobile technology into curriculum and instruction. These widespread issues need to be addressed at the very beginning of one-to-one programme implementation, and the need for technical support does not disappear with time in laptop programmes, on the contrary, as the equipment ages, the number of related technical issues usually increases (Stavert, 2010).

### *Absence of technical support*

Therefore, concerns related to technical support, or more precisely, the absence of technical support for teachers and students in order to make the classroom processes flow unhindered are frequently discussed in the existing literature. For example, teachers in the Maine Learning Technology Initiative, a state-wide programme still being implemented in the USA, in which all students throughout grades 7 to 12 are provided with personal learning technology in the form of laptops (Maine.gov, 2013), confirmed that the shortage of technical support was one of the major problems hindering the integration of laptop technology into instruction (Silvernail & Lane, 2004).

Holcomb (2009) even reports cases where schools abandoned the laptop programmes due to the problems that emerged in the process of implementation. However, the stakeholders of such programmes expect it to be successful and in order for such success to be attained the provision of technical support is ‘critical’ (Lei, 2010).

Not only is the actual absence of technical support a problematic aspect of one-to-one programmes, but the understanding among teachers that such support is not readily available, even if they do not need it immediately, creates an environment where they refrain from using technology which impedes the integration process (Molina, Sussex, & Penuel, 2005). Absence of proper attention to the provision of technical support on behalf of programme implementers and educational leaders leaves teachers alone with the frequently arising problems. Considering the need for training and professional development discussed earlier, teachers cannot be expected to alleviate such issues by themselves.

### *Curriculum integration*

The review of literature also identified an issue that tends to emerge in a number of studies – the integration of one-to-one within the curriculum. While most of the literature focuses on one-to-one programmes implemented in the USA, it is important to bear in mind that depending on the implementing country the requirement to adhere strictly to the curriculum may vary. Fleischer (2012) determines two different directions in addressing curriculum related issues in one-to-one classes: some teachers are concerned about curriculum changes resulting from computer-assisted instruction, others are designing a completely new curriculum to integrate technology into it. For example, studies report that students are not afforded a proper chance to fully explore new media, just because teachers are trying to keep on scaffolding classes by old, lecture-style methods in order to strictly follow the curriculum (Fleischer, 2012).

It is one side of the story that curricula are affected by the introduction of technology into classes, but on the other hand, in some instances the frequency of technology usage is in turn affected by the requirements written out in curricula. For example, when teachers think that any particular introduced innovation is distanced from, and has nothing to do with, the existing curriculum, they try to avoid it (Sarama, Clements, & Henry, 1998). Therefore, the process of learning how to teach on a

laptop programme requires learning how to integrate technology into the curriculum (Franklin, 2007).

Despite the problems related to the introduction of technology and its effect on curriculum, some researchers like Holcomb (2009) state that 70% of teachers surveyed reported on the effectiveness of technology use in meeting the curriculum goals, and moreover in individualizing their curriculum to assist particular needs of students. Similar results are reported from the State of Maine, USA, where Silvernail and Lane (2004) found that over 75% of teachers considered having laptops as a supporting tool in meeting state-wide learning standards.

In general, the educational process is affected by the use of technology only in the case of thorough integration with curriculum and teaching and for this purpose teachers often require "examples of effective technology-based learning activities and curriculum resources" (Bielefeldt, 2006, p.3).

Another aspect of one-to-one programmes that can be considered a challenge is gaining the support of the community and especially the parents of children participating in such programmes. A number of researchers indicate the importance of parents' role in the overall implementation process and the potential success of one-to-one programmes; therefore the next section explores this particular issue.

## 2.7 Parents' role in the implementation

The least visible stakeholders of one-to-one programmes are often the parents, but at the same time they may have a significant influence on the programme implementation. Some researchers consider parental support of one-to-one programmes important since they share responsibility for the provided equipment and it is in their power to encourage children to use it properly (Spires, Oliver, &

Corn, 2012). Others also regard parents' engagement in programme implementation as crucial, since such an engagement could potentially contribute to increased interest in learning, as well as "student exploration and self-expression" (Sell et al., 2012, p. 21). Parents' involvement by viewing students' daily homework and evaluation results would also increase their success in learning (Center for Digital Education, 2008).

Some scholars report that in certain programmes parents, as well as community members, became involved in the teaching and learning process (Rockman et al, 2003). In those cases, parental influence on computer usage resulted in curriculum modifications and improvement of their own digital-literacy skills through active participation in daily classroom activities process (Rockman, 2003).

Sell et al. (2012) suggest that in order to be more successful, educational leaders should actively listen to parents, and adjust their practices and build consensus with parents alongside educators and community members. Such active communication should be ongoing both before and during the implementation of a one-to-one programme.

As illustrated above, the involvement of parents in the implementation process of one-to-one programmes is considered important, but the degrees of engagement vary across programmes as reported by different researchers. Even though Maninger and Holden (2009) reported, based on teachers' opinions, that after the implementation of one-to-one parental involvement was still lacking, Rockman (2003) suggested that in schools participating in laptop programmes, involvement of parents had increased. Such a discrepancy in parental involvement in the one-to-one programme implementation is understandable, since the engagement may depend on a wide array of reasons and specific characteristics of a programme. Hence, it seems interesting to pay careful attention to such issues when studying the processes of one-to-one programme implementation.

On the other hand, the motivation of one-to-one programme managers to promote parental engagement in the processes may vary as well. The Abell Foundation (2008) reports such motivation has manifested itself in states and districts engaging parents for the sole purpose of having supervision over the equipment provided to students.

Since, as opposed to teachers and students, parents are not present in school, it becomes interesting to explore how they receive information about the ongoing processes within one-to-one classrooms. Some researchers report that the provision of laptops increased the number of instances of teachers' communication with parents by e-mail (Bebell & Kay, 2010; Lei & Zhao, 2008). However, the existing literature does not explore deeply what is being communicated. Zhao and Frank (2003) report that teachers were most frequently using computers to communicate with parents and to prepare for instruction. This study does not make an inquiry into the characteristics of such communication either. One conclusion that Zhao and Frank (2003) do make is that teachers communicate with parents using computers more often than they communicate with students. Weston and Bain (2010) talk about the necessity of providing feedback from an entire community, including parents, in order to set up aims and procedures for implementation and communicate to parents the ways in which they can assist in successful results.

It is always essential to reach out to parents to guarantee their "buy-in and support" for one-to-one programmes (Livingston, 2009, p. 34). In the Great Maine Schools Project (2004) parents were surveyed to learn more about their children's school experience due to the introduction of one-to-one. The parents reported the most important changes as increased motivation for doing schoolwork, as well as greater interest towards classes and improvements in grades. Within the same survey, less than 10% of parents reported noticing a decline in the school experiences of their children since the commencement of the one-to-one. Such observations of parents can surely provide a clearer understanding of the effects laptop programmes can have on students and it would be an interesting aspect to further explore when studying one-to-one programme implementation processes.

## 2.8 Summary

The main purpose of this chapter was to review the existing literature on one-to-one programmes worldwide and identify the factors that were revealed by other scholars. The majority of studies reviewed here originate from the USA and explore the processes of one-to-one programme implementation in US schools. Most authors seem to agree that as the name suggests, the core defining factor of one-to-one computing programmes is its distribution ratio, i.e. one computing device per child, as well as uninterrupted access to the Internet and the availability of the devices anytime and anywhere.

The factors that tend to influence one-to-one programme implementation across the globe turn out to be quite complex and at times closely intertwined. As can be logically expected, technology usage in classrooms brings about a host of technical issues, which end up significantly altering the planned forms of implementation. Such technical problems include, but are not limited to: battery charging issues, the short life-cycle of batteries, wireless connectivity issues, etc. As the literature review revealed, easily manageable technical problems can be handled by tech-savvy students in schools. However, this does not completely remove the need for outside technical support, the absence of which in most cases hinders the programme implementation.

Other than the technical issues, the literature review identified a multitude of additional factors that often prove influential to the implementation process of one-to-one programmes worldwide. Among such factors is the positive or negative attitude of students towards the programme, or in other words their satisfaction or dissatisfaction with the infusion of technology in the classroom.

A similar factor that can have a decisive influence on the usage of technology in teaching processes is the attitude of teachers towards the programme, or as most scholars dub it, "teacher beliefs". The beliefs they hold towards one-to-one influences their decisions for frequency of technology usage within classes. The lack of preparedness of teachers to infuse technology into their everyday teaching may result in them altogether avoiding this responsibility, which raises the issue of the importance of professional development. Professional development is also considered to be a significant factor influencing the implementation of one-to-one programmes and there is a certain controversy among scholars as to what components should be included in order to make teacher professional development more effective, whether they should be oriented to instant results in terms of practical technology usage exercises or cater for more far-reaching development of skills.

Another aspect that affects the implementation of one-to-one programmes is the parental attitude towards the entire process. Since they potentially have direct control over the time and frequency of computer usage by their children outside of the classroom, their personal preferences may influence the success of the programmes.

Similarly, the decisions made by the leadership, which includes programme implementing authorities, as well as the executive branch of the implementers, i.e. school administration, can readily influence virtually all aspects of one-to-one computing. It is in the power of implementing authorities, such as government agencies, as well as school administration and to some extent teachers as well to modify curricula at will, which affects the modes and characteristics of one-to-one programme integration into teaching and learning.

Another interesting aspect of one-to-one programmes revealed while reviewing the existing literature was that the integration of technology into classroom processes tends to contribute to the engagement, frequency and variety of computer usage; and the frequent use of technology has also encouraged the classroom processes to take a more student-centered direction. Even though researchers refrain from claiming that

technology has transformed the teaching methods from a teacher- to student-centered one, there still are many who raise and extensively discuss this issue.

The literature reviewed, and summarized here, serves as a background to the study and the identified factors that affect the implementation process of one-to-one programmes globally will be revisited later on in the Findings and Discussion chapters of this thesis, but first the following chapter outlines the methodology used to undertake this study.

# 3 Methodology

## 3.1 Overview

The methodology chapter will start by outlining the aims of this study and move on to the description of the researcher, discussing his personal and professional ties to the study.

The chapter will continue with the description of the research design familiarizing the reader with the research methods, the issues and limitations, and the sampling; in this case the three schools that have been observed – two of them located in the capital and one in the region.

In order to examine the one-to-one programme implementation from the inside, I have used qualitative research methods, which included classroom observations, follow-up interviews with teachers and individual student interviews, as well as focus group discussions in order to engage parents and teachers separately in a healthy debate about the programme and to analyze their opinions.

The chapter then will move on to the very core of the research – step by step analysis, introducing first the preliminary examination of the data and the initial general sense derived from it by applying the so-called 'helicopter view' approach. The next step will be the description of the coding process, which outlines the strategy used and the initial root and sub-codes that emerged followed by the in-depth analysis of the data.

The chapter ends with the consideration of the ethical issues related to the research, as well as commentary on its validity, reflexivity and generalizability.

## 3.2 Research aims

Maxwell (2005) explains the importance of one's goals for a study in relation to two functions: 1) worthiness and 2) justification, and recommends one to reflect on one's goals and motives seriously and systematically while deciding on a research project. Maxwell proceeds to distinguish three kinds of goals: *personal, practical goals, and intellectual (or scholarly) goals* (p.16).

My personal goals mainly included my desire and intention to explore teaching and learning with one-to-one computing, my practical goals were focused on improving the existing situation related to the programme. However, after thoroughly studying educational research my intellectual goals shifted from analyzing the implementation processes of one-to-one computing to understanding the inner workings and the processes of the integration of technology into teaching and learning as described in the introduction chapter of the thesis. Therefore, following Maxwell's recommendations, I developed my research aims based on my scholarly goals and professional as well as personal interests in the topic.

The one-to-one computing initiative is one of the recent educational initiatives introduced in Azerbaijan, and is still in the pilot stage of its implementation. Hence, there was a need to investigate the impact of the one-to-one computing programme upon learning and teaching in order to contribute to the implementation of the programme across the country as well as to the knowledge of the field. I was driven with a curiosity to study how teachers scaffold their lessons by integrating this programme into their teaching, and how students learn in a one-to-one setting. As explained in the introduction chapter of the thesis, my original research question as well as research aims and objectives have been slightly changed. Consequently, my research aims prior to starting data collection were:

- to examine the teachers' ways of deploying the features of the one-to-one programme in their classes;
- to explicate students' study preferences and practices with one-to-one computing during classes and at home;
- to scrutinize parents' opinions on their children's studies with the one-to-one programme;
- to contribute to the knowledge in the field.

To reach these aims I adopted qualitative research methods for data collection: observations, follow-up interviews and individual interviews as well as focus group discussions. Three schools were included in my study: two schools in the capital city Baku and one school in a rural region. I will further discuss the process of selecting schools and each sample group separately and the rationale behind the sampling in section 3.5 of this chapter.

## 3.3 The researcher

According to Maxwell (2005), while conducting research you do not need to separate your work and life from your research as they can be a good source for the study. He continues to describe what Strauss (1987) (as cited in Maxwell, 2005) calls the "*experiential data* - the researcher's technical knowledge, research background, and personal experiences" (p. 38) and suggests that one develops what he calls a "researcher identity memo" (p. 39) in order to reflect on the researcher's experiential knowledge, goals and interests. Thus, I developed such a researcher identity memo which forms the basis for this "Researcher" section where I discuss my professional and personal ties to this research and to what extent I incorporate them into the study while staying alert to possible bias that could arise.

As an employee of the Ministry of Education, I am involved in the implementation of the one-to-one computing programme in Azerbaijan, and I am one of the

forerunners with genuine interest in the successful implementation and spread of the programme throughout the country. I am the head of the Bureau on ICT for Education established under the Ministry of Education of the Republic of Azerbaijan and am responsible for the implementation of numerous ICT integration projects, including the development of ICT infrastructure, application of e-learning tools to management and administration as well as improving teaching staff qualifications. The Bureau is also responsible for the implementation and monitoring of the one-to-one programme at selected e-schools. As a result, I was first acquainted with this particular programme in a professional setting and had the privilege to participate in the first stages of its implementation. My curiosity in the subject grew with each new phase and my involvement in the project triggered my interest to study the topic further and explore the factors influencing the integration of this programme into teaching and learning.

As an 'insider' I had various opportunities to study the one-to-one programme and its implementation in schools. Nevertheless, I wanted to conduct a thorough research, which would provide the readers and myself with pertinent information about the influence of the one-to-one programme on learning and teaching. My intention was to participate in the study only as a researcher with fresh insights and understandings.

Maxwell (2005) emphasizes that "attempting to exclude your personal goals and concerns from the design of your research is neither possible nor necessary. What is necessary is to be aware of these goals and how they may be shaping your research and to think about how best to achieve them and to deal with their influence" (p. 19). I have been aware that I could have held preconceptions, personal goals and concerns arising from my involvement with the programme and that is why I have remained alert to them before collecting the data. Nevertheless, being aware of them and their potential unwanted interferences to my data collection and its interpretation process has kept me mindful throughout the research process. The extent to which I have achieved a distancing of my personal concerns and preconceptions from the data

analysis, I think, will be revealed in the analysis and interpretation process of the data.

Furthermore, being actively involved in the implementation of the project from its conception hindered my active participation in the data collection process. It was impossible for me as a researcher to personally go to schools for data collection since school principals and teachers were already acquainted with me as an employee of the ministry. For them I was a 'ministry person' and therefore I might not have obtained their free and unbiased opinions. There was also a strong possibility that teachers would view the whole research process as an evaluation of their teaching performance. Consequently, I decided to hire a research assistant through a careful recruitment process.

My first main focus was to recruit a research assistant who was familiar with research methods, especially with qualitative research methods, and could understand my research aims. I hired a female research assistant who had recently returned to the country upon finishing her graduate studies abroad. Although her graduate degree was not related to education, she had conducted small-scale research during her studies, and was familiar with the relevant research methods. During interviews, she also emphasized her enthusiasm about the topic and research as well as her plans for doing a PhD in education in the near future.

Initially, the research assistant went through a month-long training where she thoroughly studied qualitative research methods, techniques of conducting interviews and focus group discussions. The training was held in collaboration with myself and a colleague who teaches research methods. During the training, the research assistant on her own studied research methods mainly through relevant literature provided by myself. At the end of each week, we met with her and discussed the knowledge she had obtained, performed practical tasks and answered her questions. Later on, she conducted pilot interviews with teachers. Only after providing my feedback on the pilot interview recordings and transcriptions, I decided to begin the data collection

process. During the pilot interviews, I observed that the research assistant being a female made communications with respondents more easily since a large proportion of them was females and young children.

## 3.4 Qualitative research study with grounded theory method

Strauss and Corbin (1990) explain qualitative research as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (p. 17). According to Berg (2001), qualitative research is used to answer questions through careful examination of social settings and their participants. Denzin and Lincoln (2005) argue that qualitative researchers study phenomena in their natural settings and attempt to interpret participants' perspectives on these phenomena.

I decided on a qualitative research design for my study as I was curious to explore the context and setting in which the one-to-one programme was being implemented as well as the beliefs, motives and attitudes of contributors who took an active part in the process. I have been convinced that qualitative study would greatly contribute to my research aimed at finding the factors influencing the integration of one-to-one computing into learning and teaching. Unlike quantitative research, qualitative research would allow me to study perspectives and opinions of the research respondents in greater detail.

I hereby explain my reasoning behind choosing qualitative research in line with Creswell's (2003) descriptions of its characteristics. One-to-one computing is implemented at schools, and thus, I planned to collect data at schools – the natural setting for my qualitative study. I employed the qualitative research methods of observations, follow-up interviews, individual interviews, and focus group

discussions. I believed qualitative research could provide a broad range of opportunities to reveal phenomena enabling me to interpret the data based on a thorough analysis of the natural setting including the perspectives of the respondents.

Maxwell (2005) affirms that the "strengths of qualitative research derive primarily from its inductive approach, its focus on specific situations or people, and its emphasis on words rather than numbers" (p. 22). He proposes an interactive model of qualitative research design with five components: 1. Goals, 2. Conceptual Framework, 3. Research Questions, 4. Methods, and 5. Validity and exhibits the relationship among the components in the following diagram (see Figure 3.1) explaining that the components are linked and integrally connected to one another.


*Figure 3.1 Interactive model of research design adapted from 'Qualitative Research Design an Interactive Approach' (Maxwell, 2005, p. 5).*

I interlinked the five components of my research in a similar way and adopted a constructivist grounded theory approach to guide me throughout the study.

Glaser and Strauss first introduced the term Grounded theory in their book titled "The Discovery of Grounded Theory" published in 1967. They defined the term as "the discovery of theory from data - systematically obtained and analyzed in social research" (Glaser & Strauss, 1967, p. 1). Creswell (2012) states:

> "A grounded theory design is a systematic, qualitative procedure used to generate a theory that explains, at a broad conceptual level, a process, an action, or an interaction about a substantive topic. In grounded theory research, this theory is a "process" theory – it explains an educational process of events, activities, actions, and interactions that occur over time" (p.423).

Charmaz (2005) one of the founders of constructivist grounded theory, relates the term grounded theory to a method as well as the product of inquiry mentioning that most researchers use it as a mode of analysis, and describes the methods as guidelines enabling researchers to collect the data and build theories based on thorough data analysis as well as conceptual development. Glaser & Strauss (1967) distinguish four interrelated properties in grounded theory: fitness, understanding, generality, and control. Unlike them, Charmaz (2006) "views grounded theory as a set of principles and practices, not as prescriptions or packages" (p. 9).

Among the different versions of grounded theory, I selected Charmaz's constructivist approach in order to better explore the attitudes and perspectives of the respondents. My intent was to reveal the factors impacting upon the integration of one-to-one computing into teaching and learning through interactions with the real actors - teachers and students - as they, I believed, could be the main sources for my data collection.

The major reason for selecting specifically Charmaz's constructivist grounded theory approach stems in the complexity of Azerbaijani educational system, which is the result of the sporadic application of radical reforms throughout the past decades and the prevalent Soviet-style approach in teaching still lingering on in most of the schools of the country. The modernization attempts have created a mixture of school cultures that tends to be unpredictable in nature. Given this complexity, I deemed it more reasonable to construct theory based on the gathered data, rather than apply an existing theory and run the risk of leaving a lot of aspects unexplained.

The same logic drove me to put in more work in interpreting the gathered data and use pattern detection for the coding process rather than rely on a pre-existing coding template. I strongly believe that thoroughly sifting through the gathered data step by step was the most appropriate method to extract the valuable information for analysis. It allowed me to make sure no voice was left unheard and helped me safeguard against superficial interpretation of the data.

While Glaser & Strauss (1967) emphasize that theory is being discovered, developed, from data detached from the researcher, Charmaz (2006) stands against their position assuming that the researcher does not discover data or theories, but constructs them based on examination of a natural setting and interactions with participants. I share the viewpoint of Charmaz (2005) as she states, "A grounded theory approach encourages researchers to remain close to their studied worlds and to develop an integrated set of theoretical concepts from their empirical materials that not only synthesize and interpret them but also show processual relationships" (p. 508). I was professionally attached to the world which I intended to study, and therefore I retained close contact with it, since, to my best belief, being a part of it would assist me to better understand and analyze the setting as well as the views of the respondents.

Denzin ((1970), see Hutchinson, 2005) claims that grounded theory becomes increasingly useful "if little is known about a topic and few adequate theories exist to

explain or predict a group's behavior" (p.123). Although a large number of qualitative or quantitative studies related to one-to-one computing and its implications for education has been implemented worldwide, only a few of them have studied a case such as Azerbaijan, where the education system is going through drastic reforms. I attempted to study the one-to-one setting in Azerbaijan because I was convinced that this particular research would give insights and explain difficulties related to the implementation of the programme in my country, and would also contribute to the relevant body of knowledge worldwide.

As I have noted, I mainly followed the constructivist grounded theory approach of Charmaz (2006) in my research. Following Charmaz I have stayed open to new opportunities which led me to employing a 'helicopter view approach' that constituted the first stage in the analysis process of the data. Using the 'helicopter view approach' I attempted to familiarize myself with the collected data before conducting a very detailed analysis. For this purpose, I simply watched the observation videos, listened to the recordings of the interviews and the focus group discussions.

## 3.5 Sampling of schools

I intended to identify and select "information-rich cases for the most effective use of limited resources" (Patton, 1990, p. 169) by employing purposeful sampling to select schools and participants. In line with Creswell (2007), purposeful sampling was used to select participants and settings that could inform me about the phenomena of the study.

The research started with the selection of schools implementing the one-to-one computing initiative: two schools in the capital, Baku, that had been involved in the one-to-one computing initiative for four years in one case, and for five in another, and one school in the region that was in the second year of the project

implementation. By including a regional school that is also new to the project I wanted to examine possible differences among schools in the implementation of the programme. After analyzing monitoring reports conducted by the Ministry of Education, I identified three schools that had continued to implement the programme among fifteen schools which implement the one-to-one computing initiative. I included these three schools in particular as they were in different phases of the implementation, therefore offering a certain degree of diversity in terms of their experience with the programme. Additionally, I involved the regional school to compare and contrast with the implementation patterns in the Capital Schools.

I continued using purposive sampling in selecting teachers and their classes to observe, students to interview and parents for focus group discussions (see Appendix 3: type of the data). While selecting teachers, attention was paid to the experience of teachers with the one-to-one programme. I intended to create a diverse group of teachers by choosing the ones possessing divergent experience with the one-to-one programme. For instance, among teachers there were the ones who had been teaching with the one-to-one programme since the programme started, others with two years of experience and some who had just started their journey with one-to-one computing. After the selection of teachers, the following classes were selected for observation: two Math classes, one Biology, one English, and two Azerbaijani language classes. All of these classes were being taught with the new curriculum that was recently introduced to schools. One of the participants was a primary class teacher, and she offered for observation her Azerbaijani language class where she used netbooks more frequently, as she explained, due to the convenience of integrating programme features into the classroom processes.

I was trying to select students with diverse levels of ICT skills for interviews. Two students from each class were selected, one who appeared to have better and another with weaker ICT skills. For focus group discussions, I selected parents of the students who were interviewed, for the purposes of exploring parents' attitudes towards their children's studies with the one-to-one programme.

Upon identifying schools I prepared informed consent letter drafts (see Appendix 4: letter draft for school principals) for principals to obtain permission for data collection. In the letters I asked for their written consent to participate in the research, and also briefly explained the nature of the research, its methods and steps. After the principals signed the informed consent forms for participation, I arranged separate meetings with principals of the selected schools in person and familiarized them further with the research emphasizing that the data collection was not related to any activities of the Ministry of Education. During our meetings each school principal expressed interest in the research and all three agreed to participate. They introduced my research assistant to the responsible vice-principals who provided her with pertinent information and contacts, and assisted her throughout the data collection process at the schools. In the consent letter drafts developed for research participants, I highlighted that only my research assistant and I and, if needed, the supervisors of the study would know the identities of the participants. It was also clarified that all the names would be coded in the final thesis. Likewise, to keep the names of the participant schools anonymous, I named them Capital School 1, Capital School 2 and Regional School (see Appendix 5: brief information about schools and organizational charts).

*Capital School 1* is one of the oldest schools in Baku, and there are two languages of instruction – Azerbaijani and Russian, which is a remnant of the Soviet education system where Russian had been the language of instruction in parallel to the Azerbaijani language. Since 2009, this school has been part of the one-to-one programme; however the implementation of the project is still in a pilot stage. Prior to starting classes in a one-to-one setting, the teachers of the school have received training on the one-to-one programme provided by designated organizations (see Appendix 6: brief information about the organization and the training it provided). Initially one primary class was selected and another one was later added to the pilot project. At the time of the data collection we worked with two 5th grades. In addition

to notebooks for teachers, and netbooks for students, one-to-one classrooms have also been supplied with interactive whiteboards, printers and projectors.

*Capital School 2* is one of the schools that joined the one-to-one programme in the initial stage, and since then the programme has been continuously implemented. The programme started in the primary grades, and has gradually spread to upper grades. During data collection we observed 4$^{th}$ and 7$^{th}$ grades at this school. At the moment, the programme is only implemented in one of the several second, third and fourth grades. The classrooms of this school too have been provided with necessary equipment such as projectors, interactive whiteboards and printers.

The *Regional School* had shown initiative by applying to a competition for participating in the programme, and was one of the winners. The Regional School had been implementing the one-to-one computing initiative for two years before data collection for this study. Although in the first year netbooks had been distributed to students of two upper grade classes and each student had received a netbook, in the second year the school principal had changed the approach and distributed netbooks to only excellent students in upper grades. As a result, only three netbooks had been provided to each of 5th, 6th, and 7th grades. At the time of the classroom observations there were four netbooks in each class. Currently, only fifth grades are provided with netbooks in this school. Similar to the Capital Schools, in Regional School classes as well have been equipped with projectors, printers and interactive whiteboards (see Appendix 7: specifications of the equipment provided to schools).

## 3.6 Issues and limitations

I am an employee of the Ministry of Education, and the position hindered my direct participation in the data collection process. At the time of writing this thesis, I was the Head of the Bureau on ICT for Education which also monitored the implementation process of the one-to-one programme. Since teachers already knew

me as a “ministry person” they could see the research as an evaluation of their performance. Therefore I hired a research assistant to collect data at schools. Despite the fact that all the observations and interviews were recorded, and the research assistant shared her personal observations about lessons and respondents, I believe, I would have obtained further information of interest to me on the classroom activities had I personally participated in the data collection. I was greatly interested and curious to witness non-verbal communications of the respondents in person. Moreover, during interviews with teachers and students the research assistant allowed them to take breaks from time to time, and I missed the topics of those conversations as well.

The collected data were transcribed, and translated from Azerbaijani into English. “One unavoidable issue here is that transcribing in any but the most cursory of ways is extremely time consuming, and one thing researchers usually lack is time. We do not generally cost time for transcription in to our research bids, or if we do it is to pay external transcribers” (Ross, 2010, p. 9). With a full-time job and my research, I could not spare time for translating and transcribing the interviews. Instead I asked the research assistant to perform it, and considering that she had participated in the interviews and focus group discussions in person it would be easier for her to translate and transcribe data accurately. As Azerbaijani is my native and English is my second language, it was very convenient for me to supervise the process of translation and transcription. In order to check the accuracy of the transcriptions and translations, I listened to the recordings of interviews and focus group discussions and read their transcriptions simultaneously. Working solely with transcriptions might have led to loss of bits of information for the research. This approach proved to be practical in terms of identifying any possible mistranslations and misinterpretations. After my feedback, the research assistant corrected all the mistakes, and I once again checked the last versions of translations and transcriptions.

In his book, Kvale (1996) emphasizes that the question – "'What is the correct transcription?' cannot be answered – there is no true, objective transformation from the oral to the written mode. Therefore, while performing coding and analysis I worked with the video and audio recordings together with the observation notes, the transcriptions of the interviews and the focus group discussions to be sure about my interpretations and explanations.

## 3.7 Research methods

For this research study I used the following research question: "What factors influence the integration of one-to-one computing into teaching and learning?"

Effective technology integration is an achieved process when its use supports curricular goals and four key components of learning, which are:

- "active engagement;
- participation in groups;
- frequent interaction and feedback;
- connection to real-world experts" (Edutopia Team, 2008).

I was happy to adopt this definition and intended to examine the level of integration of one-to-one computing into learning and teaching by looking at the level as well as processes of netbook usage in the classroom. Thus, I decided to use the qualitative research methods of classroom observations, follow-up interviews and individual interviews, plus focus group discussions.

Prior to starting the data collection process, I prepared informed consent letter drafts for research participants that included brief information about the research, its purpose, methods and a space for the participant's name and signature. Through the consent letters each sample group was informed about the process in which they

would participate, its purpose, duration and structure respectively. The research assistant's contacts were also given in the consent letters in case any further question related to this research emerged (see Appendix 8: informed consent letter drafts for respondents).

It has been noted earlier that in order to collect the data, I employed the following qualitative research methods:

- classroom observations,
- follow-up interviews,
- individual interviews,
- focus group discussions.

I will describe the employment of each method separately in the following subsections.

### 3.7.1 Classroom observations

I employed observation research methods in order to investigate the factors affecting the integration of one-to-one computing into learning and teaching by observing netbook usage at the classroom level. After the school principals gave their permission to collect data in their schools, they introduced the research assistant to the responsible vice-principals who gave us the list of the teachers who taught classes in a one-to-one setting. Using purposive sampling I selected two teachers from each studied school based on their experience with the one-to-one programme, their participation in the training on one-to-one computing and the grades they taught. Later, the research assistant discussed the availability of the selected teachers with the vice-principals and received teachers' contacts for further discussions.

The research assistant first contacted teachers by ‘phone to arrange separate meetings with them. During the meetings, she informed teachers about the research in detail, and presented informed consent letter drafts. Informed consent has been defined by Dienar and Crandall (1978) as “the procedures in which individuals choose whether to participate in an investigation after being informed of facts that would be likely to influence their decisions” (p. 57). Teachers were reminded once again of their right to refuse to take part in the research or withdraw from it even after it was started. Upon obtaining teachers’ oral and written consent, I decided to start the data collection process. Teachers provided their class schedules, and through careful selection I decided on classes to observe. While selecting classes to observe I chose different subjects and grades to gather rich and diverse data.

Two classes per studied school were observed, and correspondingly a total of six classroom observations were conducted. In the Capital Schools, class sizes ranged from 30 to 33 students. There was only one class with a smaller number of students, namely 16 as it was a language class, during which students are usually divided into two groups and taught separately. However, class size in the Regional School varied from 15 to 18 students. The research assistant also composed a detailed summary of her observations in a written form in English, and attached the materials such as handouts, charts, etc. that teachers used during the observed lessons.

During the classroom observations, students’ engagement level, the number of students working independently/in pairs/in groups, the student-student and the student-teacher interaction were recorded. I wanted to observe teachers’ teaching styles with one-to-one computing in the classrooms and the way of integrating netbooks into the teaching-learning process. In addition to classroom dynamics, I also paid attention to the subjects taught. Throughout the observations interesting issues such as subject matter and availability of subject specific e-resources in the local language, impact of physical classroom settings, and additional technology available in the classrooms, viz. interactive whiteboards, printers, projectors etc. were taken note of.

The classes were also video-recorded. The research assistant installed a small video camera at the back in each classroom. She herself sat close to it and zoomed in on activities of interest when needed. The research assistant was allowed to enter the classrooms before the classes started to install the camera, and consequently all the classes were recorded without any interruptions. Each classroom observation lasted 40-45 minutes, depending on the fixed class schedule at schools. I was able to compare video-recordings with the notes taken during observations, and raise important questions to understand teachers' behavior: reasons for organizing activities in a certain way; and the effect of technology on the realization of curriculum goals. Creswell (2003) suggests that the qualitative observer can decide to be participant or non-participant. Although it was not always possible for the research assistant to retain a detached position, especially during the discussions on the matters concerning education and educational practices in general, she still tried to remain a non-participant as much as possible. After observations she spent some time with the teachers, discussed the lessons in greater detail and reminded them of follow-up interviews.

### 3.7.2 Follow-up interviews

According to Kvale (1996), through interviews people can express their opinions in their own words. In order to elicit perspectives of teachers on the classroom activities they used during observations I decided to conduct follow-up interviews with the teachers whose classes were observed. It was also a valuable opportunity for teachers to elaborate on their classes and for me to clarify certain issues that I noticed in the video-recordings. The follow-up interviews were semi-structured "where topics and open-ended questions are written but the exact sequence and wording does not have to be followed with each respondent" (Kvale, 1996, p.278). There were two follow-up interviews in each school, in other words a total of six follow-up interviews with teachers were conducted.

I started watching the observation videos as soon as they were ready. When doing this I was taking notes of my comments and questions which later helped me in forming my questions for follow-up interviews. To better understand the classroom activities I had seen in the observation videos, I studied the materials used during lessons. Having analyzed the observation videos and read all the supporting materials, I had a number of discussions with the research assistant. Based on my comments and notes from both the videos and discussions with the research assistant, I formulated my questions and engaged in dialogue with her to make sure that we had a mutual understanding about the purpose of the questions. It should be highlighted that my questions derived from certain classroom activities seen in the observation videos, on which I sought teachers' opinions (see Appendix 9: questions for follow-up teacher interviews).

As I stated earlier, teachers were informed about the follow-up interviews prior to observations, so my research assistant called them to arrange a time and place of their own convenience for the follow-up interviews. The research assistant met with the teachers on different days after their work hours at school, 4 to 6 days after the conduct of observations. Prior to starting the interviews, the research assistant reminded the teachers about the purpose of the research once again and answered their questions related to the observations. The interviews were semi-structured in nature, and interviews included the use of video-stimulated recall technique and a set of open-ended questions to discuss topics of mutual interest.

Video-stimulated recall (VSR) "is an introspection procedure in which normally videotaped passages of behavior are replayed to individuals to stimulate recall of their concurrent cognitive activity" (Lyle, 2003, p. 861). According to Powell (2005), "the video-stimulated reflective process is a collaborative inquiry between the research partners – teacher and researcher" (p. 408). Gass and Mackey (2000) explain that VSR helps to recollect memories to offer more accurate information. Teachers were invited to watch the observation videos of their lessons during

interviews as “a prompt for generating a reflective dialogue” (Tanner & Jones, 2007, p. 708).

Gass & Mackey (2000) highlight the importance of minimizing the time delay between the recall and the actual event. Although I attempted to keep the time delay as minimal as possible, in one case one teacher had a hard time recalling the reasons behind some of her activities. In general, I believe using VSR technique in the follow-up interviews with the teachers presented more clarity on the classroom activities providing the teachers with the opportunity to better elaborate on these activities and illustrate their opinions on the integration of one-to-one computing into their lessons. In addition, teachers discussed the reasons for using certain classroom activities and assignments during observations, their benefits and results. They also talked about the group activities that students were asked to perform, and features of the classroom management software employed throughout the lessons. Moreover, teachers complained about the scarcity of e-learning resources in Azerbaijani, and how they spent hours to prepare content for one-to-one classes. Another topic almost all the teachers mentioned was the netbooks and software being old, and the need to upgrade them with new technologies.

The follow-up interviews were also audio-recorded, lasting from 40 to 60 minutes. They were translated from Azerbaijani into English and transcribed into English by the research assistant. I first listened to the follow-up interviews, then compared them with the transcriptions and provided my comments and feedback on the transcriptions for the research assistant’s review. Later, I listened to the recordings again and read modified transcriptions to approve the final versions.

### 3.7.3 Individual student interviews

In line with Kvale (1996), through interviews you can learn participants’ opinions and reveal their understandings.

The research assistant in consultation with the teachers identified two students per observed lesson during the follow-up interviews to be invited to individual interviews. I discussed the reasons for choosing those students, and agreed with the choice after watching the observation videos again.

Students were selected based on their engagement level in classroom activities; special attention was paid to include one student who was good at netbook usage and one who faced challenges in each class. Upon selection of the students, the research assistant revisited schools to invite them to participate in the research and to obtain the contact details of their parents.

According to the Australian National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007), "the child or young person's particular level of maturity has implications for whether his or her consent is necessary and/or sufficient to authorize participation" (p.55, also see (Midgley, Davies, Oliver, & Danaher, 2014)). This stipulation rightly raises the issue of sufficiency of a consent provided by a minor and stresses the importance of seeking consent from the parents or guardians of a child, who is participating in a research study, rather than acquiring consent from the child himself/herself (Midgley, Davies, Oliver, & Danaher, 2014). Since the ages of the selected students varied from 9 to 14, the research assistant contacted their parents one by one, informed them about the research and received their oral and written consent to conduct individual interviews with their children. Having received informed consents from adults, the research assistant approached students again seeking their consent to participate in the research. Luckily, all the selected students and their parents were willing to participate in the research and provided written and oral consent to do so. Students and parents were informed about the nature of the research, told that their identities would be kept confidential and they were also assured that they would not suffer any harm. Once again, they were reminded of their right to withdraw from the research at any time.

In one class one student expressed his desire to be interviewed and the teacher asked the research assistant to include that student. After hearing how enthusiastic that student was, I included him in the sample group of students. Therefore, instead of 12, a total of 13 individual student interviews were conducted. Interviews were semi-structured in nature and conducted without the involvement of parents and teachers. The students were asked questions prepared by the researcher and then were invited to watch the classroom observation videos to clarify some of the classroom activities (see Appendix 10: questions for individual student interviews). I used VSR as a technique during student interviews as well, inviting students to comment on the observation videos and reflect on their activities. "Children can offer important insights into their learning processes that are of interest to us as researchers and teachers" (Tanner & Jones, 2007, p. 715). Several students expressed a special interest in watching the classroom observation videos and used the opportunity provided to comment on the issues of interest to them and myself.

Kvale (1996) highlights that the interviewee should feel stress-free in the interview situation to be able to speak confidently. Creating a comfortable atmosphere for students to freely express their opinions was a priority. Hence, interviews took place in the conference halls of the schools or in the classrooms after class hours. The research assistant attempted to create an informal atmosphere so that students would feel comfortable and relaxed. Students were frequently offered to take breaks to rest. During breaks the research assistant tried to get to know the students better and discuss their interests. Several students were eager to talk about their classes with one-to-one computing during breaks as well, and the content of several conversations between the research assistant and students were included into the notes of the research assistant. There were also instances when the research assistant would resume the recording by asking those students to talk about the issues they mentioned during breaks.

During the course of the interviews, students talked about studying in the one-to-one setting and its impact on their ICT skills. The majority of students stated that they collaborated and assisted one another when needed. Student attitudes towards homework on netbooks were also explored through interview questions. Students were asked about their preferences for working styles at school: whether they liked to work alone, in groups or in pairs; and the answers varied, as following chapters will reveal.

### 3.7.4 Focus group discussions

In addition to the individual interviews, we conducted focus group discussions with the teachers, whose classes were observed and with the parents, whose children were interviewed to encourage participants to share their opinions in a safe environment among their colleagues and/or peers. According to Wilkinson (2004), focus group methodology "... involves engaging a small number of people in an informal group discussion (or discussions), 'focused' around a particular topic or set of issues" (p. 177). Focus group discussions enrich the data because during discussions participants initiate new topics and issues to talk about. Kitzinger (1994) suggests using focus groups in two cases: 1) as a quick and convenient way to collect data from several people simultaneously; and 2) as a useful tool to obtain complementary information to a studied case.

Although literature on focus groups have typically advised that they should consist of between six and eight participants as the optimum size, groups of a smaller size have been successfully used in studies of sensitive behavior (Basch, 1987; Duncombe & Marsden, 1996; Maxwell & Boyle, 1995; Nix, Pasteur, & Servance, 1988) cited in Bloor, Frankland, Thomas & Robson (2001). Krueger (1994) refers to small groups as 'mini-focus groups' (p.17). Liamputtong (2011) emphasizes that smaller groups enable all participants to talk and discuss issues of interest to them leading to the collection of valuable data.

The focus group discussions we conducted with parents and teachers were also small in size. In the case of the former, I did not want to mix parents with varying experience from different schools, and therefore, four to five parents participated in focus group discussions. In the case of the latter, two teachers from each Capital School were expected to attend the meeting in Baku, however one of them was not available due to personal reasons. In the region, we had to conduct a teacher focus group discussion with two teachers, which was a very small size for a focus group discussion; nevertheless I considered it successful as both teachers participated actively. I initially wanted to invite teachers from the Regional School to focus group discussion with teachers from the Capital Schools. However, I decided to hold these discussions separately due to several reasons: firstly, because I thought it would be inconvenient for them to participate in the discussion with the teachers from the Capital Schools as there was a considerable gap between their experience with one-to-one computing and secondly, due to the heavy schedules of the teachers in the region they were hesitant to travel to Baku. Consequently, in Baku the focus group discussion was held with three teachers and in the region with two teachers.

### *Parent Focus Group Discussions*

We carried out focus group discussions with the parents whose children participated in individual interviews; in total, three focus group discussions were conducted with parents, one in each studied school on Saturdays. I designed the focus group discussions with these parents to gain information on the usage of netbooks at home – information that could be compared with students' answers regarding this matter.

Prior to discussions, the parents signed informed consent letter drafts providing their agreement to participate in the research and for the discussions to be audio-recorded. Additionally, at the beginning of each focus group discussion, the research assistant took her time to explain the nature of the research to the participants once again to create a more comfortable and familiar atmosphere for them. The research assistant

moderated the focus group discussions, asked questions that I had formed in advance keeping the participants on topic, but leaving the greater part of the total allocated time for discussion (see Appendix 11: questions for focus group discussions). Open-ended questions were used to explore parents' attitudes towards their children's studies with netbooks and to view the students' experiences with the one-to-one programme at school and at home from a different angle. These groups provided an invaluable opportunity to compare parents' answers with students' and teachers' responses from the interviews. Four to five parents took an active part in 50-60 minute-long focus group discussions.

According to Krueger & Casey (2000), focus groups are "a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (p. 2). The interviewer usually does not address a question to one specific person, but instead encourages the group to share their opinions on the matter (Kitzinger, 1994). During focus group discussions, parents answered questions explaining their perspectives and understanding of the integration of one-to-one computing into learning and teaching. As the focus group discussions were of a semi-structured nature, parents did not hesitate to start discussions among themselves around the one-to-one related subjects. Interestingly, parent-initiated discussions provided valuable insights and standpoints of parents on the programme that I otherwise would have failed to obtain.

During parent focus group discussions, parent (dis)satisfactions with the programme, their concerns, complaints related to netbook usage during and after classes as well as their support and interest in the programme were explored through the questions. Parents compared teaching and learning in the past with that of the present; in particular they discussed working on copybooks vs. netbooks, handwriting vs. typing on netbooks and traditional teaching methods vs. current teaching methods.

### *Teacher Focused Group Discussions*

Two focus group discussions were conducted with the teachers whose classes were observed, one in Baku and one in the region. In Baku, teachers agreed to meet in one of the studied schools. Four teachers were invited to the focus group discussions in Baku. One could not attend due to personal reasons. In the region, the research assistant conducted the focus group discussion with both teachers of the classes observed in the school. Focus group discussions were audio-recorded and lasted approximately from 60 to 90 minutes.

During the follow up interviews, the research assistant spoke with the teachers about the upcoming focus group discussions. Later on, the research assistant met with the teachers one by one, and during these meetings she explained the nature of the planned focus group discussions. Teachers in the Capital Schools agreed to meet at one studied school on a Saturday morning. The teachers in the Regional School agreed to meet after classes at the school, and both were present in the discussion. The focus group discussions with teachers were built around the issues related to teaching and learning, classroom settings and classroom activities implemented during the observed classes. Focus group discussions with teachers were an effective tool to explore divergent opinions and obtain more insights on their ways of integrating one-to-one computing into classroom processes. Teachers had a chance to discuss the one-to-one related issues with their peers and share experiences, which, according to their appraisal at the end of the discussion, they found quite useful.

During teacher focus group discussions teachers compared group activities in ordinary classes with those of one-to-one classes. Teachers also highlighted the features of the one-to-one classroom management software and ways of using them. Like parents, teachers also compared traditional teaching methods with current ones and all the accompanying changes.

Since the research was conducted in Azerbaijan, the largest part of the collected data was in the native language of the respondents, namely Azerbaijani. In Azerbaijan, especially in the capital city, Baku, part of the population still uses Russian in daily conversation since it was the second language of instruction during the Soviet era. That is why some of the parents and one teacher asked the research assistant for permission to speak in Russian to better express themselves in the focus group discussions. All the data from the interviews and focus group discussions were translated and transcribed into English, including the speech in Russian.

The data collection processes, translation and transcription of the gathered data lasted approximately a year. At each step I held constant discussions with the research assistant, sharing my ideas and providing comments and feedback. The research assistant was actively involved in the data collection phase of my research; she collected data at three schools, translated and transcribed data from interviews and focus group discussions into English. I still maintained full supervision over the data collection process. We met regularly and held discussions on the data collection process, sharing our opinions and concerns with each other. She continued providing her feedback during the data analysis process; she assumed the role of a critical reader alongside my supervisors, who guided me through each step of the research. She read my analysis and findings, provided valuable comments, because she was personally involved in the data collection process, which allowed her to take note of all occurrences in the classrooms, interviews and focus group discussions. On top of this I gained significant experience of working with a fellow researcher.

## *Data Analysis Software*

Charmaz (2000) notes that using computer analysis software enables the researcher to "map relationships visually on screen" (p. 520). I used Computer Assisted Qualitative Data Analysis Software (CAQDAS) to store all the collected data in a systematic and synchronized way as well as to conduct data analysis effectively. Among the available software, I decided to use Dedoose, a web-based qualitative and

mixed method tool for my research as it allowed me to work with the large amounts of data in a structured way.

I uploaded videos of the classroom observations, observation notes, audio files and transcriptions of the follow-up and individual interviews and focus group discussions onto Dedoose. Silverman and Marvasti (2008, p. 35) group advantages of CAQDAS under four main categories three of which were relevant to Dedoose:

1. *"Speed at handling large volumes of data, freeing the researcher to explore numerous analytic questions."* Dedoose provided numerous tools to code a large amount of data systematically, and generated qualitative charts. Using Dedoose, I believe, I saved my time for doing analytical work.
2. *"Improvement of rigor, including producing counts of phenomena and searching for deviant cases."* Dedoose generated qualitative charts that displayed the usage frequency of each code, and also co-occurrence of codes that assisted me in analyzing the whole corpus of data. Besides, I had access to code excerpts separately for further analysis of the data, and could download any chart, table or document generated by Dedoose to include into my final thesis, if required.
3. *"Facilitation of team research, including the development of consistent schemes."* Given that Dedoose is an online tool, it provided me with a space to collaborate online with my supervisors and research assistant whenever I needed their feedback and opinion.

## 3.8 Data analysis

The data analysis process was divided into two stages. Figure 3.2 below is a visual representation of the process.

The first stage (colour blue) was the adoption of the 'helicopter view' approach. In addition to this approach I also developed memos and notes. These two steps collectively contributed to the development of preliminary themes.

The second stage (colour green) followed more rigid steps: the process of Initial Coding, continued by the Creation of Codes and Code Sets and then moving onto the more scrutinized Focused Coding. The latter comprised of the following three steps: Writing Memos, Comparing and Contrasting Codes and Code Sets, as well as Refining Codes and Code Sets.

The next part of the flowchart (colour grey) reflects the remainder of the processes used throughout the research. The Second Stage was followed by the In-depth Analysis of the refined codes and the Analysis of Dedoose Charts which in turn contributed to developing Categories and Themes. At this stage, it became possible to compare the results of the two stages of analysis, which were then used for identifying factors.

In the later stages of the analysis, the literature was revisited based on the already identified categories, themes and factors, in order to develop a comprehensive framework.

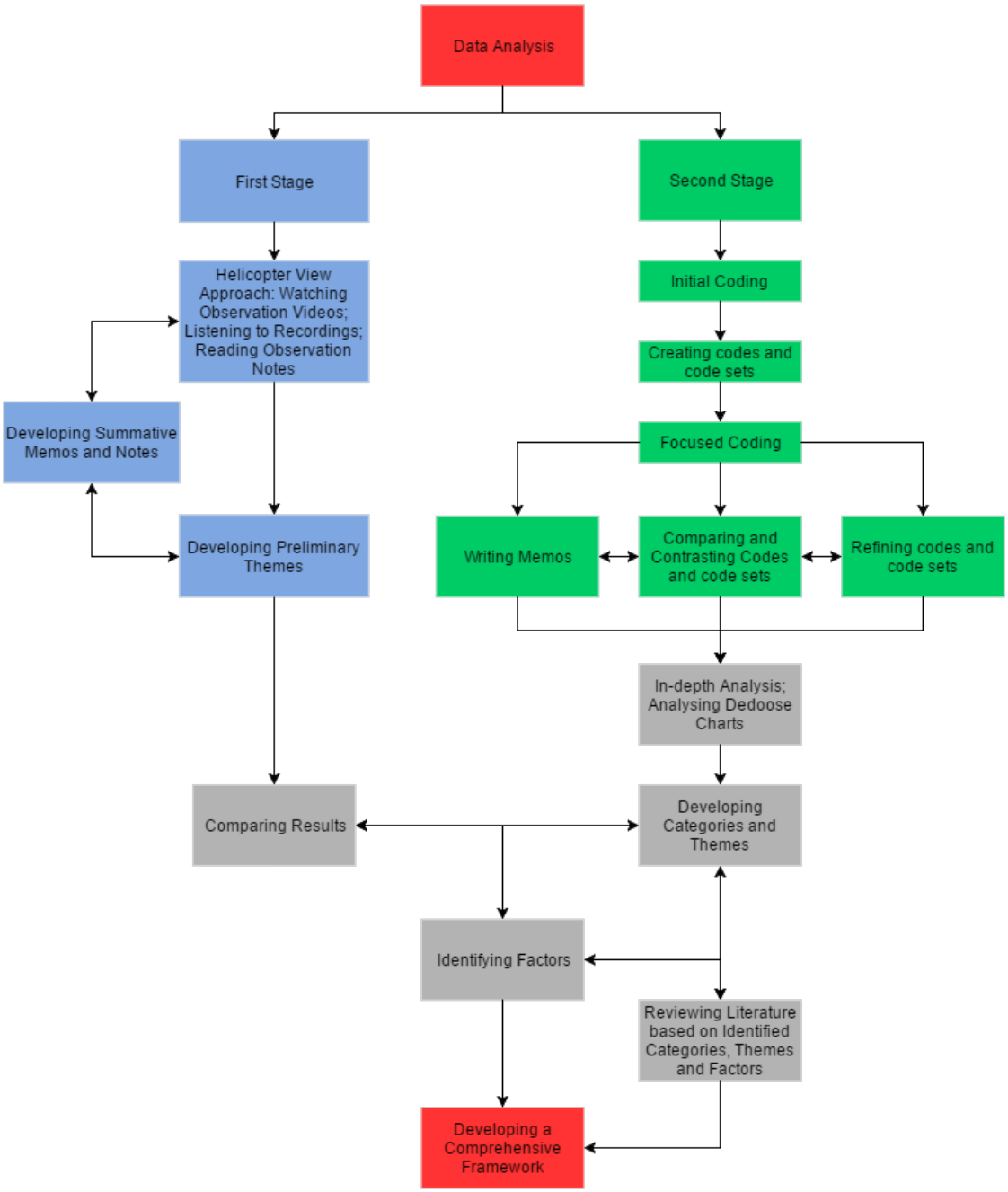



*Figure 3.2 The flow chart of the data analysis process.*

### 3.8.1 Preliminary examination of the data

Maxwell (2005) emphasizes that "the experienced qualitative researcher begins data analysis immediately after finishing the first interview or observation, and continues to analyze the data as long as he or she is working on the research, stopping briefly to write reports and papers" (p.95). I started analyzing the data as I proceeded with the data collection process; I first watched classroom observation videos as soon as they were available, and read observation notes, thorough descriptions of each observed class provided by the research assistant. While watching the observation videos I wrote memos on the issues that caught my attention and interest.

In line with Maxwell (2005), listening to interview recordings is considered as an opportunity for data analysis similar to reading transcriptions. Thus, I performed a similar action with the interviews and focus group discussions, i.e. I listened to their recordings and wrote memos. Then I familiarized myself with all of the gathered data by employing the so-called 'helicopter view' approach with an intention of making initial general sense of them. This technique allowed me to familiarize myself with the raw data, since it was a practical way to gain initial understanding without performing any coding and/or further analysis. In addition, notes, memos, and questions I developed throughout the process let me form an initial and broad interpretation of the data, developing the following themes:

- newly emergent practices;
- focus on technological learning;
- attitude of school administration;
- problems raised by the stakeholders.

After the initial data examination was completed, I noticed that classroom observations and student interviews held substantial weight and importance for me in the study, because the former mostly captured and communicated classroom processes happening in the one-to-one setting and the latter seemed to be more naïve

in a good sense without any particular agenda (uninformed by expectations). Although I retained this opinion throughout the analysis process I still gave considerable attention to the rest of the data collection methods and formed some of my discussions on those as well.

As mentioned above, during the initial data review process, I started writing memos on potentially emerging subjects of discussion that appeared interesting. My memos varied in nature, however they mostly comprised of my reflections on, and analysis of, the observation videos, interviews and focus group recordings as well as readings I had been doing for the study. Though my memos were not interrelated to each other and not all of them were used while writing the thesis, still they greatly assisted me in forming my interpretation of the data and in further development of my ideas. Maxwell (2005) associates the value of memos with two chief benefits: the first is how memos assist you to reflect, analyze, as well as self-criticize instead of simply recording episodes and opinions, and the second is how they are organized systematically, so that they can be practical to use and retrieved in the next steps of research. The memos I recorded were arranged in a systematic way so that I could refer to them several times during the writing process and use them appropriately. Charmaz (2005) sees "memo-writing as the pivotal intermediate step between data collection and writing drafts of papers" (p.72). I found the process quite beneficial and practical for analyzing the data, and I continued to do memo-writing throughout the research process (see Appendix 12: several memos). In addition, the research assistant wrote memos mostly while working in the field, and we devoted a day to share and discuss our memos written on different research-related subjects which became useful in the next phases of the study.

### 3.8.2 The process of coding

According to Creswell (2012), the process of coding is "one of reducing a text or image database to descriptions and themes of people, places or events. It involves

examining the text database line by line, asking oneself what the participant is saying, and then assigning a code label to the text segment." (p.261). Having gained a general understanding of the data based on certain themes created while watching the observation videos, listening to the recordings and reading observation notes, as a next step, I started reading and coding the classroom observation notes.

In line with Charmaz (2006), the coding process was emergent, and therefore I did not think about or create any form of code sets to guide me through this process. I employed an *initial coding* strategy for which Charmaz recommends "to remain open to seeing what you can learn while coding and where it can take you" (p.48). Without having any preconceived set of codes in mind, at that point, I was open to every kind of emerging patterns, regularities and ideas. Furthermore, Dedoose happened to be a very practical and convenient tool for coding since it has a feature that differentiates coded segments from one another by marking them with various colors. I could also group my codes and attach any number of sub-codes to them highlighted in different colors (see Appendix 13: Dedoose screenshot).

I gathered all codes developed from the classroom observation documents separately, under the 'classroom observations' umbrella, as these particular data solely represented the research assistant's and my observations without any statements from teachers and students. As such, I was curious to compare and contrast the codes attached to classroom observations with the ones ascribed to the interviews and focus group discussions. More importantly, it was a valuable opportunity to compare and contrast, to some extent, the statements of the respondents with their actions and consequently the data from different sources.

Teachers were asked preformed questions during the interviews and similar patterns among the codes emerged from the interview transcriptions. However, with each interview, new patterns and code labels developed as well. I usually remained alert during the initial coding process not to miss any information since every bit of data was central and informative for further coding and analysis purposes.

Having finished coding student interviews I compared and contrasted the codes of different student interviews with one another and as a result I could reveal the differences in students' perspectives on the netbook-related matters and in the implementation of the programme among the three participant schools. At this stage of the coding process, I also compared and contrasted codes assigned to student interviews with the ones attached to the teacher follow-up interviews. The purpose was to compare students' perspectives with those of teachers'. Furthermore, comparing codes and their excerpts seemed to be critical and necessary for validity purposes as student interviews communicated further details of the observed classroom processes.

As a result of coding the transcriptions of focus group discussions, the number and variety of codes and sub-codes broadened and code sets started to appear. As such, new unforeseen topics emerged from the discussions among teachers and parents. Similar to the interviews, the focus group data were also coded using the initial coding strategy, and the developed codes were compared and contrasted with those from the interviews and the observation notes. Consequently, a considerable gap appeared among the perspectives of teachers and students as well as between parents and teachers and students.

During the initial coding process, I continued memo-writing and constantly comparing and contrasting the codes drawn from each sample group with each other. The method produced further understanding of the data by offering a chance to examine the answers of the respondents within the relevant sample group and/or across the sample groups. Careful reading of the "materials" and constant comparisons across the datasets allowed me to scrutinize the data while performing initial coding. Throughout the process I recorded my questions and developed new memos; and accordingly, upon finishing initial coding, I returned to several respondents to address my questions in order to fill in gaps and to make more sense of the data.

A number of code sets emerged upon completion of the initial coding process. For instance, teaching-related codes were gathered under a set that I named 'teaching-related' such as 'teacher interest,' 'teacher ICT skills,' 'teacher experience with one-to-one computing'. These codes and their excerpts communicated additional details about teachers' perspectives on the programme implementation.

As a next step, I selected several codes apposite to the research aims and my personal interest, which were crucial for answering my research question, and revisited the data with the purpose of performing focused coding. Charmaz (2006) defines focused coding as "using the most significant and/or frequent earlier codes to sift through the large amounts of data" and this process "requires decisions about which initial codes make the most analytic sense to categorize your data incisively and completely" (p. 57). The selected codes were useful for a deeper inquiry in the focused coding process.

As I proceeded with focused coding, new codes emerged and several previous ones became refined and reshaped. For example, I developed new code labels such as 'teacher reputation,' 'teacher frustration,' 'parent comparisons,' etc. based on in-depth examination of the data. As a result, the number of root and sub-codes in Dedoose totaled 264. In addition to the emergence of new codes and revision of the existing ones, the focused coding process also revealed new ideas as well as patterns in the data that attracted my attention.

Charmaz (2006) points out that "through focused coding you can move across interviews and observations and compare people's experiences, actions and interpretations" (p.59). I thereby firstly compared and contrasted codes with codes, and then data with data to examine closely the suitability and adequacy of new codes. During the focused coding, I also continued writing memos based on new codes and ideas developed as a result of this process.

Following the above-mentioned steps I proceeded with the in-depth analysis of the data.

### 3.8.3 In-depth analysis of the data

Using various tools provided for analysis in Dedoose, I initially attempted to analyze all the 264 developed codes. Therefore, I read through the code sets as well as the codes with their excerpts, and also analyzed the frequency of their appearance in the Code Application Chart. My main intention was to identify code sets and codes that I considered crucial for the elucidation and interpretation of the data to answer my research question. Consequently, I selected 82 codes that comprised the most commonly and less frequently emerging codes in the chart, (see Appendix 14: most commonly and less frequently emerging codes). Having read the excerpts of the selected codes again, I continued writing memos in order to develop my ideas and better explicate the respondents' answers. Studying the selected codes with their excerpts revealed even more significant matters for further analysis.

Furthermore, in Dedoose, I developed separate Code Application Charts for each sample group, and reread the excerpts of the same selected codes within each group for the purpose of revealing divergent opinions of the respondents that could become essential. In addition, during this process I compared and contrasted codes with their excerpts across the sample groups. As such, taking Charmaz's (2006) suggestion into consideration, I continuously compared data with data to find similarities and differences among research participants' perspectives on arising issues. Moreover, I reviewed the frequency of the selected codes within each sample group and scrutinized their excerpts to seek potential common patterns. As expected, the process unfolded diverse opinions of the respondents from different sample groups on which I developed memos with the intention of integrating them into the findings and discussion chapters.

In addition to this, I analyzed the Dedoose charts displaying co-occurring codes, according to the frequency of their appearance, to expose and delineate possible relationships, if any, among the code sets, and the codes. I identified approximately 79 cases of co-occurring codes bearing unexpected and interesting relationships with each other, and explored them reading their excerpts. I also studied and analyzed the selected co-occurring codes within each sample group, comparing and contrasting them across the groups. As an outcome of this process, I described them with very brief logical explanations and developed new memos capturing my ideas (see Appendix 15: selected most co-occurring codes).

Consequently, the data started to make more sense to me, and as a result I managed to create a deeper interpretation of them. Having performed the above mentioned steps of the in-depth analysis process, I began noticing and threading relationships as well as differences among the codes. Subsequently, the selected codes and co-occurring codes drawn from different code sets started to create new themes which were grouped under three categories (The themes and codes of each respective category will be illustrated in the findings chapter (Chapter 4, Figures 4.2, 4.3 and 4.4). It should be noted that despite the salient differences among the codes, some of them are still interrelated and therefore can be included in more than one category. The created categories are the following:

1) student-related category;
2) teacher-related category;
3) classroom dynamics-related category.

According to Cavanagh (1997), the purpose of creating and defining categories is to provide means of describing the phenomenon under investigation, to increase understanding, and to generate knowledge. Maxwell (2005) divides categories into three distinctions: *organizational, substantive, and theoretical* (p.97). In line with Maxwell, while organizational categories are referred to as umbrellas, gathering similar data for the next steps in the data analysis, substantive categories are closer to

the data without any theoretical implications, however, theoretical ones are abstract and mainly based on researcher's concepts rather than participants'.

I refer to the developed categories as 'substantive' ones in line with Maxwell's (2005) distinction. "Creating substantive categories is particularly important for ideas (including participant's ideas) that don't fit into existing organizational or theoretical categories; such substantive ideas may get lost, or never developed, unless they can be captured in explicit categories" (p.98). By creating substantive categories, I also attempted to capture and explain key directions in the data analysis process. For instance, the student-related category was formed with the intention of using the relevant codes to amplify students' perspectives on the programme, and other related issues exploring the programme's impact on the students. The same method was applied in the creation and explanation of two other categories. I define each category and indicate the codes they include in a separate table (see Appendix 16: categories and codes they include).

In summary, the whole data analysis process started with initial data examination where I applied the so-called 'helicopter view' approach by watching the observation videos, reading the observation notes and listening to the recordings of the interviews and focus group discussions. After completing this stage, I developed themes by composing memos. In the second stage – the process of coding – I started coding the data first employing the initial coding strategy. Next, I continued the process using focused coding that allowed me to refine/reshape my codes and add new ones to the emerging code sets. Also in this stage, I practised the constant comparison method to compare codes and their excerpts within and/across the sample groups. In the third and final stage of the data analysis process – in-depth analysis of the data – I selected and analyzed 82 codes and 79 co-occurring ones with their excerpts using different qualitative charts produced by Dedoose, and compared them across the sample groups. In this stage, I developed three categories (Teacher, Student and Classroom dynamics-related) that included relevant codes and helped me better interpret the data. As a result of the data analysis process, I developed themes that will be

presented in the findings chapter and interpreted in the discussion chapter of the thesis.

## 3.9 Ethical issues

Based on Maxwell's (2005) recommendations I tried to address ethical considerations and concerns in each step of the data collection, analysis and interpretation. Heeding research participants' concerns and ensuring their confidentiality and equity of treatment were crucial for me.

My position at the Ministry of Education brought a number of ethical considerations to be approached with great care and attention, because working with principals and teachers was part of my job, as a Ministry employee. Therefore, I could not participate directly in the data collection process and had to use the services of the research assistant. She was trained on various research issues including ethics and detailed information about voluntarism, guarantee of privacy and anonymity, confidentiality, informed consent, rapport and friendship was provided (Lichtman, 2006).

During our initial meetings with principals we explicated that the research was conducted solely for my doctorate program, and that it did not have any ties with my professional work. Although one of the major principles associated with the ethical conduct list (Lichtman, 2006), do no harm, is mostly associated with medical studies; it is also important to inform all participants in social studies that the research has no risk for their position, reputation or work. Similarly, I attempted to pass the same message to research participants via the research assistant, who had a direct communication with them, and also emphasized the matter in the permission letters directed to principals and informed consent forms addressed to teachers. It was important for me to make sure that teachers did not see the research as an evaluation of their teaching performance or overall achievement progress of their students, and

participated in the research with an intention of contributing openly to the data collection process. Consequently, all informed consent letters included brief information about the research goal and objectives as well as the expected roles of research participants.

Another ethical consideration related to teachers was to assure their confidentiality and anonymity. I stressed the matter in the informed consent letters, and the research assistant repeatedly notified teachers that only my research assistant, my supervisors and I would have access to the data. In the informed consent letters, I also stated with complete confidence that throughout the study absolute anonymity would be provided for all the research participants –teachers, parents and students.

The research assistant and I also approached teachers' schedules with care not to create any kind of disturbance to the flow of their lessons. Vice-principals informed us beforehand that teachers do not use netbooks in all classes. The research assistant thoroughly discussed lessons which would normally have the usage of one-to-one computing; however specific dates for observations were not agreed in advance. Moreover, during observations the research assistant remained careful and attentive not to disturb the flow of the lesson in any way; she installed the camera in the back of the room and sat at the desk near the camera trying to be as inconspicuous as possible. Nevertheless, despite her efforts there were students who became distracted from classroom activities and from time to time curiously checked the camera set up in the back of the room.

Ethical considerations and issues related to the involvement of children in research have been discussed and debated in several studies (Cocks, 2006; Alderson & Morrow, 2004). We approached young participants of the study with extreme care and attention as an end in itself and considering the importance of students' honest views and perspectives. Upon identifying and selecting students the research assistant first approached them and then contacted their parents to obtain consent. I was sure that students' answers could be affected by their understanding of the

research and their vision of participation in it. Consequently, with the help of the research assistant I attempted to convince them that the research had nothing to do with their academic achievement and it would not influence their relations with teachers and/or school officials in any way. Secondly, I did not want children to perceive the research assistant as a teacher or any kind of ministry official, but rather as an adult with curious questions about the one-to-one computing programme. Since the Azerbaijani education system is still influenced by the previous Soviet legacy, students might not always feel comfortable to speak out their thoughts in lessons. The research assistant's friendly and casual approach to students was intended to break this barrier, where possible, and make students feel comfortable enough to openly share their views. The interviews mostly took part in separate rooms, not classrooms, and I strongly believe that they felt more comfortable and relaxed.

According to Orb, Eisenhauer and Wynaden (2000), qualitative research is built around exploration, study and description of people, events and environments, and may create tension between the research objectives of achieving findings for generalization purposes and the right of the participants to maintain and protect their privacy. That is why the desire to participate in a research study depends upon a participant's willingness to share his or her experience. Thus, I asked the research assistant to remind the participants about the confidentiality of their identity before collecting data. Students were also aware of their right to withdraw from the research at any time they wanted. Parents were the most concerned participants of the study as they truly thought that their participation in this study could have some unpleasant effects on their relations with teachers and/or school officials, especially because their voices would be recorded. The research assistant hence held long conversations with parents answering their questions and assuring them that no harm would be caused to either parents or students since nobody except her, myself and my supervisors would have access to the interview recordings and their transcripts.

## 3.10 Validity, reflexivity and generalizability

### *Validity*

"Qualitative researchers rely – implicitly or explicitly – on a variety of understandings and corresponding types of validity in the process of describing, interpreting and explaining phenomena of interest" (Maxwell, 1992, p. 279). In line with Eisner and Peshkin (1990), validity of research also depends on deciding how researchers' understanding relates to reality. According to Hammersley and Atkinson (2007), no data in themselves can be considered valid or invalid, what should be studied are the researcher's interpretations and perceptions drawn from them. Hence, I believe in order to ensure the validity of the data, my inferences, claims and understandings of them should also be an issue to be explored.

Maxwell (2005) argues that although one might follow different procedures and use various methods and techniques, there is no guarantee for the validity of results. Accordingly, since none of the prescribed strategies are guaranteed to prove successful, I find it more important to acknowledge and address validity threats instead.

In this research study there are three validity threats: first, whether classes we observed and video-recorded are ordinary in nature or they were prepared as "show-off" classes for observation. Secondly, the extent to which we can judge the validity and trustworthiness of the research participants' replies; and thirdly, my assistant's interpretation of the data and mine, which Maxwell (2005) calls "researcher bias" (p.108).

Upon watching the observation videos, I experienced certain doubts about the validity of the classes observed; i.e. it seemed to me that those classes did not necessarily happen every day or week and they might have been simply "show-off". I discussed my concerns about this issue with the research assistant as she was the

one present in the classes and she could supply more information regarding the matter. She also had similar concerns and we therefore delved into the follow-up interviews with the teachers and in particular with the students. During interviews we heard a few students informally mention how they had prepared for the observations though the exact day was not agreed with teachers, or how they were used to hosting guests during the classes in general. Of course, it was not the case with all observed classes; teachers were obviously capable of preparing for such observations on short notice, and as a researcher, I still had to be aware that it might cause validity threats for the study.

In order to increase the validity of the participants' views I employed various methods, which I expand on below including individual interviews, focus group discussions and classroom observations.

As mentioned earlier, the research assistant was responsible for moderating interviews and focus group discussions because my participation might have affected the information the participants provided due to my position in the Ministry of Education. Bearing this in mind I had to pay special attention to communicative validity to authenticate the knowledge acquired during interviews (Kvale, 1996). Sandberg (2005) sees communicative validity as "one criterion for achieving truth" (p. 54) and recommends conducting interviews in the form of dialogues with many open-ended, follow-up and repeated questions to assure accurate understanding by the participants and achieve high communicative validity. As recommended by Krueger (1994) the moderator has to be highly trained and the questions should be fairly specific. Correspondingly, I trained my research assistant on moderating depth interviews and focus group discussions, and tested our questions with a group of volunteer teachers prior to the actual data collection.

Before conducting follow-up interviews with teachers, I again watched the classroom observation videos and prepared a list of clarifying questions and pointed out issues of interest to be addressed by the research assistant. I believed it would allow me to

ensure validity of my interpretations as far as possible and thus cross-check the responses with recorded classroom observations. A similar strategy was applied to other research participants before in-depth interviews and focus group discussions.

Kraft (1999) states "when three or more methodologies or sources of data are accessed and the results are compared with each other, you can provide a more complete understanding of the issues or questions being studied" (p. 24). Hence my inferences drawn from watching classroom observations were also cross checked with the responses given during follow-up and individual interviews, because "making comparisons between data about what people say and do, however, strengthens your assertions about implicit meanings" (Charmaz, 2005, p. 68). To have a complete picture, teachers and students were observed in real classroom processes to perceive and interpret their attitude as well as behavior towards the programme to the best extent possible.

To further increase the validity of my interpretations of the classroom activities, and of the whole body of data, I constantly visited the data and my research assistant met with the research participants to discuss issues of concern. Since I was unable to directly participate in the data collection process, I supervised it with the utmost care so that all doubts about the validity threats that the research assistant could bring to the study would be eliminated. It was important to make sure that she was alert to these threats, would restrain herself from influencing respondents' answers and would not attempt to elicit responses that she would like to hear. I believe we tackled this threat by constantly acknowledging and trying not to surrender to it. The similar threat named "researcher bias" (Maxwell, 2005, p. 108) described above made itself present during the data analysis and interpretation process. Being aware of this threat and remaining alert throughout the process I maximized my efforts to ensure validation of the analysis as well as interpretation of the data and avoid possible negative consequences.

## *Reflexivity*

According to Langridge (2007), "reflexivity is the term for the process in which researchers are conscious of and reflective about the ways in which their questions, methods and very own subject position (as white/black, middle class/working class, heterosexual/homosexual, insider/outsider, etc.) might impact on the psychological knowledge produced in a research study" (p.59). He further suggests all researchers should repeatedly ask themselves certain questions on the goals and outcomes of the research, his/her relationship with the research subject, the impact of findings on participants, etc. Malterud (2001) believes that reflexivity has equal importance to relevance and validity and explains it as "an attitude of attending systematically to the context of knowledge construction, especially to the effect of the researcher, at every step of the research process" (p. 484). In my view, reflexivity and self-criticism can increase the validity of the research as the researcher is constantly aware of the influences he might bring to the research and is ready to display them to the readers for their consideration.

I have chosen to study the factors influencing the integration of a one-to-one computing initiative into learning and teaching for a number of reasons. As mentioned earlier, one-to-one computing in Azerbaijan is still in the pilot stage and therefore it has been of great interest to me, to investigate whether the programme has any effects on teaching and learning, and what factors affect the integration process of this initiative. As a strong advocate of the programme I have been closely involved with the launch and implementation of the project in Azerbaijan. Thus, in this particular situation I am acting as an insider; recognizing my personal and professional interest I am very well aware that my own understandings and assumptions inevitably might influence the ways, to some extent, in which I am going to interpret the collected data.

Gilgun (2011) defines reflexivity as the researcher's awareness about the influences on the research process. The author recommends researchers to become reflexive

mainly in three areas: 1) the topics they want to study as the researcher has to make a clear distinction between personal and professional choices; 2) the participants they work with and study; and 3) the audience the research will be addressed to. In this case the language used and its lucidity is also important. Being a "ministry person" I had to ensure that the research participants' responses were not affected by my position, hence I used the services of the research assistant as described above. While this fact kept me at a distance from the data collection process it had some positive effects as well; during the data collection and analysis process I engaged in long conversations with my research assistant, who helped me more clearly define my role as a researcher that impelled me to keep my personal and professional beliefs about one-to-one computing aside. And more importantly, throughout the research I constantly remained in touch with my supervisors who never hesitated to provide their valuable feedback and comments to my study which greatly assisted me in conducting this research.

## *Generalizability*

As in many other qualitative studies, the generalizability of the research findings can be taken up on two different levels: "internal" and "external" (Maxwell, 1992). Internal generalizability would be applying a certain conclusion within a single setting or group to other representatives of the same environment that were not studied, while external generalizability would mean application of the same conclusion to a wider population (Maxwell, 1992). A similar, but more specific, definition can be considered for the description of generalizability as 'across' and 'within' cases (Gomm, Hammersley, & Foster, 2000).

Maxwell (2005) considers that external generalizability often is not an essential issue in qualitative studies; however, it should not be understood that "qualitative studies are never generalizable beyond the settings or informants studied" (Ibid, p.115). Citing other sources, Maxwell offers a list of features that make generalizability possible in case studies and nonrandom samples: participants' evaluation of

generalization possibilities, the resemblance of conditions to other situations, the belief that the studied phenomenon is universal and justifications from other research projects ((Hammersley, 1992, pp. 189-191; Weiss, 1994, pp. 26-29) see Maxwell, 2005).

Among these approaches, I mostly refer to the 'internal' generalizability or, as it is otherwise called, generalizability 'within' the studied cases. This sort of generalizability is more significant for a case study, since it inherently speaks of the validity of the findings and conclusions reached. The 'external' or 'across studies' generalizability ought not to be disregarded completely, but its application can be much more vague and prone to subjective interpretation.

The present study has taken into consideration the aspect of generalizability on each step throughout the research planning. At the very first stage, a purposive sample selection method was used to identify the schools that were representative of those implementing one-to-one computing. The schools to be observed in the capital city were selected based on a criterion of having at least 2 years of experience in the process of integrating technology into teaching and learning. A regional school was also added to the selected sample, since its characteristic features greatly differ from the capital schools. This kind of sampling allowed me to study the possible aspects of the integration, made the study more representative and increased the chances of 'transferability' (Gomm, Hammersley, & Foster, 2000) of the findings and conclusions.

Another aspect that affected the sampling of subjects (in this research - schools) was what Payne & Williams (2005) refer to as 'access to data'. The authors state that when certain phenomena occur in many different places, there are more possibilities for investigation (Payne & Williams, 2005). As such, any other school implementing one-to-one computing could have been a good source of data for analyzing the process of the integration. Naturally, instead of Azerbaijan, this study could have included, for example, Georgia, the neighboring country with many similarities in

terms of the history of recent decades, education system and experience in the implementation of one-to-one computing. However, I refer again to Payne & Williams (2005) who consider it reasonable for a researcher to conduct the investigation in a convenient environment, within a travelling range of where he or she is based. In their article the authors define 'location' of a researcher or the research subjects not only as "physical location, but also social location in terms of networks and processes, which provide awareness of research issues, where they are the most clearly manifested, and the means of establishing contacts with potential informants" (Payne & Williams, 2005, p.308). Accordingly, by selecting Azerbaijani schools as a 'social location' for my study due to the convenience, the access to data, and the awareness of the school processes (being an employee of the Ministry of Education) I managed to initiate and conduct this study, however its generalizability is limited.

The initial observations had shown that some students in various classes tended to be more active than others and used their technological skills more frequently to assist teachers and peers. Therefore together with the tech-savvy students, other less active students were also interviewed. As it later turned out, the less active students appeared to be nonetheless technologically competent, which refuted the idea of only the active students having the necessary technological skills.

In order to "allow for relevant heterogeneity" (Gomm, Hammersley, & Foster, 2000, p.108) while selecting teachers for further interviews, particular attention was paid to choosing the ones teaching different subjects with various length of experience. The diversity allowed for a wider array of information to be attained and made the experiences of the selected group of teachers more susceptible to internal generalizability.

Due to the cultural traditions of the country, diversification of parental groups invited for the focus group discussions was limited mostly to female representatives (out of

12 parents only one was male) - mothers of the interviewed students, which deprived the research of an option of learning the fathers' opinions.

Gomm, Hammersley, & Foster (2000) raise the issue of 'temporal scope' in a case-study research, reflecting on the fact that frequently the scope of a given study is taken to be longer than the period of observation. The statement is then followed by the clarification that if a researcher observes one class throughout a study year, it does not necessarily entail that the next cohort will be the same and raises some questions in terms of internal generalizability of the data, especially in relation to students' performance indicators (Gomm, Hammersley, & Foster, 2000). The aim of the present research was to identify the factors influencing the integration of one-to-one computing into teaching and learning based on the stakeholders' (including students') views and opinions. Even though the data have been gathered two years ago, it can be claimed that the identified factors have some generalisability over the years and different cohorts,. For instance, *teacher beliefs, parental support, student satisfaction* are expected to remain similar within a certain margin, until the programme implementation processes are altered by educational leaders.

## 3.11 Summary

This chapter described the methodology used to gather the data and illustrated the analysis process. The chapter focused on the researcher's motivation to undertake the study, the general aims of the research and the methods used to conduct it. Using qualitative research methods and applying the grounded theory framework I have tried to identify the factors that influence the integration of one-to-one computing into teaching and learning.

The data were first analyzed using a 'helicopter view' approach, which served as an appropriate tool for preliminary examination. The general observations derived from

this approach later proved quite useful in refining the codes that emerged through the process of coding. Once I had identified the codes with the use of the Dedoose tool, I moved on to the in-depth analysis of the data and arranged the codes that emerged into separate themes and categories, which helped me to arrive at the findings to be discussed in detail in the following chapter.

# 4 Findings

## 4.1 Overview

In the beginning of this chapter I will present the results of the initial perspective attained through the employment of the 'helicopter view approach', which has been described in the methodology chapter (see chapter 3). The preliminary examination of the data was carried out in order to familiarize myself and to acquire a general sense of the gathered material. It proved to be a helpful approach as its outcomes played an important role in forming an initial understanding of the data. Section 4.2 below will cover four major themes that were developed as a result of the preliminary examination.

The chapter will continue with the presentation of the outcomes of the in-depth analysis process, which consisted of four different stages (see chapter 3 methodology). In this section the detailed description of the findings will be communicated through categories and their themes that will be presented in three main subsections: students, teachers and classroom dynamics. Additionally, in the end of the chapter the analysis of the parents' views will be presented in detail.

## 4.2 Preliminary overview of the data

Commencing the data analysis process, I attempted to attain a general overview perspective on the data through the preliminary examination of the observation videos and interview recordings, in parallel to writing memos and taking notes (see chapter 3, section 3.8.1). The outcomes of the exercise have been gathered under four topics, which separately address: the practices that are currently emerging in

classrooms as a result of the introduction and widespread use of technology; an increased focus on technological learning; the significance of the school administration's attitude towards one-to-one computing; and several problems raised by research participants.

The following account of these four topics presents the reader with an initial overview understanding of the study's outcomes, while later sections provide a more in-depth examination of its findings.

## *Newly Emergent Practices*

New classroom activities emerged owing to the Classroom Management Software (CMS) introduced within the one-to-one computing programme. The software enabled teachers to create a 'virtual'[6] classroom setting by connecting teachers' notebooks and students' netbooks via a local area network.

One of the most commonly used activities in such a 'virtual' classroom setting was preparing tests for students and sending them to their netbooks to be completed within a set time frame. The individual student interviews revealed that the students were excited and willing to perform different types of tests on netbooks. They seemed to opt for doing tests on netbooks, stating that it was practical and allowed them to receive immediate results. The teachers also supported employing computer-based tests for it saved them time and lessened paperwork while evaluating students' responses one by one.

Another feature of the CMS allowed the students to share their assignments with the teachers to be displayed on interactive boards. In most cases the students finishing the earliest had their work showcased by the teachers on interactive boards. The students were enthusiastic to perform better and conclude their work faster in order

[6] I have named this setting a 'Virtual' Classroom because it is created by the Classroom Management Software, where teachers can interact with students online and control screens of their netbooks, in parallel to exchanging files.

for it to be displayed on interactive boards and receive immediate feedback from the teacher and classmates.

Achieving the creation of the 'virtual' classroom setting was not always easy, because it was often disrupted by connectivity and netbook-related problems. Nevertheless, the majority of the students stated that they collaborated and assisted one another when unexpected technical or netbook-related problems occurred. Such technological issues fostered student/student and student/teacher collaboration as the students helped both their classmates and the teachers to solve the problems.

The 'virtual' classroom setting seemed to save overall time during classes as the teachers did not have to move around to distribute and collect assignments or spend extra time checking students' works individually. Instead they could send assignments to all the students simultaneously or receive completed ones within the 'virtual' setting. They could see students' netbooks' screens on their notebooks and had full control over them. They could shut down netbooks or freeze a netbook's screen for some time. Although the software seemed to be attractive and practical to the participant students and teachers, several students addressed certain missing features of the programme and shared their suggestions. For example, some students pointed out that it was impossible for them to communicate with one another or share files among themselves (student to student). They expressed their interest in having a communication tool similar to the one that was connecting teachers and students in the CMS, which students could have used for collaboration purposes while working in groups.

In general the creation of a 'virtual' classroom setting, provided it was completed without any technical interruption, seemed to increase the speed of certain aspects of classroom interaction. Several students reminisced about how they used to prepare presentations for different classes and bring them to school on flash drives before they were given netbooks. However, after the introduction of the 'virtual' classroom setting the process was further simplified. Students were now preparing and bringing

completed assignments to classes on the netbooks, and instead of handing the assignments to teachers on flash drives they were simply sending those through the classroom network.

In all the observed classes the students made presentations on the netbooks, searching for information on the Internet and using various programs or Web 2.0 tools introduced by their teachers or found by themselves. While certain students were comfortable enough in preparing presentations with MS PowerPoint, others chose Web 2.0 tools like timetoast.com, prezi.com, bubbl.us and so on. It should be highlighted that similar tools had been broadly used by the teachers through the life of the programme, which might well urge students to follow their example.

The students further noted that while preparing presentations they had to merely add one-line entries to the slides, instead of writing lengthy texts. For example, if they were writing long essays before, with the use of presentations they had to include only key points to briefly introduce the topic, which had resulted in a complete alteration of their writing habits. While in the case of handwriting they could not afford errors, because making one would require them to rewrite the whole page, netbooks offered the very attractive option of editing text as many times as they needed.

The integration of the programme affected classroom dynamics as well. For example, in the Capital school 1 a teacher said he did not ask his students to stand up, come to the board or raise hands, because they could use similar features of the Classroom Management Software. Also in the Regional School the teachers had changed the usual placement order of desks and created a different setting, due to the limited number of computers in each class caused by the adjustments in the netbook distribution, which did not allow the students to work individually and instead they had to work in teams (see chapter 3, section 3.5). In the Capital schools, however, the students were mainly working individually and sometimes in pairs with their desk-mates when they had to share netbooks due to technical problems that arose.

### *Focus on Technological Learning*

One of the opinions expressed by the parents was that, unlike regular classes, in one-to-one classes more technological learning rather than subject domain learning had been occurring. However, the observations revealed that the teachers and students were striving to improve their ICT knowledge and skills, because it meant better infusion of the programme into classroom processes as well as minimizing the risk of disruption during classes. In the follow-up interviews and the focus group discussions teachers reiterated that the students acquired ICT skills at a more rapid pace, sometimes excelling the teachers' understanding of computer usage and capacity to solve technical problems. The parents also emphasized that their children were ahead of them in these matters. Nevertheless, they stated that more technological learning was happening as opposed to subject-related learning and considered it a distraction from the study processes. While the students and the teachers took a separate stance asserting that technological learning was developing in parallel to subject learning, parents had a completely opposing idea claiming that it was happening at the expense of curricular learning.

The administration in both of the Capital schools had established technical support systems to assist teachers and students with any kind of technological or software problems related to computers. Also administration officials at the Capital school 2 seemed to pay special attention to providing the students with relevant ICT skills and knowledge so that they could operate netbooks more effectively. For that reason the 'ICT Union' had been established in the Capital School 2 where students from different classes, in particular from one-to-one classes, attended workshops after regular school hours to obtain ICT knowledge and skills to become, in the ICT union's terms, 'ICT masters'. In one-to-one-integrated classes the 'ICT masters' were expected to assist fellow students along with their teachers in solving technical issues when necessary. This kind of collaboration to solve emerging technical

problems seemed to strengthen relations and cooperation among students, as well as between students and teachers.

Learning new software and obtaining new ICT skills seemed to be a necessary and stimulating process for the students, and for the teachers this process was strongly associated with better implementation of the programme, but for the parents it seemed to be an entirely contrary scenario. During the focus group discussions the majority of the parents touched upon the matter several times exploring it from different angles and emphasizing the necessity for implementers to consider the situation.

Considering that the teachers and the students were using computers daily and it had already become a necessity, obtaining technological skills seemed to be an important part of the learning process for them. It was also observed that in the classes where the students and teachers possessed relevant ICT knowledge and skills, fewer interruptions seemed to emerge and the classes were being conducted with a natural flow in comparison with the similar one-to-one classes in which the students and teachers lacked necessary ICT skills.

### *School Administrations' Attitudes*

Differences in the attitude of a school's administration towards the one-to-one computing initiative and its implementation seemed to make a considerable impact upon and brought changes to the overall execution of the programme and the success of classes in such a setting. For example, the teachers considered themselves more motivated to integrate one-to-one computing into their classes in the presence of their school administration's support and encouragement. Furthermore, the teachers explained how they became enthusiastic, trying to excel at their profession when feeling appreciation and assistance from their school administration. The teachers being bolstered by their school administration in addition to their positive personal

and professional attitude to the programme seemed to contribute fundamentally to the desirable integration of one-to-one computing into classroom activities.

Moreover, the analysis of the classroom observations revealed that the programme seemed to yield favorable outcomes where the school administration had kept a watchful eye over the implementation, assisting the teachers with necessary technical support at school. As mentioned during the interviews and observed in the videos, not having technical support disrupted the natural flow of classes, and hence to some extent hindered the application of the programme in the schools. The Capital schools had access to trained technical staff responsible for the maintenance of computers and providing the students and teachers with technical assistance when required. However, in the Regional School there was a lack of technical assistance, and therefore the school principal had to call in professionals from the capital to fix technical problems, which consequently caused a loss of time and frustrated the teachers. Interestingly enough, in the same school an Informatics teacher sat in the back of the classroom during both classroom observations and the reason for her presence was explained by the assistance that might be required in the case of any unexpected technical problem.

As described in Chapter 2, in accordance with the mandated procedures of the one-to-one computing initiative netbooks must be distributed to each student, and this was the case at the beginning of the programme in the Regional School as well. However, in the second implementation year the administration of the school had adjusted the procedures based on their own decision (see chapter 3, subsection 3.5) and had distributed 30 netbooks among students who had excellent marks in all subjects taught at grade levels 5, 6, and 7 only; as a result four to five excellent students in two classes of each of these grades had been provided with netbooks. The adjusted pattern of distribution affected the use of netbooks during classes. Firstly, the limited number of netbooks did not allow students to work individually, as in the capital schools. Secondly, teachers had to make changes to the classroom activities they had developed; they had to prepare group activities with netbooks and limit or

adjust homework conducted on netbooks. Overall, these adjustments resulted in further consequences in the conduct of classes; namely classroom activities with netbooks mostly comprised of group work – four to five students working with one netbook. The students seemed to hold different opinions on this type of work; nevertheless the majority compared the current situation with the one in the previous school year and concluded that one netbook-per-student was more practical and effective than the current way of distribution. During the follow-up interviews and the focus group discussions the teachers of the Regional School also reviewed the current situation. Although they pointed out advantages of such a type of group work, in the end they remained in favor of students' working individually with one netbook. In general, when the research participants in the Regional School were asked about their preference they emphasized that it was better during the previous school year and they wished that all the students in one-to-one classes were again provided with netbooks individually.

The uneven distribution of netbooks in the Regional School also impeded individualized and home usage of netbooks. The students could complete home assignments with netbooks only if they stayed at school after classes, or gathered in one student's house in their neighborhood who had a netbook or any other computer. However, such arrangements were not accessible for everybody considering that some of them resided in remote neighborhoods, away from those in possession of computers.

In general the findings gathered under this theme hinted at the significance of the approach taken by the school administrations towards the one-to-one programme. The teachers also highlighted the importance and consequences of the school administration's support; especially by emphasizing the effects it would have on their teaching and overall professional growth, and motivation to conduct one-to-one classes.

### *Problems raised by the stakeholders*

During the data collection process the participants explicitly expressed their complaints and concerns about the programme implementation and its drawbacks. To name a few, the teachers complained that while they were having training on the programme they had failed to immediately apply the acquired knowledge in teaching as there were delays in the distribution of netbooks. As a result there were cases where the teachers explained the lack of certain classroom activities in terms of the quality of training they had undergone and the time gap between training courses and the actual distribution of computers to classes. The teachers who did not report any problems related to training seemed to conduct more effective one-to-one classes in comparison to the ones who had concerns with the training part of the programme.

Moreover, the teachers and the students reiterated that the netbooks were old – had been used for four years already – and it was necessary to replace them with new ones or preferably with tablets. The teachers also touched upon the need to replace textbooks with e-books. Although the parents in general were opposed to the frequent usage of technology, they were still in favor of distributing new innovative tools such as tablets to replace old netbooks considering the necessity of transforming education by deploying technology. The reason for resisting the regular use of technology was parents' concerns about children's health, namely their eyesight.

Additionally quite a large number of parents considered netbooks to be causing regression in the development of their children's speaking and writing skills. They claimed that their children were constantly typing on netbooks and therefore their handwriting and speaking skills were degrading. According to the parents the reason for this development was the teachers' inability to ration efficiently the usage of netbooks during classes. In particular the parents of the students in the Capital schools suggested decreasing netbook usage during classes and balancing the textbook-netbook usage ratio to 50-50, because their children were using netbooks

extensively during each class period, and the parents considered this as an unnecessary overuse of technology.

## 4.3 The outcomes of the in-depth analysis

This section will encompass the detailed description of the findings revealed as a result of the in-depth analysis. The in-depth analysis led to the findings of this research, enabling me to bring out the major themes within each category. The section will start with the findings of the student-related category, continue with the teacher and classroom dynamics related categories, and end with the subsection on parents' attitudes towards the programme and its impact on their children's studies. Figure 4.1 summarizes the categories alongside the themes developed as a result of the in-depth analysis.

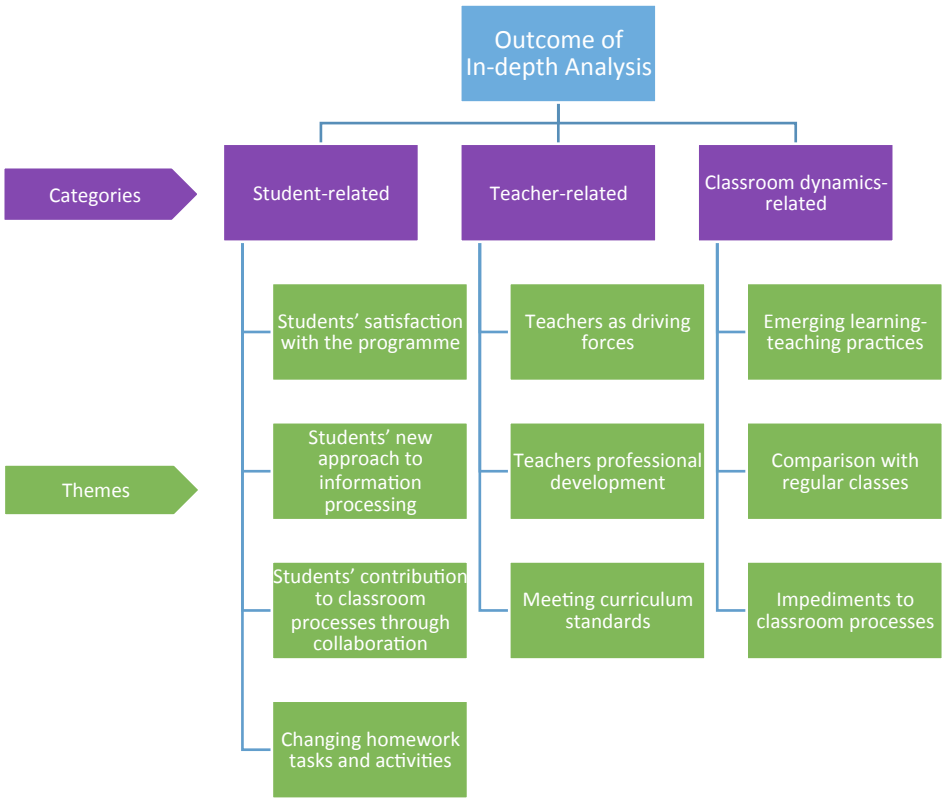



*Figure 4.1 Categories and themes developed as a result of in-depth analysis*

### 4.3.1 Student-related category findings

The student-related category reveals students' perspectives on the programme integration in their classes as well as other student-related findings. The sub-sections are concerned with students' views and evaluation of the programme. The aspects related to students' satisfaction with the programme and new approaches to information processing are discussed in following sub-sections. Additionally, the emergent alterations to classroom processes including students' collaboration and homework preparation will be reviewed. The student-related category with its themes and associated codes is illustrated in Figure 4.2.

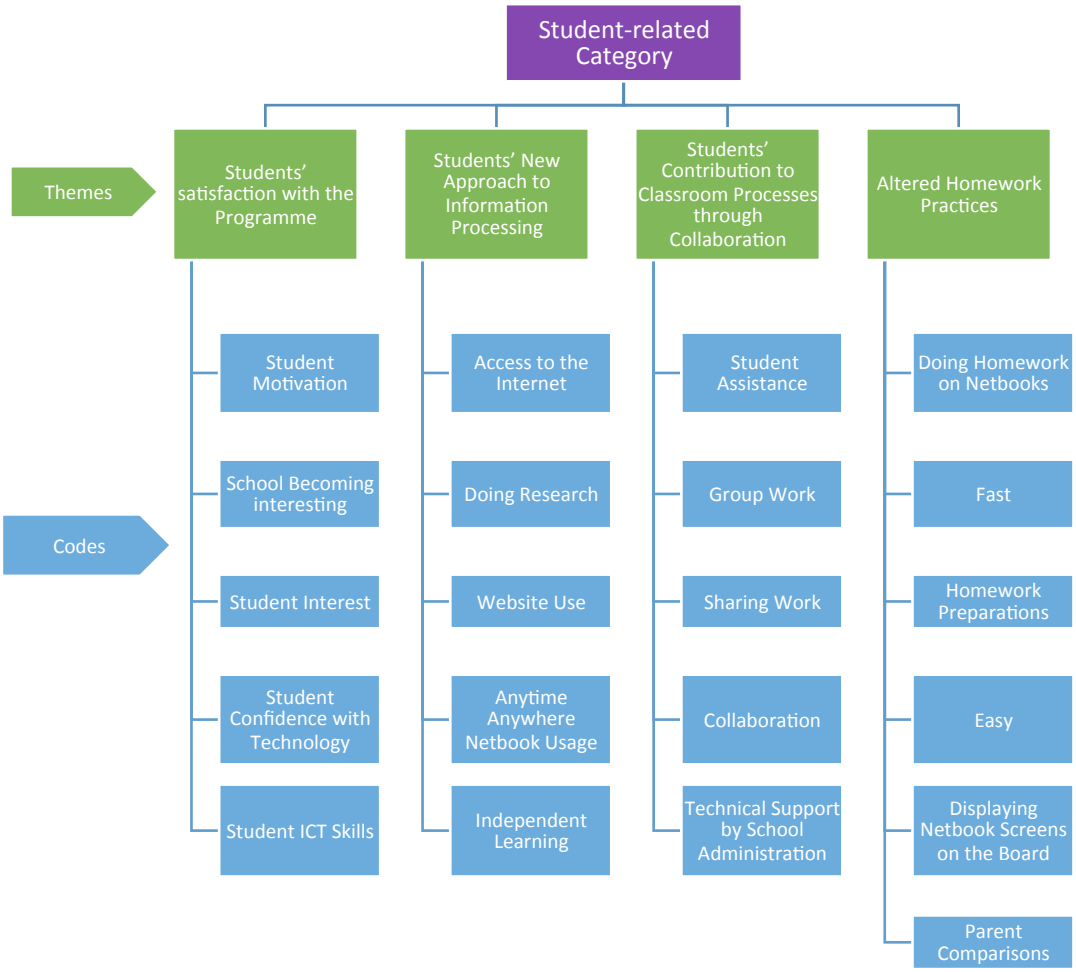



*Figure 4.2 Themes of the student-related category and codes from which they have been developed.*

#### 4.3.1.1 Students' satisfaction with the programme

The data analysis revealed that among the three groups of study participants the students were the happiest with the introduction of technology. They claimed that classes had become more interesting since they started studying with one-to-one. The students explicated their motivation for studying with one-to-one computing in their own way bringing arguments and examples from their studies. One student mentioned:

> The teacher himself makes good presentations, and has a very good knowledge in computers. That is why we know that every day we will have a different class and we will be surprised at school. He [the teacher] uses interesting pictures, animations and recordings. It makes class interesting for us. (CS 1, St. 6)

Based on the quote above it is obvious that the way teachers conduct the one-to-one classes had a noticeable impact on students' attitude towards the programme, mainly in terms of their expectations of interesting teaching methods. However students' interest in the programme was not limited to just the teachers' ways of conducting classes. In many cases it stemmed from their own personal experience and perception. In the individual student interviews, almost half of the students explicitly stated their interest in, and motivation for, netbook usage.

> I managed to express myself with the help of the computer (CS 1, St. 7);

> All of us are happy when we have computers in class (CS 2, St. 2).

Preparing presentations for classes seemed to enhance student enthusiasm and curiosity towards the subjects taught in the one-to-one setting, because it included using a great deal of visual aids and research, viz. finding materials and pictures on

the Internet, applying different backgrounds and patterns to the presentations and so on. The data analysis revealed that the majority of the students considered themselves motivated when they prepared presentations for lessons and when teachers displayed them on interactive boards.

> When I work with a netbook I get more curious about the teacher's reaction to my work. Most of the time, the teacher asks us (as I mentioned earlier) to make a presentation on some topic. … And we can show our presentations using projectors. (CS 1, St. 5)

Moreover, rereading excerpts of co-occurring codes within the student category I concluded that there were types of students with considerable interest in netbook usage who were also noticeably motivated to utilize them during lessons and therefore were striving to better familiarize themselves with technology to operate netbooks efficiently. As revealed in the 'Focus on technological learning' subsection of the 'Preliminary overview of the data', students' were leaning more towards technological learning, (see section 4.2). The results of the in-depth analysis not only confirmed these findings but also revealed that technological learning bolstered students' confidence in their studies as well.

This claim is supported by the fact that the students seemed certain that they were outperforming their peers in regular classes, since in the one-to-one classes the learning process was enhanced by technology. Furthermore students' comparisons of their studying in a one-to-one class versus a regular setting surfaced their confidence with technology i.e. they conveyed enthusiastically that they could provide the research assistant with basic knowledge on computer usage, they would assist their teachers, peers and parents if needed, and in most cases they were able to solve technological problems.

> I think considering my age I know enough. Sometimes even teachers ask me some things and I show. (CS 1, St. 8)

Almost half of the interviewed students mentioned that most of the time they did not seek help with netbook usage, and even when they did they usually searched for solutions on the Internet.

> My best friend is YouTube. I search there, find, watch videos and learn. (CS 1, St. 8)

#### 4.3.1.2 Students' new approach to information processing

The one-to-one computing programme was also aimed at creating and improving anytime anywhere learning opportunities for students, boosting individualized learning by providing each and every student with a compatible device. The students in the observed one-to-one classes, excluding the Regional School, were each provided with a netbook as well as Internet access at school and at home ensuring continuous access to information. While comparing one-to-one classes with regular ones several students talked about the newly offered opportunities:

> A class with netbooks is more interesting and practical. Everything goes very fast and things get solved very fast. Ordinary lessons are also interesting; but it takes a lot of time. (RS, St. 11)

The research participants largely recognized access to information anytime anywhere as an advanced tool for searching for necessary materials on the Internet to accomplish assignments. For example, one parent even went so far as to compare a visit to a library to having access to information by searching on the Internet and considered the latter far more advantageous:

> When they use the Internet they access the latest information. When you visit a library you have one source, but on the Internet you have a variety of resources and information. (CS 1, P 8)

The students were finding necessary materials on the Internet and bringing them to classes to share with others. Teacher (RS, T 5) mentioned that the students would sometimes introduce new resources found on the Internet to the whole class, which were not familiar even to her. As such, they admitted that the students sometimes would gather information on the topic of discussion from the Internet that would be new for teachers themselves too.

> When you ask students to do research on something they do it very actively and enthusiastically. Sometimes they can even find things that are unknown for a teacher. (RS, T 5)

Given the fact that the Internet enables vast and diverse information processing and sharing opportunities the students frequently surfed the web in order to carry out different types of activities, such as independently researching on the Internet, preparing presentations, watching educational videos, visiting educational websites, etc. Teacher (CS 2, T 1) elaborated on the Internet search and considered the whole process as a way of learning and gaining knowledge:

> They [students] themselves find any material on the Internet. It is not just for their presentation, and they also go to the Internet to gain some knowledge. .... They have a difficulty with the spelling of a word; there is no need to look up in the dictionary; they open up their netbook, search the web and find the spelling and the pronunciation of that particular word. (CS 2, T 1)

While the students and the teachers talked with enthusiasm about searching the web and designing presentations, at times describing it as a learning process, the parents also delved into the matter stating in contradiction that the process did not involve

any sort of knowledge acquisition, because usually students only pasted necessary materials from the Internet to the presentations.

> Sometimes a teacher asks them [students] to prepare presentations. … children don't do anything creative there. … they don't have their own products there (CS 1, P 7)

Although some of the students admitted to copying and pasting from the Internet, there were those who would insert their own interpretation of the acquired information into their presentations instead of simply copying from the Internet. The teachers also connected Internet-based research with the ability of learning individually and independently.

> Students can download information, pictures from the Internet on their own and create something independently…. It means they are developing. (RS, T 6)
>
> They [students] can use resources from the Internet on their own and make presentations. They can express themselves more independently. … be it in groups, in pairs or individually. (RS, T 6)

#### 4.3.1.3 Students' contribution to classroom processes through collaboration

The students were observed to contribute to the learning process within the classroom developing collaborative skills in a number of ways. Frequently they would share knowledge acquired during individualized learning via the Internet at home by presenting to the whole class, or working in groups or pairs exchanging their knowledge and ICT skills with peers and teachers. Preparation of presentations using materials found on the Internet enriched the information learnt on particular topics during classes and forced the students to engage actively in classroom

processes. There were students who could find additional materials, sometimes even new and unfamiliar to the teachers. Using computers at home and including new information taken from various Internet-based sources students would provide additional knowledge on the topic to the whole class through their presentations.

> … we work with one-to-one and everybody puts his knowledge on the table. For instance, if one student knows that "CTRL+C" means copy … and tells others it gets more interesting. (CS 1, St. 5)

> For instance, if one student has some difficulty with PowerPoint they [students] help right away. … they [students] help each other and they speed up the process. (CS 2, T 1)

> For instance, when we need to make a presentation about the human spine, we go to the Internet to find necessary pictures and information. Then we share it on the interactive board and everybody learns something from the presentation I have made. (CS 2, St. 2)

> Most of all [I like] doing assignments and showing presentations. In such cases, students receive new information and learn from the presentation I show them. (RS, St. 12)

The students considered group work in one-to-one classes interesting, because they could learn collaboratively, exchanging their knowledge and assisting one another. Several students supported group work as opposed to individualized learning as a practical way of gaining comprehension through the process of sharing knowledge.

> We mostly learn better in groups, because we all share ideas and they become common. (CS 1, St. 8)

However, this was not the case for all the students interviewed, as there were those who emphasized the importance of working alone and even supported their claims with persuasive arguments (see section 4.3.3.1. 'Emerging Learning-Teaching Processes').

> I learn how to do something on my own. Yes, somebody could help me in a group, but you know it is better when you learn on your own. (CS 2, St. 4)

Both the observations and the interviews revealed that unexpected technical problems hindered classroom activities, sometimes to quite a great extent. As there was no immediate technical support provided to the teachers during classes the students seemed to take on the role of assistants on their own and help their classmates and the teachers whenever they could do so.

> Research Assistant: Do you help your classmates if they have problems with netbook usage?
> CS 1, St. 7: Yes, I want not only me but our whole class to be computer-literate so that we can represent ourselves in various competitions.

Evidently students' contribution to classroom activities by providing technical assistance, exchanging ideas while working in teams and sharing newly found Internet resources boosted collaborative learning practices in one-to-one classes.

#### 4.3.1.4 Altered homework practices

The students in the Capital Schools were taking the netbooks home, which to some extent changed the preparation and content of the homework since the teachers assigned certain tasks (mainly presentations) to perform using the devices. Hence during the interviews the students described the process of designing presentations at home emphasizing the time required to find necessary materials on the web.

Allowing students to present the homework on interactive boards to the whole class seemed to enhance students' interest and engagement level. Correspondingly, most of the students reflected on how easy and fast the homework preparation became, because the use of only a few sentences would suffice to communicate the gist of the topic; besides all materials and visual aids were accessible on the Internet. While comparing the present style with the previous preparation of the home assignments on copybooks, the students responded differently, nevertheless most of them stated that the current process was time saving and more comfortable.

> … because it is very comfortable now. Writing one essay with neat handwriting takes so much time… But when you type you are done with the essay in a short period of time. It is very fast and easy. (CS 1, St. 5)

There were students who explained the ease of preparing homework: by emphasizing the ease of finding necessary information from the Internet as opposed to using books or encyclopedias. As pointed out in section 4.3.2 of this chapter the students seemed to develop a new approach to information processing. For example, Student (CS 1, St. 5) conveyed in his answer to a question on homework preparation:

> It takes less time now. Before we would use encyclopedia or books to find some info, but now you just find materials on the Internet, and prepare and design our presentation accordingly. (CS1, St 5)

Moreover, the students were also asked whether they used netbooks instead of performing regular homework in copybooks. Interestingly enough it was revealed that if not specifically instructed some teachers did not accept or like the homework prepared on netbooks, nevertheless there were also teachers who supported such initiatives and even shared prepared tasks with the class via interactive boards.

Research Assistant: Does it ever happen so that a teacher gives an assignment to do in a copybook but you perform it on your netbook?

RS, St 13: I do my homework on a notebook [home computer] and then I put it on a flash drive, and show it to the teacher at school on other kids' netbooks. [7]

Research Assistant: Does teacher accept it?

RS, St 13: Yes.

Due to the limited number of netbooks in the classes the process of homework preparation was quite different in the Regional School. When assigned homework on netbooks, the students had to stay at school after classes, or gather at the house of a student who had a device to work on, or prepare right before the class started:

> The teacher assigned tasks to each group. We had divided tasks [within a group] among us: one should bring information about his [the poets about whom they were preparing a presentation] birthdate, one his pictures, and one samples of his works. Then during the break the teacher gave us time to put all the information together on a netbook. (RS, St. 13)

The teachers also commented on the ease of the process of evaluating homework since the introduction of one-to-one computing in their classes. Teacher (CS2, T1) drew particular attention to the practicality of the students' sharing assignments electronically with the teacher in order to be reviewed at school or at home.

> When I give homework to them I send it to their netbooks. If they work on it at home, they send it to my notebook in the morning. If they do that work in the classroom, it is still good for me that I don't carry heavy copybooks for Math or Azerbaijani, they simply send to my notebook, and I work at home. … It is comfortable for both the students and myself. (CS2, T 1)

[7] In the Regional school, due to the uneven netbook distribution only a few students were provided with netbooks in each one-to-one classroom (see section 3.5 and section 4.2)

Similarly, while being asked about the most interesting part of working with netbooks Student (RS, St.13) answered this way:

> The most interesting part is when the teacher sends us homework and we perform it in an electronic version. It is more practical than writing on copybooks. For instance, you can download pictures from the Internet, but how can we download pictures to a copybook? (RS, St. 13)

The parents reaffirmed the teachers' and the students' opinions about homework preparation on netbooks, and restated the fact that it was much easier to find resources for presentations from the Internet. Additionally the parents compared the whole process of searching the Internet with reading books and looking for desired information.

> Before they used to go to libraries to find some information or materials, now there is all kind of information on the Internet; it is easier to find anything now. (CS 2, P 1)

In summary, the students were significantly more enthusiastic to study in the one-to-one setting. The data analysis helped me identify motives for the students' satisfaction with the programme. The students were observed to develop their ICT skills as well as a new approach to information processing, often contributing to the learning process within the classrooms through collaboration. New opportunities presented by the introduction of modern technologies were largely accepted by the majority of the students. Despite the described disadvantages, understanding the obvious benefits of the introduction of new tools none of the students seemed to be strictly against the integration of netbooks into the classroom processes.

## 4.3.2 Teacher-related category findings

Teachers as the main implementers of the programme had a considerable impact on its integration into the classroom processes. Consequently the teachers' role in the programme was thoroughly analyzed, and the findings on their attitude and engagement in implementation were gathered under three themes in this category: teachers as driving forces to implement the programme; their professional development within the programme; and attempts to meet the standards of the newly-introduced subject curricula. Figure 4.3 illustrates the category's themes and codes.

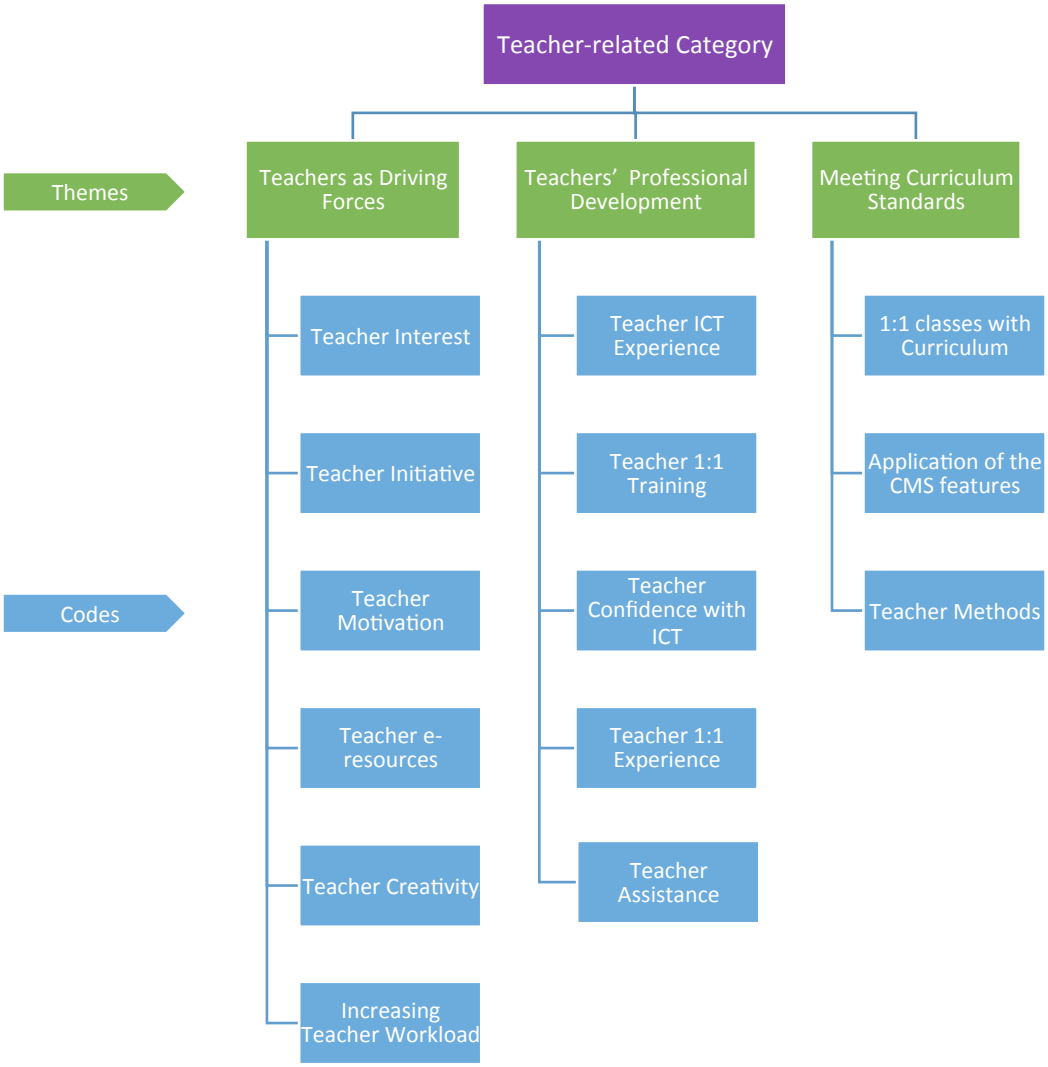



*Figure 4.3 The Themes and codes of the Teacher category*

#### 4.3.2.1 Teachers as driving forces

The analysis revealed that teachers' interest in infusing the programme into classroom processes was pivotal to successful integration. Interested teachers had strong beliefs in the programme implementation; they also felt motivated to exploit all the opportunities to implement it. For example, they showed initiative by joining the one-to-one related training, searching for various teaching tools and software on the Internet and preparing needed e-resources for the classes.

> Comparing opportunities made me the 'adorer' of ICT. Excuse me for the expression [smiled]. I decided to use it wisely. …wishing to have the same opportunities, I decided to use the given opportunity better. In the first years I worked very hard. Sometimes I was staying up till 3 in the morning preparing e-resources to use during classes. (CS 1, T 3)

> … when I know that I have to prepare a colorful lesson for tomorrow, I gather all information. … I create a folder and put them inside. Then I start thinking in which stages of my lesson to use those materials. (RS, T 5)

The teachers talked about the scarcity of available e-resources, which left them no choice but to create materials on their own to employ in one-to-one classes. Having no guidelines on the preparation of such educational materials led to: extra work, long hours, but more importantly teacher creativity that assisted them in developing the necessary e-resources using materials from the Internet and textbooks.

> Of course, I used video material to present new information. I want to bring to your attention that video materials on Math are very scarce. But there are other e-materials. We add our creativity. We surely use them as well. We add something to certain video materials from ourselves. I like that. (RS, T 5)

> .....You can't manage with time. You should create a resource every day. There is no resource available. Subject curricula have recently been applied. Thus we have to spend a lot of time to create e-materials. There are times when we want to have at least 30 hours in a day [smiling]. (CS 1, T 3)

When the teachers were asked whether they shared the created e-resources with colleagues some admitted they were not interested in doing this, while others said they would not mind if requested by a peer. The teachers also were questioned if their school administration offered any support in finding relevant e-resources for classes and a large number of the teachers responded negatively.

> Frankly speaking, I don't give [e-resource] to others, because that is what I have created. There have been times that I have stayed up whole night and thought how to do things. Then you see it [the e-resource] as your child. How can you give it?! But if there is some consultation needed, of course, why not. They are my partners. How can I not advise?! He/she creates himself/herself, but I give directions. I have also got directions from somebody once. (RS, T 6)

> [We share e-resources] only within school. If an acquaintance of mine teaching in a different school asked me, I would gladly share my e-resources. However, I haven't uploaded it anywhere. (CS 2, T 1)

> I had a blog, which I couldn't use for a while. I have uploaded materials on my blog through ishare.az, but they got deleted soon after. But I don't hide anything from the colleagues who ask me for the materials. (CS 1, T 3)

> I have to confess one thing: I had shared it on my Facebook page. There were some teachers who knew about it and some would even ask for permission to use it, and afterwards thank me. But I don't like to advertise. It is not in me. It requires some additional talent. (CS 1, T 3)

Only interested teachers were ready to undertake the extra amount of work to implement the one-to-one computing initiative. Most of the participant teachers highlighted the difficulty of using one-to-one computing in their classes as they had to bear the extra workload of spending time on the Internet to find interesting and relevant materials for lessons, preparing e-resources from scratch, and so on. These teachers expressed their readiness to work long hours out of their personal and professional interest and motivation to innovate.

> … we have always been innovative. We wanted to bring innovation to broaden interest, scope of students. (CS 2, T 1)

Teachers' willingness to implement the programme was not limited to the activities mentioned above; interested teachers continued to attain alternative solutions to emerging problems. One teacher had extension cords installed in the classroom so that students could plug their netbook chargers as most of the time students' netbooks would run out of energy. One teacher had managed to fix the projector in the classroom, whereas another stopped implementing the programme due to the same problem.

Working with the one-to-one programme required not only teacher motivation and interest, but also creativity and inventiveness since there were no predetermined guidelines in the existing curricula or any manual that could provide teachers with pertinent materials on the pedagogy of constructing lessons in this kind of setting. Teachers were expected to bring their own innovation to the classroom to both accomplish the standards of the recently introduced subject curricula and successfully integrate the one-to-one programme. Teacher (RS, T 5) said: "students should be in the role of researcher… and if a teacher is not creative, it would be difficult."

There were cases during observations when the teachers would design certain activities for the students. For example, some teachers would voice record a text leaving several gaps in order for students to listen and complete. Others would prepare stimulating videos or presentations to capture and hold students' attention.

> … you saw videos that I have done in the Movie Maker program. First put pictures and then add appropriate sounds to make it more enjoyable for kids. They get relaxed. You get tired in Math. … Sometimes I record my own voice. … And also use the PowerPoint program. (RS, T 5)

In some cases, teachers would create interesting learning activities helping students to acquire content knowledge with the use of netbooks. Teacher (CS 1, T 3) asked students to create their own e-vocabularies of unknown words using word processing software, by writing definitions found in an online e-dictionary. The particular learning activity combined content with technology; through this activity the teacher not only met the content requirements of the subject, but he also made proper use of netbooks for this purpose.

> For instance: … our students have e-vocabularies. When they work with texts, they look up unknown words in e-dictionaries [there is a website called azdili.az]; they don't turn over many book pages to find certain words; within a second they find the definitions of unfamiliar words and copy them to their e-vocabularies. (CS 1, T 3)

As mentioned above, teachers' creativity and willingness allied to their beliefs in, and positive attitude towards, the programme were found to be the main driving forces of the integration of the programme into teaching and learning. Despite the fact that the process would sometimes require extra work and long hours of acquaintance with technology, the majority of the interviewed teachers were motivated and interested in developing new teaching methods.

#### 4.3.2.2 Teachers' professional development

A few years prior to joining the one-to-one computing initiative all of the observed schools were provided with notebooks and projectors, and teachers completed a relevant training course on ICT integration. Several teachers declared that even before that time period they had shown initiative and brought a projector to the classroom to display presentations to a class.

> In 1997, when our school wasn't an e-school [8] I conducted a lesson by adding an ICT element to it; I brought a projector from a different school and made presentations. It made my lesson attention-grabbing. Then I asked our principal to get the projector and he did. Then there weren't any electronic boards or anything. I used it on the white wall. Being interested in development depends on a teacher. (RS, T 6)

In addition to the general training on ICT integration teachers were expected to take part in mandatory training on one-to-one computing funded by the Ministry of Education before starting instruction in their particular setting. Teachers without the relevant training background on ICT and one-to-one computing were not considered eligible to participate in the pilot programme.

The analysis pointed out the importance of necessary ICT knowledge and skills as well as pertinent knowledge of one-to-one infusion into classroom processes. Alert to the importance of the particular abilities necessary for efficient integration of one-to-one computing interested, motivated and creative teachers were striving to further strengthen their capacity by acquiring essential ICT skills. Their professional development continued through the programme; several teachers mentioned joining additional training or learning new software and programs on the Internet. Having

[8] For the definition of e-school, please see the chapter 1, section 1.2.2.

necessary ICT skills strengthened teachers' confidence with technology and assisted them in overcoming technical problems during classes.

> We have been working with computers for 5-6 years now. In the beginning we didn't know anything about computers, not even how to start them. But we took different courses. It is obvious that you can learn very little within just a month, so we tried to broaden the material that we learned during one month. (RS, T 5)

The provision of apposite training to teachers was an essential factor in the programme since they were expected to use features of one-to-one computing in their classes and encourage students to do so at home. In the follow-up interviews, the teachers further elaborated on their experience with the training. While some teachers considered they received training of a high quality others expressed opposing ideas blaming the limitations in their classroom activities on the inadequacy of the training. Several teachers pointed out some other aspects of the training that needed improvement since, to their best belief, this training had a potential to better prepare them for the one-to-one setting.

> We learned some new necessary things within the certain limited timeframe. Then we continued learning as we kept working. (RS, T 5)

In addition to the training, the teachers' experience in conducting one-to-one-integrated classes proved to be important too. Naturally teachers possessing more experience in teaching one-to-one classes happened to be better implementers of the programme. However, they seemed not to be satisfied with their skills and therefore highlighted that the constant attempts to hold more interesting classes was not only a motivator for them, but beneficial for their students as well.

> Students find them [one-to-one classes] more interesting than daily routine classes. I think nowadays they don't expect routine lessons from us. Every day

> they know something interesting and new will happen. They come to classes every day with enthusiasm. It motivates them. They are curious about the interesting things they will learn. It helps them not to be lazy. It also makes them interested. (CS 2, T 1)

The factors related to teachers' skills and experiences described above played an important role in integrating the one-to-one programme into classroom processes. It has been established that the teachers with the necessary ICT knowledge and skills as well as considerable experience in scaffolding one-to-one classes appeared to conduct well-organized and effective lessons. The teachers with less experience reiterated their enthusiasm and determination to advance their skills and know-how to become proficient implementers of the programme in the future.

#### 4.3.2.3 Meeting curriculum standards

Azerbaijan has undergone several educational reforms in the past decade one of which is the introduction and application of standard-based subject curricula. All observed lessons in this research study were conducted in line with the new subject curricula, where the teachers attempted to fulfill the standards for their subject. As noted earlier, the teachers not only did not possess any guidelines or manuals on the integration of one-to-one computing into their teaching methods, they also lacked pedagogical support or a study guide for meeting content requirements with the help of one-to-one computing. Nevertheless, teachers thought of new ways and methods to incorporate the given technology and curriculum standards into their classes to achieve adequate results and realize the learning outcomes.

Despite the fact that during the data collection teachers were not asked any concrete questions on the newly introduced standard-based subject curricula and how they were meeting its content requirements through one-to-one, several teachers touched upon the issue and talked about various methods that they developed and applied to

the teaching process. For example, Teacher (CS 1, T 3) assigned as homework on a netbook to draft a plan of the material read and be able to retell it during the next lesson. By means of this assignment students would identify various parts (introduction, main body and conclusion) of the text, thereby meeting the 'demonstrating coherent writing skills' standard of the subject.

Similarly, Teacher (CS 1, T 4) told students to find similarities and differences between Azerbaijani and British traditions and prepare presentations on the topic on the netbooks. They sent the completed presentations to the teacher through the CMS and then she displayed the selected ones on the interactive board. When presenting each student would speak about the findings and attempt to use new words and expressions correctly. This learning activity was the exciting part of the lesson; students not only competed to find peculiar similarities and differences between the traditions, but they also made efforts to demonstrate their oral speech skills, thus the professional use of one-to-one computing to meet the curriculum requirements was observed.

The observations revealed that the individual netbooks along with the prepared tests were popular tools for measuring whether or not the precise learning outcomes were achieved. This was mostly applied at the end of the teaching unit. For instance, Teacher (CS 2, T 1) tested students' knowledge and skills on phonetic analysis of words, and grammatical analysis of sentences. She sent the tests to students' netbooks and monitored their screens while they answered the questions within a given time frame.

In summary, some of the teachers were attempting to meet the newly introduced standard-based subject curricula by utilizing methods and activities they had developed themselves; their personal and professional enthusiasm and motivation were the major assets to conduct one-to-one classes.

This ‘Teacher Related Category Findings’ section has expanded on the initial account in the ‘Preliminary overview of the data’ (see section 4.2). It was clear that while teachers did not receive any support from school management in pedagogical as well as technological aspects of the programme implementation, there were still those who continued implementing it mostly due to their own enthusiasm and attitude towards the programme. There were two types of participant teachers; some of them were interested in the implementation of the programme and therefore, in spite of certain challenges, worked hard to integrate the CMS features into their teaching along with meeting content requirements, whereas the less motivated teachers who had difficulties in overcoming the problems tried to attribute the implementation related problems to others. Thus it becomes apparent that teachers’ professional and personal attitudes towards the program had a major influence on the integration of one-to-one computing into teaching and learning.

### 4.3.3 Classroom dynamics

The third category developed as a result of the analysis related to classroom dynamics, which covered findings concerning the processes taking place in one-to-one classes. In comparison with the teacher and student related categories that mostly aimed at identifying the driving forces behind the integration of one-to-one into teaching and learning, the findings included in the classroom dynamics-related category explore the process and try to identify its drivers. Figure 4.4 displays the themes and codes structured under this category.

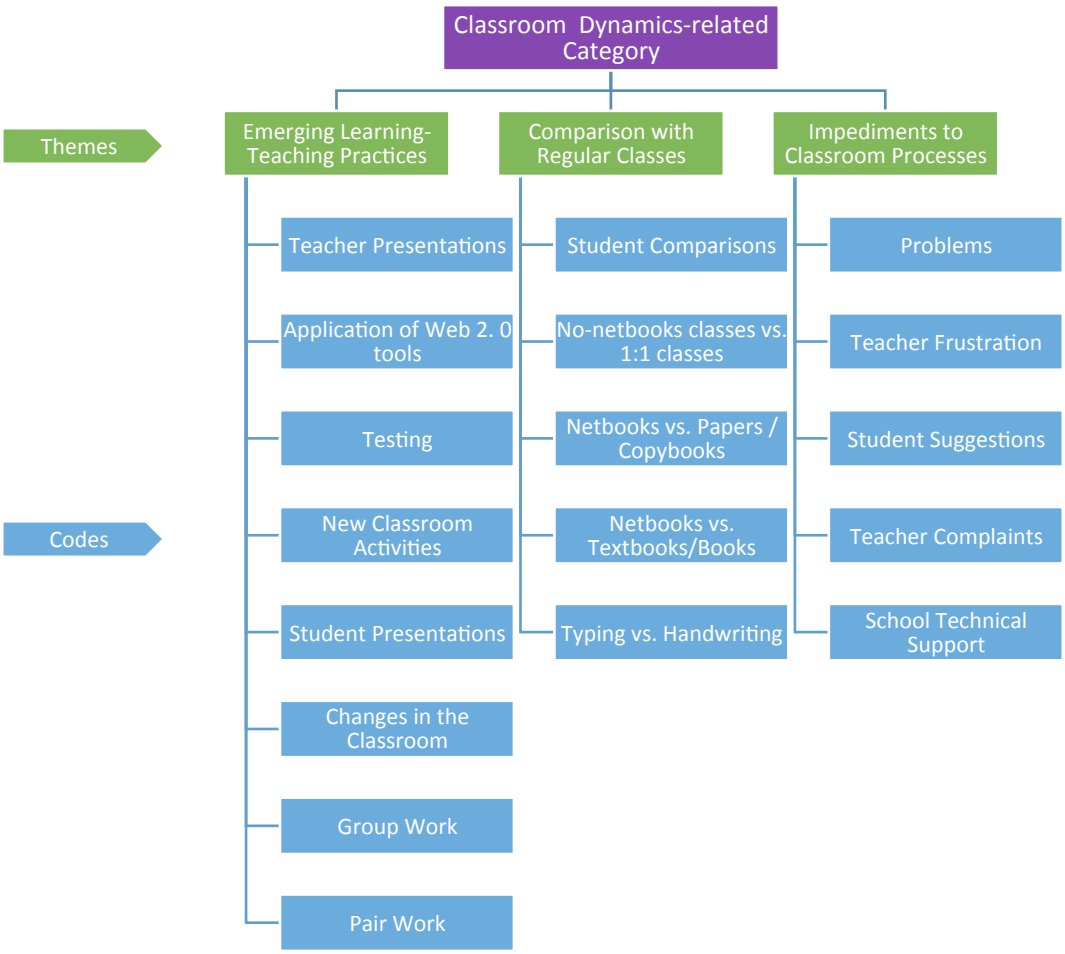



*Figure 4.4 The themes and codes of the Classroom Dynamics Category.*

#### 4.3.3.1 Emerging learning – teaching practices

As stated in the 'Newly emergent practices' subsection of the 'Preliminary overview of the data', (see section 4.2), during the observations new classroom practices were revealed in one-to-one classes, such as preparing presentations, working with Web 2.0 tools, using educational websites and different features of the CMS. In-depth analysis confirmed these overview findings and gave a finer-grained picture of emerging practices in the classes. In the observed classes the teachers were using various features of the CMS such as preparing tests, exchanging files, displaying

netbook screens on an interactive board, etc. A large number of the teachers used various presentations to trigger students' interest in the topics to be discussed right from the beginning of the lessons. The teachers explained their use of presentations as a way of increasing students' interest in classes since they were visual, helping the students better remember the introduced materials and over time strengthen the learning process.

> The teacher makes presentations and the students find it very interesting. They say: "Better to see once than to hear a thousand times." (RS, St. 10)

In addition to the unanimous opinion expressed by the teachers, the students indicated the advantages of new learning tools, such as Web 2.0 tools, offered by the teachers. The teachers and students mainly used these tools for preparing assignments, acquiring information from Wikipedia and YouTube. It should be noted that even though most of the teachers and the students talked about using the Web 2.0 tools, the Internet resources and certain websites (for example online educational resources created by the MoE) for preparing presentations and other assignments, only in one out of six observed classes did students actually use websites for preparing presentations, timelines or photo collages.

> We do assignments with Web 2.0 tools. We find those tools on the Internet and we work with them. It is more exciting than presentations. (CS 1, St. 6)

According to the teachers, the CMS considerably improved their techniques for assessing student learning. One of the most used tools that teachers and students equally favored was the provision of tests during classes. Although several teachers mentioned their previous experience in preparing summative tests on paper they still highlighted the ease and practicality of organizing similar activities with the use of the software in the one-to-one setting. The teachers emphasized that instead of wasting a lot of paper and time they could simply prepare tests on notebooks and disseminate them among students using the local area network, which had also

decreased their workload. In addition to all these advantages it was observed that the students were becoming enthusiastic about performing tests on their netbooks. The teachers explained this fact in terms of some of the features of the software, such as setting a certain timeframe for answering test questions, immediate visibility of assessment results, etc.

> You know, we used to prepare tests on papers and carry them home. Burden… Time…But with one-to-one we save time, because when we take one notebook home we make test questions on two or three subjects. And it also creates interest in students. They wonder what they will get and how their results will be. (CS 2, T 1)

> Checking tests of 32 students: we have small summative assessments for 32 students makes approximately 150 tests in Literature and Azerbaijani Language classes. You know how much time and nerves it takes to review all those tests? But when you do e-tests within ten minutes you finish that test and grade it. (CS 1, T 3)

As noted earlier in section 4.2.3, the students could answer test questions sent by the teachers on their netbooks and return answers back to the teachers. The software would save and check the answers, and then teachers would display those on an interactive board. Having an opportunity to receive assessment results immediately on their netbooks and to discuss them with the whole class impelled students to strive towards better results.

> Because the teacher makes interesting tests. We work with computers. It is interesting. Before the teacher would mark results as right and wrong, but it [computer] calculates results very fast and sends us automatically. (RS, St. 12)

> The teacher prepares tests and sends out to everybody all at once. Here you get results very fast since it is electronic. (RS, St. 11)

As has been described, the teachers set a certain time limit for the students to complete the tests. When the students and the teachers were asked about students' attitudes towards timed tests most of the answers appeared to be similar, stressing that it helped the students learn to manage their time and be organized while responding.

> Student CS 1, St. 5: I mostly like making presentations and doing timed tests on netbooks.
> Research Assistant: What kind of tests?
> Student CS 1, St. 5: Timed tests. Like for 5-10 minutes we fill them in and send back to the teacher. Then it checks results automatically and we can view the results immediately.

Besides, several teachers had started new practices such as integrating games or social media into their teaching. For example, they mentioned preparing crossword puzzles for the students to solve to achieve entertaining learning.

> We see crosswords as entertainment. But I give crosswords as an assignment. So crossword stops being a game, becomes a tool to develop intellect. …. these kinds of tasks help students enjoy the lesson…. Sometimes we use Facebook during lessons and children seem to like it. We are trying to combine the elements of social media with learning. (CS 1, T 3)

The students had also thought of using new learning tools to assist them during classes. For example, one student described how he would take notes on his netbook in a word document instead of writing them down in copybooks. Several other students mentioned watching YouTube videos to learn how to make origami, how to

use certain programs, or solve other netbook-related problems including ones related to various software used in netbooks.

> Student CS 1, St. 7: Now I have opened Word, I noted something down. … I note them down so I can recall.
> Research Assistant: Were you noting what teacher was saying?
> Student CS 1, St. 7: Yes, I noted what teacher says on my netbook. I type what teacher says and what is useful for me so that I can remember better.
> Research Assistant: And you keep the file for yourself?
> Student CS 1, St. 7: Yes. I keep that file.

As described in a preceding section (see section 4.3.2.1), Teacher (CS 1, T 3) had started another innovative practice requesting students to create their e-vocabularies using an online tool – a website called 'azdili.az' which was created by linguists for the purpose of providing users, such as learners and teachers with a monolingual dictionary, sets of grammar rules and other Azerbaijani language-related assistance.

The same teacher (CS 1, T 3) also talked about using a social network website, namely Facebook, which allowed the students to exchange their work among themselves and also share their completed assignments on his timeline for public viewing. This teacher mentioned that in addition to using Internet resources, he would ask his students to use Facebook in order to share files or links to the presentations they had prepared on various websites.

> Teacher CS 1, T 3: I suggest students to share resources that they create with Web 2.0 tools on Facebook.
> Research Assistant: Does it happen during or after classes?
> Teacher CS 1, T 3: If we can manage then during classes. It doesn't take much time. Students have also 'phones so they can share during breaks as well. Sometimes it happens that I give it as homework, for instance in

> Prezi.com, timetoast.com. After they create it they send it to me right away. I like and then I share it. You see that they get more likes.

In addition to emerging classroom activities several teachers had developed new classroom rules, which had changed regular settings in certain ways as well. For example, Teacher (CS 1, T 3) in the Capital school 1 mentioned that he did not ask students to stand up or come to the front of the class while answering, instead the students were required to use the 'raise hand'[9] button in their netbooks, and talk from their seats as standing and looking at their netbooks might cause certain health problems.

> Now I don't let students stand up every time when they have something to say. … If you are working you don't need to stand up. You are just looking at the netbook and speaking. (CS 1, T 3)

> Now we don't need to stand up or anything. It is seen there [in observation video] now. There is a hand sign there. We press it and the teacher sees us. We don't need to raise hands anymore. Sometimes when we have something to say to the teacher we write her a message, like "Teacher, my battery is dying." Or, "Teacher, I haven't made a presentation, don't check". (CS 2, St. 1)

It should be underlined that the one-to-one computing initiative had both direct and indirect impact on teaching styles. While most of the teachers in the Capital schools favored giving assignments to students to work on netbooks individually, the teachers in the Regional School had to adjust their assignments for groups due to the limited number of netbooks in the classes. However, they also expressed their preference for individual work on netbooks if each student was provided with one. The students and the teachers were encouraged by the research assistant to elaborate

[9] There is a button called 'raise hand' in the Classroom Management Software. Students press that button when they want to say something to a teacher, instead of raising their hands or approaching the teacher.

on the process of group work with netbooks and also the assessment of group work after completion of assignments. Several students and teachers explained their experiences with, and preferences for, working in groups in the following way:

> All did the same amount of job, everybody had a different task. For instance, I did design, one found information, one found pictures. (RS, St. 12)

> I like to work in groups. It is easy to work in groups. For instance, when we make presentations one student puts pictures, one gathers information, one prepares and it is easy this way. (RS, St. 10)

In parallel to working in groups the students worked in pairs. While at times it happened due to technical problems, i.e. one student's netbook would run out of energy, or be broken; sometimes teachers had prepared particular assignments that required work in pairs, in other cases teachers merely preferred students working in pairs rather than in groups.

> Yes, sometimes one of the kids doesn't bring his netbook, and then he works with his desk mate. They share the netbook and work together. Or sometimes somebody's netbook runs out of power. There is a place in the back. They charge there and start working. (CS 2, St. 1)

> I don't use group work here much. Peer work is much more practical than group work now. In groups usually one or two students work and others are just waiting. But when they work in pairs they share the responsibility. (CS 1, T 3)

However, be it in pair or group work, the students could not communicate with one another using the CMS. For that purpose they had various solutions: while several students preferred to sit together around one desk others would use Skype for communication so that they would talk when needed.

> One-to-one program is a one student – one computer program. One student – one computer program is to make things easier. But some things can be made much easier. … students cannot connect to one another. If they could connect to each other, group work would improve. (CS 1, St. 8)

The Emerging Learning-Teaching Practices theme illustrated that the teachers and the students used various tools such as the CMS, Web 2.0 tools, educational websites, Microsoft Office programs etc. to integrate the one-to-one programme into classroom processes. Notwithstanding some of the problems that arose, the teachers and the students mostly relied on their creativity and imagination for finding new ways of using computers during classes. The classroom activities also showed that teachers played a significant role in motivating students to use netbooks in diverse ways.

#### 4.3.3.2 Comparison with regular classes

Only several classes in each of participant schools had joined the one-to-one programme and the rest were taught in a 'regular' way. Advantages of learning with the one-to-one programme were identified based on the students' responses.

The majority of the students in the study considered themselves more knowledgeable than their peers studying in regular classes; the students believed they would definitely win any potential competition and if necessary, they were ready to teach others how to use computers. The students claimed that they had become more fluent not only in the acquisition of technological knowledge, but in subjects as well. They felt that they were much more advanced than their counterparts studying in regular classes; and the main reason for this was the frequent use of netbooks during classes and at home. When the students were asked to support their statements with arguments their answers varied considerably.

> Of course, if I didn't use netbooks, if we were not a pilot class, naturally we would know less. That is why I think that our class and I myself are a step ahead of the classes that do not use netbooks. (CS 1, St. 7)

> Of course we know better, because each day we have at least one class with netbooks. Even one class a day is a very wonderful thing; because every day we experience something and … we learn something new. (CS 1, St. 8)

The participant students recognized that their peers from other classes also had computers at home. However, they believed that the time the students not participating in the programme would spend with technology was much less compared to their own use of netbooks, because they owned netbooks and they could use them whenever they wanted, unlike their peers who had to share home computers with other family members.

> For instance, classes which do not use netbooks… They will have computers or netbooks at home. … but they don't use them much. … I don't believe that they would go to websites and use something interesting. But we come to class every day, we use it here every day. (CS 1, St. 8)

The students stressed that their classes were much more interesting than the regular classes mainly due to the use of netbooks. They claimed to be receiving more and interesting information during their classes as opposed to their peers in regular ones.

> Class with netbooks is more interesting and practical. Everything goes very fast and things get solved very fast. Ordinary lessons are also interesting but it takes a lot of time. (RS, St. 11)

While comparing classes the students also added that in one-to-one lessons teachers not only shared information, but also showed presentations or other visual materials,

which assisted them to achieve better comprehension. Unlike one-to-one, in regular classes teachers were the only source of information and they taught students in an oral form, without any visual aids; therefore it could be assumed that students did not retain the knowledge provided in this way to the desired extent.

> When the teacher says and shows then we see everything on netbooks; even if we don't understand what the teacher says we can see and read everything. (RS, St. 10)

Nevertheless, there were also students who emphasized that possessing netbooks had no effect whatsoever when comparing regular classes with one-to-one, highlighting that there were no noticeable differences between the two types of settings.

> Because we are not competing with netbooks. Although they don't have netbooks here at school, they have computers at home and they use them. Also there are textbooks too. (CS 2, St. 3)

The teachers also compared different components of regular classes with those of one-to-one and described their preferences with thorough explanations. They concluded that the latter was far more interesting and practical both for them and their students.

> When I joined the one-to-one programme I was also working at an IDP[10] school in Baku and therefore had an opportunity to compare. In one case there is no ICT equipment at school: I showed them a presentation on my personal notebook. Then I came and conducted a lesson with one-to-one project in this school; it is completely different here. (CS 1, T 3)

[10] IDP school is a special school established for the sole purpose of providing education to the Internally Displaced People (IDP).

> The interest, scope of these students [using one-to-one] is broader than others. … for kids this is more interesting, it attracts them faster. This setting better involves students into the topic. (RS, T 6)

The teachers and the students used copybooks and papers in one-to-one classes with lesser frequency than in regular classes. Therefore while comparing the two different types of classes both the teachers and students mostly drew attention to the comparison of netbook vs. copybook usage. The students talked quite extensively about this matter in their answers explaining that working with netbooks was more attractive than using copybooks, and it would even encourage and motivate students in their studies.

> … it is more interesting for me to work on the netbook. Not only for me, but there are lots of students in the class who prefer to work on a computer to working on a copybook. (CS 1, St. 7)

Changes in the students' literacy practices became obvious while drawing the above comparisons. These changes were mainly observed in writing practices; whereas prior to programme implementation students would write long texts in copybooks, now they would simply create short PowerPoint presentations or use Web 2.0 tools to explain any given topic. Additionally, students' reading practices have been altered as well; they would refer to the Internet to gather necessary resources for later usage in presentations, which required their skimming large amounts of information in several different locations in order to attain necessary bits.

Furthermore, Student (CS 1, St. 8) remarked that in addition to creating attractive lessons netbooks, unlike copybooks, had a capability to archive data for an extended period of time since they were equipped with quite large memory cards.

> … copybooks can be easily lost, it is forgotten and thrown away. But we can never throw the netbook… when we write on netbooks it is already saved in its memory. (CS 1, St. 8)

The research participants also compared studying with textbooks vs. netbooks. In their answers the students leaned towards using netbooks since studying with those was faster and more appealing to them in comparison with using regular textbooks. In this regard finding materials on the netbooks through the Internet, preparing presentations using those materials, adding different animations and pictures seemed to attract students' interest and motivated their netbook usage.

> I find netbooks more interesting. Students get motivated to study, but when you work on copybooks it is a bit boring. (CS 1, St. 6)

Nonetheless, several students emphasized their preference for combined usage of textbooks and netbooks, the reason being that each is interesting in its own way and more knowledge could be derived from both.

> Both netbooks and textbooks, because sometimes there are things that you can't find on textbooks but you find on netbooks and vice-versa. (RS, St. 11)

The teachers elucidated in their answers that they preferred using computers, especially for the purpose of finding materials on the Internet that excite students and entice their attention to particular themes. According to Teacher (RS, T 5) students in her class were always interested in the materials that she would prepare for lessons since they included additional information not provided in textbooks. The students felt more motivated to learn from the resources provided by the teacher, because they were accepted as something new, something that required a certain effort on the teacher's side and a certain degree of extra knowledge that could not have been gained through textbooks only.

> I gather materials from textbooks, encyclopedia and other sources, and put them all together in a Word document. … Students understand that the teacher has prepared it. If you take only from a textbook, students find it a bit artificial, because it was already in the textbook and we could just read from it. (RS, T 5)

> …. There is an abundance of information right now. You want to pass them all to students. You can't be satisfied with only textbooks. There is only 50 percent of information in textbooks. You can talk a lot around a topic. In that regard, it [one-to-one] is a good programme. (RS, T 6)

It should be highlighted that unlike the teachers and the students the parents had a different stance towards netbook vs. textbook usage. They believed that enthusiastic students would find a way to excel in their studies even without netbooks.

> Kids who do not have netbooks will find a way to find information if they are willing to. Not depending on netbook, if a kid is interested he/she will study. Even if the school doesn't give netbooks, kids will use their personal notebooks at home. (CS2, P 1)

A number of thought-provoking issues were revealed as a result of the research participants' comparison of one-to-one classes with regular ones. The majority claimed that there was more knowledge gained in one-to-one classes in comparison with 'regular' classes. The research participants also compared studying with netbooks vs. using textbooks, and again the majority expressed their preference for the former. However, in line with their general stance on the use of netbooks, while comparing both processes the parents held an opposite opinion emphasizing that any enthusiastic and motivated student would be able to improve regardless of the teaching methods used.

#### 4.3.3.3 Impediments to classroom processes

The introduction of technology into everyday classroom activities also created a number of problems for learning and teaching processes. This section expands on the brief account of difficulties given in the 'Problems raised by the stakeholders' subsection (see section 4.2), and reveals that the teachers and the students identified a considerable number of problems predominantly concerning the issues of netbooks being old, frequent hardware and software complications and connectivity, which overall resulted in interruption of classroom processes.

As frequently mentioned by the teachers and the students one of the most recurrent problems was the short life of old netbook batteries (reliably lasting for one 45-minute period, but rarely for the duration of two classes, depending on the intensity and frequency of usage). The first logical and widely used solution was to plug netbooks directly into the power source, but this also had its own shortcomings such as the lack of sockets in the classrooms, resulting in a potential safety hazard caused by excessive use of extension leads. The students claimed to have been bringing fully charged netbooks to class, however this attempt proved to be inefficient considering the short life-cycles of the batteries, which eventually required them to team up with their desk mates or stay without netbooks. Netbook-related problems would often disturb the natural flow of the classes since the teachers had to stop the lesson and solve a student's problem in order to have all the students engaged in the classroom processes. The effort would always turn out to be time-consuming, resulting in the reduction of study time.

> To be honest their [netbooks] specifications are very low. Netbooks are old. We have created electrical network in our classroom ourselves. The students always have chargers and plug them in. (CS 1, T 3)

> And charging. I ask students to charge them so many times. It is already about the netbook itself, the battery doesn't last long. (CS 2, T 2)

Other than netbook problems, connectivity issues during classes were another major problem on which the students and the teachers focused. These sorts of problems especially frustrated the teachers, because they would considerably impinge on their classroom activities. For example, even a few seconds connectivity problem would disturb the whole process of sending an assignment to the students in the classroom. As a result the teachers had to retry sending several times, reload the software or ask the students to restart their netbooks, which would almost always result in interference to the classroom processes. According to respondents, these kinds of difficulties created barriers for the natural flow, hindering certain teaching-learning activities during lessons.

> Wi-Fi problems happen. They are minor problems and they can be solved very easily. If you remember we had a problem while sending the exam question, one student didn't get it. Students started to work in peers and the assignment was done. (CS 2, T 1)

Due to these problems, several students saw working with netbooks as a more time-consuming process than regular classes could ever be, calling the latter more productive, since in the case of standard teaching methods neither the students nor the teachers would pointlessly lose time in fixing what seemed to them like a never-ending chain of technical issues.

> For instance, yesterday we didn't use netbooks at all and of course we spent lots of time on the lesson itself. … But today we used netbooks and it took lots of time; half of the class time was spent on fixing computers and logging in [to the local area network]. I think, yesterday when we worked we were busy only with lesson, but today computers took some time from us. (CS 1, St. 7)

While reflecting on the technical complications arising during classes the students and the teachers concentrated on the possible reasons for the problems. Additionally during interviews the participants elaborated on the quick and temporary solutions they had used, (discussed in section 4.3.2.1). There were teachers who emphasized having backup plans in case any unexpected problems occurred during classes. For instance, Teacher (RS, T 5) always printed the materials she planned to use during one-to-one classes in order to deal efficiently with any unexpected problem.

> Technical problems can happen. If it happens, I have those materials [printed]. (RS, T 5)

Apart from these problems having a limited number of netbooks in the classrooms was a unique problem that the research participants of the Regional School focused on. They were not supportive of the school administration's decision to distribute netbooks among excellent students in different classes and stated their preference for reverting back to the previous practice of each student having an individual netbook. Although in the Capital schools parents were complaining about the excessive use of computers and the deterioration of reading and writing skills, in the Regional School the parents were actively asking for, and expecting, relevant officials to provide each student with a personal netbook. One of the parents expressed the desire of the vast majority of the school community to request the responsible officials to provide all the students in the school with new netbooks.

> They [government officials] haven't fully provided computers yet. They had to. … They should give and the school should distribute. (RS, P 10)

The different problems described in the preceding paragraphs were major impediments to classroom activities and a considerable amount of time was spent on coping with them. The teachers and students were obviously frustrated by the problems arising during classes, however they continued to seek new solutions in order to enhance the effectiveness of the one-to-one programme. All of the schools in

the study had some common problems, but the Regional School stood out with a specific one, namely the one computer to five students distribution ratio, which impeded learning and teaching processes in the one-to-one setting.

## 4.4 Parents' approach to the programme

The analysis of the focus group discussions aided me to gain a close understanding of parental attitudes towards the programme. During the discussions the parents did not hesitate to speak their minds and share their perceptions and observations of the children's study practices in relation to the programme. They also communicated their interest in, and support for, the programme as well as their concerns, complaints and suggestions. This allowed me to explore students' study habits with netbooks at home, the parents' influence over them, and their overall attitude towards the programme.

During focus group discussions the parents were asked about their children's study habits with netbooks at home. The inquiry revealed that the students predominantly prepared presentations at home using MS PowerPoint or Web 2.0 tools, and for that they would search the Internet for necessary materials and visual elements to include in the assignments.

> They search for information and then make presentations. (CS 2, P 2)

> It is the same; they make presentations on all the subjects, in particular in Maths, History, Russian and Literature classes. Now, mostly they prepare presentations for History classes. (CS 2, P 1)

It was important for me to delve into parent-student cooperation and relations in respect to the use of netbooks at home. During the interviews several students

mentioned that every time they needed assistance with netbook usage at home they would ask their fathers or older siblings, while others stated that they did not ask for help at all; instead they would search the web and find solutions on their own. Furthermore, although several parents stated that they would help their children if they asked for this, others stressed that their children did not ask for assistance anymore since they were operating computers far better than the parents. Overall, the majority of the parents proudly admitted to their children being better at using computers than them.

> No, I don't. They are better than us. (CS 2, P 3)

> I used to help before but not now. Now they teach us. (CS 2, P 1)

> … they already know more than we do. And they type so fast. (CS 2, P 2)

The majority of the parents articulated their interests in, and support for, the programme underlining its positive impact on their children's development. According to the parents, being computer literate and being capable to use computers for classes was regarded as a necessary skill to be used not only during studies, but also later on during their careers as well. They specifically highlighted that the modern era demanded knowledge and skills in technology use and studying with netbooks prepared their children for future challenges.

> I say "yes" to computers. I like it. Everything everywhere is done with computers. (CS 2, P 2)

> They started using computers in schools, and I think it is very good. When they go to work they will be excellent users. (CS 2, P 1)

Parents' interests in, and support for, the programme were conveyed by the teachers as well; quite a few teachers talked about the parents' interests in the programme

implementation at the outset and their readiness to provide full support. Many parents would like their children to continue studying with one-to-one computing until they graduate from school mostly because these children are used to this particular scheme.

> It would be better if they use till the end of school. (CS 2, P 4)

> I would want them to use computers till the 11th grade [last grade of school]. I don't understand why netbooks are taken back in the 7th grade. (CS 2, P 1)

However, it is worth emphasizing that despite their interests in the programme, some parents drew attention to their concerns and complaints about it. They referred to a number of issues regarding netbook usage during classes including the harm it would cause to their children's health, their study styles and outcomes of the learning processes. The parents' health concerns were largely related to the 'radiation netbooks emitted, which could potentially cause eyesight problems'. Referring to an unspecified study found through a search conducted on the Internet, one of the parents had this to say:

> It is not recommended to have more than 4 netbooks in one room. I understand that, but I don't know if it is appropriate to use 30 netbooks at the same time in one room. In the beginning, I said that my child would acquire ICT skills, but I can't get his health back once the computers cause damage to his health. For me, my child's health is of great importance. (CS 1, P 5)

Parents' other concerns and complaints were uncovered when study practices were compared with those of children from 'regular' classes, taking into account the differences of the study settings. Interesting aspects and issues surfaced during their comparisons. While some parents expressed their desire to keep the old teaching methods alive, others mentioned that the new learning style was faster and more practical.

> I can say it helps to catch up with the world. I think my kid is not staying behind within the country and abroad. Truth be told, in our times we used to go to libraries, and we didn't stay behind either. My point is if a kid wants to study, and he is motivated, he will. Of course, kids learn more, because it saves time and energy. (CS 1, P 6)

> In our times we used to go to libraries, scour books, spend hours, but now it is very fast. (CS 1, P 5)

Furthermore, some other parents held netbook usage and access to information anytime anywhere responsible for making their children lazy. According to them, having unlimited access to information had made their children passive and consequently lazy. In the past, they would visit a library and scour through shelves in search of necessary materials for their studies, etc.

> ..But they have gotten very lazy. Computers have made them lazy. (RS, P 9)

> Students become lazy. They have everything in the palms of their hands. They don't feel motivated to do anything. They spend little time on their studies. …They stop being hardworking, because they can find anything on the Internet. (CS 2, P 4)

> Technology cannot always be with you, it can't always help you. Your brain should always be your help. (CS 1, P 7)

As the section 'Preliminary overview of the data' indicated, (see section 4.2), the parents highlighted that their children were only acquiring technological knowledge and skills as opposed to the actual domain knowledge they were expected to be gaining at school. According to the parents, their children were more attracted to the technological side of the programme, at times not paying enough attention to their

studies. As a result, they claimed that while studying with one-to-one computing the children were acquiring technological skills instead of learning about a subject domain.

> You know what making presentations means for them?! It is all about learning different software. They go to new websites just to learn new software, the topic of the presentation is left behind; they are only interested in the technical side, the new things. (CS 1, P. 7)

> No matter for how long you ask them to work on computers, they will take it. Even if they don't have anything to study, they will still sit at computers with great pleasure. (RS, P 12)

Another issue brought up by the parents was children's handwriting and speaking skills, which have already been touched upon in the 'Problems raised by the stakeholders' subsection (see section 4.2). Exploring this topic in greater depth, the majority of parents recalled their own handwriting and speaking skills at the same age and concluded that their children's skills were degrading due to excessive and unnecessary netbook usage, in particular in Azerbaijani Language and Literature classes. Additionally, children's weak handwriting and speaking skills appeared to be a major concern since the parents talked about this matter in great detail using numerous examples and blaming mostly netbook usage for the decline.

> … their handwriting is very poor. In the past, if we had bad handwriting we would get one point lower. But now nobody seems to pay any attention to handwriting. (RS, P 10)

> It is not good to work with computers all the time; they should have handwriting skills too. How are they going to write in the future? I understand technology is used everywhere, but I still think they fail in handwriting. Kids' reading skills are also degrading. (CS 2, P 1)

The parents also explicitly stated that paper books were preferred over e-books. They remembered the times when they themselves were students and how they used to read paper books, which they saw as a primary tool for their children to be able to better express themselves in social situations.

> In our times they were killing us when we couldn't read with good intonation. But at least we were being given some books to read. What are they doing now? I ask him to recite a poem and he does it in haste. (CS 1, P 5)

> If you don't know your language, if you can't read classics, then what difference does it make if you study with one-to-one and get a high score in the tests. When I ask my son to talk, I see that I am much better at expressing myself than he is. That is the issue... (CS 1, P 5)

> In general, the computer itself creates motivation in kids. First of all, they want to do homework and play afterwards. …. But I am speaking for myself: during the Soviet times, we would read fiction. Now you can read on the computer too. They say you can find anything there. It is one thing to read thoroughly and understand, but it is another to just skim the book. … It doesn't get stuck in their heads. Nowadays, kids don't have speaking skills, and oratorical skills. I am talking about kids of this generation. None of them has. It is all – "Hi, how are you?" That's it. But they are all shy to say something, for example at a birthday party. (RS, P 9)

They compared reading paper books vs. reading e-books and favored the former for several reasons, but mainly due to the perceptions that netbooks are bad for eyesight and that radiation from the screen is harmful.

> …You are saying e-books. When they read their eyes get tired. If you put e-book in front of him [Student], he will read overnight, but if you put paper book you read 5-10 pages, and you want to sleep soon. (RS, P 9)

> They are children. They don't need to use e-books. (CS 1, P 5)

> Reading e-books is not interesting at all, it doesn't give any pleasure. In order to read a book, you should find a good spot with a tea or coffee. (CS 1, P 6)

Due to the concerns related to health issues, deterioration of reading and speaking skills and lack of handwriting practice, in some families the parents put restrictions on the duration of netbook usage at home. Several parents in the Capital schools made the decision to shorten the total amount of time their children could use netbooks at home and also control their access to it throughout the day.

> My mother lets us use it [netbook] for an hour. She doesn't let us use more than one hour. An hour every day. (RS, St. 13)

> My son had to make presentations for an Interdisciplinary Subject class, and he wanted to use netbook, I did not let him do so. I was telling him, "Use new encyclopedias that I have bought. You should use books, you should touch books." (CS 1, P 5)

Other than restricting the duration of netbook usage at home, parents in one of the Capital schools had attempted to influence the netbook usage in classes bringing up the issue with the school administration, but they did not manage to gather enough supporters to enforce the initiative.

> Yes, it is a lot. We have even raised this issue in parent meetings as well. The principal said that she couldn't do anything. (CS 1, P 5)

Studying teachers' perspectives on these matters was important for me; therefore the research assistant raised the topic among them during the focus group discussions. Quite interestingly, it was revealed that the teachers held completely contradictory opinions on these particular issues. For instance, the teachers took an entirely opposite stance to the parents regarding students' handwriting and speaking skills, emphasizing their importance, however mentioning that the development of these competences also depended on parents, and not only schools.

> I can bring a counter argument. Students have been using one-to-one in Azerbaijani and Literature classes for five months. But these students are 13 years old. Handwriting skills should have been formed by now. The vocabularies of students are very limited. And why is that? - It is mostly connected with family [because they speak Russian at home]. Many students have limited vocabularies… For instance, yesterday one of the students asked me what "initial" meant. And I explained it to him. You have seen the website azdili.az. I tell them that you can go to that website on your phones any time, and you can learn the meanings of any words from there. (CS 1, T 3)

Based on their pedagogical knowledge and experience, the teachers repeated that the development of handwriting skills was a subjective issue because having neat handwriting was not really needed in the era of technology. They instead suggested paying more attention to the development of critical thinking skills, which is in demand in any job market. As for speaking skills, teachers did not consider this an issue; according to them, students were improving their speaking skills while making presentations in front of the whole class.

> Neat handwriting can be achieved by practice. We can form it in an educated or uneducated person anytime. But if we delay the development of critical thinking skills, we won't be able to cope with it later on. (CS 1, T 3)

This and similar important matters related to the viewpoints of parents will be further explored in the discussion chapter, in the section titled – 'The Viewpoints of the Parents'. Additionally, the parents conveyed their suggestions to enhance the programme implementation that according to them would serve to solve the problems that they raised.

> I suggest that they divide class hours into two parts; one lesson should be dedicated to active learning, the other one to computer-based learning - your one-to-one lessons are boring, because I think there is no or very little interaction there. (CS 1, P 5)

> They started using netbooks very early; if they started a bit later it wouldn't be like that. I think it would be better after 8th grade. Their body would be ready for it too. But people are different, I know parents who let their kids play with computers for hours. I myself am a barrier for them. Just check how games are bad for brain cells. (CS 1, P 5)

Despite the fact that the parents were not directly involved in the classroom processes, they still indirectly influenced them since they held unique and at times opposite opinions on the one-to-one computing programme compared to the teachers and the students. The findings related to the parents revealed their indirect influence on the integration of the programme particularly into learning. The interviewed parents were divided in their views; while one group of parents emphasized the significance of studying with netbooks in the era of technology, another group insisted that instead students should be gaining domain knowledge with the primary focus on improving handwriting, speaking and reading skills. As discussed above, the analysis of the parental approach towards the programme disclosed opposite opinions between the majority of parents and other stakeholders of the programme – teachers and students – on essential matters for learning.

## 4.5 Summary

This chapter presented an initial overview of the findings and then moved to provide a deeper exploration of the categories and themes that emerged from the in-depth analysis of the study's data. The findings revealed that among all stakeholders, the students were the most enthusiastic and welcoming of the one-to-one initiative, while among teachers, there was a certain group who expressed willingness in adopting the method but there were ones who were less motivated to do so. While some of the parents saw the advantages of gaining skills using technology, the majority of them were openly opposing the alleged excessive use of computers in one-to-one classes, building their arguments on health issues and conservatively comparing teaching and learning using one-to-one with their own times. However, despite such opposition from the parents, teachers and students supported the initiative.

The findings also revealed that the introduction of netbooks encouraged diverse ways of teaching and learning. The students become more enthusiastic to learn and outdo their peers, while most of the teachers become more committed to their work, trying to utilize the power of the resources provided.

The acquisition of technological skills facilitated the classroom processes, which in turn resulted in better collaboration among students and faster exchange of information both with peers and teachers. More importantly, students were becoming the agents of their learning, sharing responsibility, instead of being merely subjected to imposed rules and regulations, thereby illustrating that the classroom processes experienced a certain degree of modification.

The findings will be discussed further in relation to the existing literature together with the factors influencing the integration of the one-to-one programme into teaching and learning in the following chapter.

# 5 Discussion

## 5.1 Overview

The aim of the previous chapter was to present the findings of the data analysis, outlining the main factors influencing the integration of the one-to-one programme. In this chapter I will examine closely these factors influencing the integration of one-to-one computing into teaching and learning by discussing the findings in the light of the existing literature, centering attention on the factors that appear to address the research question most directly.

The discussion chapter starts by addressing the issues of the constantly altering learning practices, the growing confidence of the students involved in the one-to-one programme as well as other changes that tend to occur in such classrooms. In addition, I also set out to compare the individualized and the collaborative learning practices used in the one-to-one setting.

The chapter not only describes the development of teaching methods within the programme, but also draws out how these teaching methods greatly depended on: teachers' beliefs, much needed professional development activities, school leadership's support, and the integration of ICT into the ongoing curriculum reform. Additionally, the parents' position on the deployment of technology in the classroom and the beliefs concerning learning that underpinned this position will be examined. The parents' and teachers' different standpoints will be compared and contrasted.

In the following section I set out to address the research question by describing and discussing factors identified in this study, and addressing its limitations.

## 5.2 Learning practices are changing

This section aims at illustrating transformations in students' learning practices brought about mainly with the introduction of technology. Given the nature of the introduction of the one-to-one program in the schools, namely the absence of strict guidelines, the teachers had to improvise teaching methods; and the lack of the top-down imposition allowed certain practices to emerge, developing according to the insights and inclinations of the teachers, and often in an emergent collaboration with the students, thereby effectively altering the teaching and learning methods. However, these positive outcomes of the innovation remained imperceptible to some of the programme's key players, and were only visible to the outside observer.

I will start the discussion with the satisfaction that students derived from the everyday usage of netbooks within and outside of the classrooms, which was also associated with the satisfaction gained through the changed learning practices. Students compared their study practices and knowledge quality with that of their counterparts not attending one-to-one classes and concluded that their own knowledge was broader. Correspondingly, I will later illustrate that this sort of appraisal serves as a form of evidence that the students' self-confidence was growing. In relation to new learning practices, I will review the emerging styles made available with the introduction of technology.

Some of the earlier researchers in the field, for example, Cuban (2001), debate that even after the introduction of technology into classrooms, teachers tend not to use it for the purposes of supporting learning as often as had been anticipated by those introducing the innovation and the way they conduct classes has not changed much; and therefore computers have had little impact on classroom dynamics. Nevertheless, more recent studies (Grimes & Warschauer, 2008; Mouza, 2008; Bebell & O'Dwyer, 2010; and Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010) point out that the

introduction of technology had positively influenced the classroom processes, especially in relation to students' learning. This study is in line with those relatively recent research findings and further reveals that both individualized and collaborative learning practices were used in one-to-one classes. I will discuss individualized and collaborative learning practices separately, contrasting them and reflecting on the characteristics and the potential outcomes each can yield.

### 5.2.1 Students' growing confidence

Even though it is hard to measure the exact level of the utilization of netbooks by the programme stakeholders, the observations reveal that among all the participants the students were the ones who almost unanimously accepted the benefits of the technology for their studies. This positive attitude was mainly developed due to the very nature of the one-to-one programme's difference from other technological innovations, giving the students a freedom of choice in terms of the access to information and materials that was almost inconceivable before. In their research Grimes & Warschauer (2008) also make this observation stating that "one-to-one laptop programs arguably offer the greatest potential of educational technologies to date in that they place the most power and versatility in students' hands, while wireless network connections open vast new vistas for communication and collaboration" (p.306). Similarly, the findings of this research demonstrated that with the introduction of netbooks the students had become enthusiastic about, and inspired by, their studies. Moreover, as described earlier in the findings chapter, among all stakeholders the students were found to be the happiest with the implementation of one-to-one computing in their classes, (see chapter 4, section 4.3.1). This claim is consonant with the research conducted by Russell et al. (2003), which identified students' ownership of computers, namely the ability to take them home, as a factor impacting upon the integration process. In my study the particular fact of possessing netbooks added to the students' satisfaction and was viewed by them as an advantage over others who were not participating in the programme.

While other students had access to computers at home, it was generally assumed by the one-to-one programme participants that these students could not have possibly spent as much time working on computers. There were several reasons stated, with the most frequently mentioned one being that other students had to share home computers with their family members. Besides, the students of one-to-one classes claimed that peers not participating in the programme would seldom ever be expected to use home computers for study purposes and usually their teachers would rely mostly on older methods of teaching. Having access to information through netbooks in and out of the classroom and having various opportunities to develop new ways of information processing and conducting homework were the main aspects boosting student happiness and encouraging different techniques of learning.

First and foremost, the ways students accessed information or materials required for their classes had changed. Previously the only sources of information for the students were their teachers and textbooks, now they had additional sources in the form of anytime and anywhere Internet access. As a result, instead of a single source, the students were provided with a selection of multiple sources, and the vast amount of materials readily accessible both in school and at home. According to the students themselves, being provided with these opportunities contributed to their learning more and improved their knowledge acquisition techniques compared to their peers in no-netbook classes. They felt privileged, more motivated and interested in their learning, which led to overall satisfaction with the education process.

The findings of this research described under the "Students' Happiness with the Programme" theme of the Findings chapter, (see chapter 4, section 4.3.1.1), revealed students' confidence with technology use and their studies, as well as increased interest in classroom processes, and in school. Quite a number of other scholars have arrived at similar findings at different times. A large number of studies have found that students' motivation in learning had significantly increased with the introduction of one-to-one computing (Russell, Bebell, & Higgins, 2004; Rutledge, Duran, &

Caroll-Miranda, 2007; Mouza, 2008; Suhr, Hernandez, Grimes, & Warschauer, 2010; Bebell & Kay, 2010; Bebell & O'Dwyer, 2010). Together with the increased student motivation, several studies have cited a high level of student engagement in classroom processes as one of the positive outcomes of one-to-one computing (Russell et al, 2004; Grant, Ross, Wang, & Potter, 2005; Dunleavy, Dextert, & Heinecket, 2007; Grimes & Warschauer, 2008; Dawson, Cavanaugh, & Ritzhaupt, 2006). Holmes (2008) considers ICT a key to successful teaching, because it guarantees students' participation. In their research Grimes and Warschauer (2008) have revealed that 74% of students in one-to-one classes found school more interesting with the implementation of the one-to-one programme. Denning (1995) states that ICT use leads to added enjoyment in learning in parallel to increased self-directed learning, a sense of achievement and self-esteem.

Student confidence with both technological and subject learning acquisition boosts their belief in their abilities to tackle challenges, which in turn adds to the success of the integration of one-to-one computing into learning and teaching. Studying in the one-to-one setting contributes to the overall satisfaction of the students with the learning process made possible through such a setting. The characteristic features of the programme, such as the use of visual aids as well as the provision of easy and instant access to Internet resources in each class contributes to increasing students' satisfaction with the learning process, urging them to excel in studies, enhancing their skills to acquire knowledge. The literature I reviewed described the broadening of students' and teachers' technological skills with the introduction of ICT (Murphy, King, & Brown, 2007; Dawson et al., 2006). However, there was a lack of research identifying a relationship between student confidence with technology use and the integration of one-to-one computing into classes. Taking into consideration the findings described in the 'Student-related category' section of the previous chapter, (see chapter 4, section 4.3.1), this study suggests that there does exist a link between student confidence with technology use and positive outcomes of the one-to-one programme, yet further evidence needs to be provided in order to support this claim.

### 5.2.2 Changes in the classroom

Even though netbooks as hardware are the most visible part of the programme, success depends on the appropriate deployment of this hardware ensuring that devices are used effectively for teaching and learning purposes. “It is really not about the laptops. It’s about what the 1:1 laptops enable in terms of new ways of teaching and learning” (Dunleavy et al., 2007, p. 451). The findings of this study illustrated that the teachers’ self-developed teaching methods as well as the use of the CMS changed the classroom activities consequently modifying the teaching-learning process to a certain extent. The fast and practical testing system made available by the CMS, the presentations students and teachers started to develop extensively and various activities prepared by the teachers through incorporating technology affected both learning and teaching. Bebell and Kay (2010) also observed that teacher practices, student achievement, student engagement, and students’ research skills changed considerably as a result of the introduction of technology. Additionally, they found that with the provision of notebooks and wireless access teaching and learning practices in classrooms changed as well.

The new classroom activities forced the students to start using new learning tools during classes and at home, such as Web 2.0 tools and educational websites. They created notepads on netbooks to gather information and e-vocabularies to store and learn new words. Students frequently did research on the Internet to prepare presentations and included information not available in textbooks, driven by the urge to create original content, in order to stand out among their classmates. Several students mentioned that before they would make presentations mostly by using MS Office software, however with the introduction of one-to-one computing they also became acquainted with Web 2.0 tools and educational websites. In the one-to-one setting students started preparing more presentations compared to the previous practice; and delivery of those presentations to teachers became much easier. While before they could only prepare presentations at home and needed flash drives to

bring them to classes, now they had an opportunity to design a presentation during classes and simply send it to the teacher via the installed local network. The introduction of technology increased the occurrence and fluency of such tasks as well as providing teachers with better opportunities of editing the students' presentations in the classrooms, thus making the process more flexible and convenient for both parties.

There also occurred a significant change in writing practices in the classrooms. In other words, the students' writing styles had been altered, since before they would spend a much longer time to write essays, dictations and other written exercises, but now students would only create a PowerPoint presentation or a short text typed on a netbook, which they considered easier. Furthermore, according to the students, preparing presentations attracted their attention, because topics were better visualized and expressed with brief text instead of long, tiresome writing. The observations have also illustrated that when creating presentations, students elected to deliver their message and arguments in the briefest manner possible, through bulleted lists on the slides; the students were inclined to work with the visually rich content of the MS Office programs and Web 2.0 tools.

As has been the case in other instances related to the infusion of technology, the parents saw a direct correlation between the abandoning of essay writing practices and the decline in their children's writing skills and deemed the change unacceptable. However, the students tended to be more in favor of laconic expression of their arguments and ideas. Some parents' preference for the "older ways" may be explained by the "existence bias" which implies that everything that exists and is well established is perceived to be better than its non-existent alternative or a new initiative (Eidelman, Crandall, & Pattershall, 2009, pp.765-775).

The purpose of assigning essays or presentations, or any other type of homework was to have the students express their arguments. Longer essays are clearly not equivalent to bulleted lists in terms of expression, but the creation of bulleted lists

calls for different skills and both types of homework yield beneficial outcomes in terms of developing skills in expression. The declining experience of longer pieces was likely to have an impact on the children's way of expressing their arguments. However, the deconstruction of a longer piece of writing in order to express it briefly in the form of a bulleted list, may also have a positive impact on the argument. This study did not aim to evaluate the quality and effectiveness of presenting arguments in a narrative or bulleted form, however, it became clear through observations that the students' work was assessed by the teachers based on their final product, be it an essay or a Power Point presentation, without further inquiring about the process involved in the creation of the product. Therefore, it is hard to decisively state whether the parents' concerns about the forms of assignments had any grounds, but as other studies have concluded, in general, one-to-one programmes do tend to improve the literacy and writing skills of students (see Sauers & McLeod, 2012; Penuel, 2006).

It is important to note that, even though the majority of both students and teachers talked extensively about the usage of websites for preparing presentations or creating timelines and photo collages, those activities were observed in only one out of six classes. Therefore since observations were conducted during a short period of time, not throughout the school year, it is assumed that these resources were used, but not on a daily basis. However based on the frequency of them being mentioned in the interviews, it can be judged that they were still prevalent throughout the majority of the classes implementing the one-to-one programme.

Apart from learning tools and activities, the teachers had created new, or improved existing, collaborative learning practices, for example by asking students to work in pairs or groups using netbooks. These types of activities, where the students would share their knowledge on a subject domain and their technological know-how, encouraged and developed cooperation among peers. Although the students were asked to work in groups, they were working on their netbooks individually, (excluding the Regional School), exchanging ideas and

knowledge and in the end making one presentation to present to the whole class. Moreover, as the students were interested in the use of ICT, they were exposed to learning new skills and acquiring knowledge in the field of technology. While working in groups or pairs, they would also usually share their technological knowledge with their fellow students and teachers in the classroom.

The results of the data analysis described in chapter 4 demonstrate the considerable impact that the emergence of new learning tools had on classroom processes in the one-to-one setting. The introduction of technology into learning and teaching creates many new possibilities to advance classroom processes. This is well illustrated in a study conducted by Storz & Hoffman (2013) in which 47 students and 8 teachers from a single school were interviewed before and after the implementation of a one-to-one programme. Alongside a number of key themes that emerged, such as "changes in teacher pedagogy", "effect on student learning experiences", "potential for improved communications", there was also a theme – "impact on classroom behavior and management" – which encapsulates the influence one-to-one computing has on classroom dynamics (p.1). All of the themes mentioned in the preceding sentence illustrate how a one-to-one programme can change "students' learning experiences and teachers' instructional practices" (p.1).

While students and teachers expressed their satisfaction with the programme, they also pointed to the limitations as negative factors hindering the teaching-learning process in one-to-one classes. The participants cited several problems such as: charging, software, hardware and connectivity issues delaying classroom processes. Similar to teachers' attempts independently to resolve the problems that arose, the students were also displaying a certain degree of agency. Several students shared their suggestions on further improvement to the programme; for example, they requested additional communication tools to connect students apart from the existing chat between teacher and students. The creation of an additional tool for communication among students was seen as a good means for lifting constraints and facilitating the more efficient conduct of group work. Specifically the students were

finding ways to work around this complication and used different online communication tools, but there was a need for an official means of exchanging information, accessing which would not be viewed as a deviation from classroom processes (such as Facebook or other social networks). The students and teachers considered the absence of such a tool deterred the use of one-to-one for students' learning purposes, hampering classroom processes. Consequently, it was regarded as a main factor diminishing the practicality and efficiency of group work organized with netbooks.

Even though the majority of the students saw the use of technology as beneficial to advancing their studies, there were several who stated that netbooks did not make a big difference in comparison to ordinary classes. These students argued that there were alternatives to computer usage within classrooms, such as owning a home computer or using textbooks. Several other students also saw working with netbooks as a more time-consuming process. This attitude was clearly rooted in their experience with the frequently arising technical issues. One of the students elaborated that half of the class time was taken up by the attempts to fix computer-related problems and log into the local area network. Understandably, when these students were faced with so many issues, they began to view ordinary classes as more effective and productive.

The absence of immediate and effective technical support caused delays in the classroom processes which at times left teachers and students frustrated. Some students and teachers also complained about the inefficiency of those responsible for implementing the programme and of the school administration in resolving technical problems in a timely manner, which in its turn affected the classroom dynamics.

### 5.2.3 Individualized learning practices

Dunleavy, Dextert & Heinecket (2007) concluded in their research that students most frequently used their laptops for conducting online searches in parallel to using MS Office programs as tools to process the information found on the Internet. As has been described earlier, (see chapter 4, section 4.3.1), the students observed in the present study were mainly requested to prepare presentations, and for that purpose they needed appropriate materials and visual aids. Therefore netbooks became a necessity. Students would conduct online research on their own with the netbooks to obtain relevant information and resources for the presentations. Eventually, this prompted individualized learning practices as well as a type of good-natured competition among students; they were inclined to enrich the content of the presentations by gathering adequate information.

Russell, Bebell and Higgins (2004) state that being provided with individual devices, students started using them for educational purposes at home more often than they had ever used their family computers, (in the case of those who had the machines at home). The findings of this research revealed that students were employing new methods and ways of conducting homework, such as preparing presentations, searching the Internet and working with Web 2.0 tools. The new techniques were not an optional addition to the classroom processes; however, the software to be used for preparing homework also was not determined by the teachers, but instead it was left to the students to choose from a variety of options, be it MS Office programs or Web 2.0 tools.

The students also mentioned how preparing homework had become fast and easy, since they could quickly find the necessary information on the Internet, and most of the time did not need the assistance of their siblings or parents at home. As opposed to conventional ways of preparing assignments, which implied going through textbooks and writing everything down on paper, they were directly searching the

web using key words, and not only was information accessed with ease but it was also readily available for copying and modifying to suit the students' needs.

Consequently, be it at home or in the classroom, students were leaning towards independent learning and in some cases even creating their own complementary learning tools, such as e-vocabularies and note-taking in a word processor. They found self-assembly of the material from the sources they found independently more engaging than using the limited amount of information provided in textbooks. As a result of this approach, students tended to express more interest in, and openness towards, the application of computers to the study process since it simplified their efforts and engaged them more with their assignments. In line with Barrios et al. (2004), technology use enhanced students' independent learning; whether they were researching or working on presentations, it assisted them in generating their own learning experiences. The findings of this study revealed that students were developing and improving individualized learning practices by taking responsibility for their learning, finding new tools, or solving their technical problems all by themselves.

Even though, according to the students, the advantage of access to information made the learning process much faster, parents criticized this significantly. As outlined in the findings chapter, (see chapter 4, section 4.3.2.1), the fact that students searched for information on the Internet and used it in their presentations was perceived differently by teachers and parents. While it was viewed as a new learning skill and habit by the teachers, the parents saw it more as plagiarism, stating that the whole effort involved only copying necessary information and pasting it into presentations, effectively excluding any chance of analyzing the used data or any sort of knowledge acquisition.

While weighing the arguments provided by teachers and parents, we have to take into consideration the level of involvement of each party in the actual process of the technology integration, namely as to what exactly it means for students to research

given topics on the Internet and use the acquired information in their presentations. Usually teachers are more involved in classroom processes where more teaching and learning takes place, whereas the role of parents at home is in most cases strictly limited to that of an observer; therefore it naturally follows that the kind of deeper involvement of teachers in the learning process makes their stance on the issues more convincing.

However, this also does not mean that parents' concerns are to be ignored. Conventional modes of teaching simply did not allow much room for plagiarism, given the limited information offered to students through books and little incentive to implement research outside the provided textbooks. The introduction of technology gave urgency to this topic by increasing the potential chances of replicating other people's work. With these new realities the burden to educate children regarding the unacceptability of plagiarism falls on the teachers, and therefore they need to induct the students into good practices, discouraging plagiarism among them and instead showing the value of creating original work.

Moreover, unlike regular classes, the students involved in the one-to-one programme were also provided with Internet access at home, which served to foster exploratory learning for handling the wide range of information netbook usage offered, as opposed to the limited source of information textbooks and teachers could provide. While generally it is expected that only several students might own a computer at home, with one-to-one it was ensured that each and every child in the programme possessed a netbook, (excluding the Regional school), with Internet access within and outside classrooms. However, whether anytime and anywhere access to devices should be considered a requirement is still a matter of debate in the scientific community involved in technology integration research (Richardson, et al., 2013). The kind of setting described above sets one-to-one classes apart from ordinary ones and even those that do have access to computers but where students are not provided with personal netbooks.

Students were leaning towards more independent learning and, as some of them indicated, they were refraining from asking their parents or siblings for help, and instead chose to handle problems on their own, by making the best use of their netbooks and the information accessible through them. The students were motivated to use netbooks effectively, and to that end they were striving to become ICT literate through obtaining necessary knowledge and skills mostly on their own. This kind of self-help behavior was further encouraged by the lack of assistance from their parents and siblings at home, as well as from their teachers at school.

On the one hand these practices helped students to develop and enhance their individualized learning in acquiring technological as well as domain knowledge, and on the other hand it contributed to collaborative learning during one-to-one classes, since, as the students themselves mentioned, they would share their knowledge and skills gained through individualized learning with the whole class if and when necessary. Accordingly, cases of collaborative learning increased and its quality developed mostly due to the opportunity of access to a wide variety of information and the possibilities of sharing it.

### 5.2.4 Collaborative learning and Crook's taxonomy

It has been noted that students who were happy and content with the learning in one-to-one classes were also keen to collaborate with, and support, their peers and teachers to stimulate the teaching-learning process in the classroom. Driven by the urge to be needed and useful to others, students were helping each other through providing or exchanging information, which created instances of social commerce, benefitting all the members of a classroom. By applying acquired ICT knowledge the tech-savvy students created an environment in which technical assistance was readily provided to the whole class. It needs to be emphasized that without the technical support of tech-savvy students to their peers and teachers, the flow of one-to-one classes would have been disrupted multiple times during a day. This claim is

supported by the observation of the classes where such kind of assistance was missing, versus the classes where it was evident.

Additionally students had developed, or in some cases were advised by their teachers to follow, other learning practices. For example, in the findings chapter, (see chapter 4, section 4.3.2.1), I described students' practice of creating individual e-vocabularies on the netbooks, and sharing those with the whole class if needed, which promoted collaborative learning among students. The students would also use YouTube, Wikipedia and educational websites to acquire new knowledge and skills and share those later with the whole class. Furthermore, the existence of collaboration, beyond technical peer support, accelerated and enriched classroom processes in one-to-one classes. This study replicates the findings of Fairman's (2004) research suggesting that students do not only cooperate to share their technological skills, but also opt to exchange their subject domain knowledge through presentations they design. Fairman (2004) draws the same conclusion by pointing out that tech-savvy students help their classmates and teachers with technology use during lessons.

The findings of this research thus illustrated that the one-to-one setting contributed to the promotion of collaborative learning practices among the students and it is noteworthy that such practices tended to occur more 'naturally' rather than as an imposed exercise. In his book titled 'Computers and Collaborative Experiences of Learning' Crook (1994) closely examines group work and collaboration through computer usage.

In his work, Crook (1994) provides a valuable taxonomy that highlights the variety of ways in which collaboration among students is fostered in a technology-rich environment. According to Crook (1994), collaboration can happen *with*, *in relation to*, *at*, *around and through* computers. Working *with* a computer implies that a student directly interacts with any given program on a machine and makes use of it for his own benefit. Collaboration *in relation to* computers refers to any topic about

which students might have a conversation with their peers and teachers, which directly or indirectly involves computers or ways of using them. Collaboration *at* computers takes place when groups consisting of a few students simultaneously work on the same issue using technology. Collaboration *around* computers refers to interaction among students while each of them is working on his/her own computer trying to accomplish a common task. Collaboration *through* computers is probably the easiest to explain and perceive, since it implies interaction among students through a network using available communication tools. In other words, collaboration through computers would be any interaction that can be regarded as virtual in comparison with face-to-face communication.

Considering the different types of collaboration described by Crook (1994) this research disclosed mainly those occurring *with, at* and *around* computers. Collaboration *with* computers was observed in most cases, as students were mostly working on netbooks individually. Collaboration *at* computers could be best illustrated with an example of group work that often occurred in the Regional School, where the students gathered around one computer and worked together to accomplish a single task, in which case the whole process happened *at* a computer. Collaboration *around* computers was observed in the group work conducted in Capital School 1, where students were assigned to work on their individual netbooks to prepare a presentation for the class, consulting with each other from time to time. In the end they prepared a presentation and demonstrated to the whole class. The diverse types of work being conducted in different classes and schools makes it apparent that the one-to-one programme is not literally about one child interacting with one machine, but instead includes a variety of practices, such as discussion about the tasks, cooperation on common assignments, exchange of ideas and in all of those the technology catalyzes intellectual activity among and between the children.

Furthermore, in line with Crook (1994), it was important for me to reveal the relationship between computers and the communication happening in collaborative learning experiences through computer-based group work. Notwithstanding the fact

that the majority of the stakeholders including the students themselves favored independent work on netbooks, still there were participants who drew attention to collaborative work and its benefits. The students reflected on the absence of communication through computers, since no software of the sort was made available for student-to-student correspondence, although the CMS had features that enabled student-to-teacher interaction. During computer-based group work in the classroom the students interacted while sitting close to one another, and at home for the same purpose they either used various applications on phones or other social network websites. Such attempts to work collaboratively, despite the fact that there was no direct communication possible through the netbooks, were certainly noteworthy.

The absence of a particular communication tool for students described above has been identified as a problem that hindered one-to-one integration. Crook (1994) also reflects on the best ways of creating a useful infrastructure in the classroom that could promote interaction among students. He states that "the design of classrooms vividly illustrates the principle that material environments will constrain and facilitate a whole range of social interactions that can occur within them. So, the structure in some particular environment may influence all sorts of collaborative engagements that we may be party to" (p. 190), which means that interaction among students can be encouraged or discouraged based on the classroom infrastructure.

As Crook (1994) describes it, the introduction of computers in classrooms has facilitated “socially organized learning”, which is represented mainly in assigned “computer-based group work” (p.121). The collaboration among students examined in this study occurs mostly through the teachers’ instruction, however, the creation of the infrastructure that Crook (1994) proposes should provide appropriate tools to promote and facilitate group work among students. Therefore the teachers may need further advice and preparation to organize this kind of work.

Interestingly, a large number of students reflected on the benefits of working in groups as a good means for familiarizing themselves with new information and

gaining additional knowledge, although there were students who preferred studying individually as well. Students' comparisons of regular classes with one-to-one classes showed that in group work conducted in the one-to-one setting all students were engaged in performing one task or another on their own netbooks, while in regular classes the situation was completely different: one student in the entire classroom would write on paper and other students who had any ideas would give suggestions on a voluntary basis, i.e. not all the group members would participate in a group work. (It was a different scenario in the Regional School, where four to five students would work on one netbook carrying out one assignment due to the adjusted distribution of netbooks). This was the major point that distinguished group work in the one-to-one setting from the regular classes. Thus in one-to-one classes students' group work combined individualized and collaborative learning practices.

The limited number of computers allocated per class was an outcome of a different implementation scenario adopted by the Regional School administration. A significant change was made to the netbook distribution pattern in the school, which illustrated the school leadership's understanding of the programme implementation, and the consequences of this understanding for classroom processes. In the Regional School, the school leadership's setting of a netbook to student ratio at 1:5 demonstrated the lack of understanding of the one-to-one programme and its aims. It also completely disregarded a substantial argument of one-to-one programmes, which implies that if everyone owns and regularly uses a personal computer learning tends to increase as a consequence (Papert 1980).

Due to the limited number of netbooks in the Regional School the teachers had to have students work in groups on netbooks, which greatly affected the types of activities and the classroom dynamics in general. Additionally the individualized learning process was interrupted in the Regional School, and the students were obliged to work in groups. This resulted in an increased amount of time spent by students working *at* computers, as Crook (1994) describes, and arguably contributed to encouraging collaborative learning in classes. It is hard to determine the advantage

of this kind of collaborative learning when the chance of comparison with individualized learning practices using netbooks had been eliminated. As far as the students' attitudes were concerned, the majority expressed their desire to have the opportunity of individual access to their own netbooks.

In summary, collaboration taking place in the classrooms was found to be a crucial factor leading to the successful integration of one-to-one computing. It could be suggested that the development of more organized collaborative learning practices can be directly ascribed to the introduction of technology in classroom settings, which contributed to, and in some cases encouraged, the students' interest in working together with peers, effectively facilitating the cooperation within the classroom. It can also be argued that the changes taking place in the classrooms were mostly positive and added to the students' overall enjoyment of the programme.

I have tried in preceding paragraphs to illustrate the individualized and collaborative learning practices taking place in the same classroom setting by comparing and contrasting them. The exercise helped to identify the advantages that these practices bear in terms of contributing to teaching and learning in schools. Thus, one-to-one computing programmes not only developed students' confidence and changed classroom practices, but they also assisted in the acquisition of subject domain and technological knowledge through the kind of individualized and collaborative learning practices described in this section.

## 5.3 Teachers are developing new methods

It became apparent in a number of instances throughout the research that the teachers exerted great influence on the programme implementation. At the same time the programme influenced the teachers by increasing their workload. Even though the

technological innovation was supposed to aid the teaching process and free some of the teachers' time, it has actually constituted a certain amount of pressure on them.

This section analyzes teachers' attitudes towards the programme, the influence they had on the overall implementation of one-to-one and the influences technology had on them. As will be illustrated, the positive or negative approach of the participant teachers to the obstacles that arose could produce corresponding outcomes, placing them on the opposing sides of a horizontal axis. On one side there were those who viewed the obstacles as challenges and used them as an opportunity to develop, while for others they served as an excuse to avoid extra workload. However, this does not mean that teachers should be held accountable for the lack of motivation to overcome the difficulties. Accordingly, this section also delves into the necessity of providing teachers with appropriate support, viewing the problem through the lens of relevant literature. The last part of the section discusses the issues related to the utilization of ICT in order to meet curriculum standards in the light of insufficient guidelines, and the complications that arose from the standards not envisioning the integration of technology.

### 5.3.1 Impact of teacher beliefs

The data analysis uncovered that other than training manuals the teachers were not provided with guidelines or standards of any kind that could offer a reference point on how to conduct one-to-one classes. However, as discussed in the previous chapter teachers who were attracted by the programme continuously strived towards enhancing the ICT skills necessary for the one-to-one setting. Similarly, the research conducted by Vannatta and Fordham (2004) asserts that it is possible to expect successful results of technology integration into classrooms provided that teachers are willing to change and improve instruction, commit to spending extra time on implementation, and alter their personal beliefs in one-to-one computing.

Scrimshaw (2004) highlights that the use of ICT in classes is "an innovation both in technology and teaching" (p.9), and Mardis, Hoffman and Marshall (2008) state that the technology use in the classroom depends on teachers' beliefs in the programme, and when teachers trust that it is beneficial for their classes they will be more motivated to use it. Similarly, in this research the teachers with strong beliefs and interest in the technology were found to develop various innovative and creative methods of integrating the features of the one-to-one programme into their classes, primarily for the purpose of directing students' full attention to the topics being discussed as well as for keeping them engaged in the classroom processes.

Accordingly, teachers' beliefs were one of the major aspects affecting the use of computers in the classroom. This claim is supported by the Garthwait and Weller (2005) study that revealed the significant link between teachers' beliefs and the potential use of technology in education. Their study explored teachers' beliefs in depth and tried to illustrate how they modify the outcomes of one-to-one computing. Earlier research conducted by Windschitl and Sahl (2002) suggests that teaching styles originate not from a single source, but from multiple sources, one of which is the perception of a teacher's role in the implementation process. Teachers' beliefs mediate the way they use technology in the classroom, and if they are not philosophically in tune with the initiative, it is less likely that they will integrate the laptops into their lesson plans (Penuel, 2006).

The review of literature revealed teacher belief to be a vital factor in one-to-one programmes (Windschitl & Sahl, 2002; Penuel, 2006; Lei & Zhao, 2008). Zucker and Hug (2007) and Inan and Lowther (2010) insist that teacher belief in one-to-one should be cultivated during their initial and continuing professional development. The findings of the research conducted by Inan and Lowther (2010) illustrate that teacher readiness and beliefs are the important factors that predict computer integration and professional development. In the present study, it was found that teacher enthusiasm and motivation to conduct one-to-one classes and further improve their professional development in this field were grounded on their beliefs in the

programme. Teachers who believed in the fruitful outcome of the initiative were motivated to continue to work in one-to-one classes and develop their skills accordingly.

Moreover, as the findings of this research suggest, only teachers with a genuinely positive interest and motivation in the programme were eager to develop an innovative approach to the teaching process in one-to-one classes, even if it meant taking on extra workload. Their dedication to the implementation of the programme was reflected in situations where the teachers would develop digital content, but at the same time print the same content out in order to safeguard against cases of power outage, technical problems, etc. When teachers adopted a positive attitude towards the one-to-one programme, despite all hardships along the way, they became more aware of the implications of the use of technology, and as a consequence were more creative in their methods of integration, notwithstanding the fact that they lacked guidelines and support in pedagogical design.

Contrary to the attitude the interested teachers illustrated, there was also a teacher who lacked interest and motivation in one-to-one classes due to encountering a large number of problems. As it was difficult for her to handle the technical issues arising during classes, she seemed to be using technical problems as an excuse to avoid extra workload, viewing the programme implementation as nothing more than an imposed obligation.

On the other hand, interested teachers regarded such problems as challenges on the road to developing and perfecting their teaching methods, which resulted in their devising new ways to overcome major obstacles. Those teachers were curious about technological innovation in education and demonstrated readiness to use each difficulty as a stepping-stone to improvement. Additionally, teaching with one-to-one was seen as a means of equipping students with the digital proficiency and necessary 21$^{st}$ century skills which were regarded as a priority in terms of preparing students for problem solving in the real world outside the classroom. This aspect

surely served as an additional motivator for teachers to continue implementing the programme with enthusiasm, enhancing themselves with experience in the field in order to be able to provide the students with required resources and necessary skills, and to contribute to the successful implementation of the pilot initiative at their schools.

However this research indicates that merely holding even very strong beliefs is not enough; in order to achieve success in the implementation of one-to-one programmes specific teacher professional development plans have to be designed that would: (a) focus on content (e.g., technology knowledge and skills, technology-supported pedagogy knowledge and skills, and technology-related classroom management knowledge and skills); (b) give teachers opportunities for ‘‘hands-on’’ work; (c) be highly consistent with teachers’ needs (Hew & Brush, 2007, p. 238).

### 5.3.2 Teachers need support for improvement

A number of studies have emphasized the necessity of professional development in order to encourage teachers to use technology for students’ learning (Richardson, Finholt-Daniel, Sales, & Flora, 2012; Richardson, 2011; Davis, Preston & Sahin, 2009). Appropriate professional development is essential to motivate teachers to infuse technology into their teaching. According to Shapley et al. (2010), the “quality of professional development” (p.33) is a strategically important factor in teachers’ technology usage. Several studies have considered ongoing professional development as one of the main requirements for the success of one-to-one programmes (Rutledge et al., 2007; Dawson et al., 2006; Grimes &Warschauer, 2008). The findings of this study corroborate the significance of teacher professional development in technology integration related projects, considering it a key to the effective implementation of such initiatives.

While teachers' sharpening their technological skills as a part of professional development is crucial to the integration of the programme, Holmes (2008) points out that the focus will always be on pedagogy as it matters most and laptops are only a tool to make sure the learning process is as easy and pleasant for children as possible. Despite the teachers being provided with technological devices and training, "the biggest challenge, however, is helping teachers develop the expertise required to harness the power of the technology" (Mouza, 2008, p. 450). Although prior to commencing the pilot teachers had gone through two-week long trainings, this was not sufficient to fully prepare them for conducting technology-integrated classes, and they had to further invest in their own personal development.

When several teachers did not feel satisfied with the knowledge and skills obtained during the training sessions they continued advancing their technological skills to enter an ever-changing world of teaching with one-to-one. Therefore these teachers in particular were found to succeed in scaffolding technology integrated classes. While certain hardware and software problems could be difficult to overcome for the teachers who showed lack of interest towards the programme, interested and motivated teachers exerted every opportunity to work around those obstacles and conduct one-to-one classes. The self-motivated positive approach surely leads to favorable results by itself, but it needs to be noted that this approach is underpinned by hard work. It should be rewarded as much as possible in order to maintain this type of attitude and hopefully encourage it among other teachers who seem to be less motivated.

Analysis of the data indicated a lack of pedagogical support in terms of how to scaffold one-to-one classes. The training that teachers had undergone was mostly focused around acquisition of technological skills, consequently leaving little room for advanced training on the integration of pedagogy with technology for meeting newly set curriculum standards. The findings of this study highlight the importance of considering teachers' professional development related to adopting one-to-one

integration methods, and that such professional development should be taking place in advance of, or very soon after, the classroom deployment of the equipment.

As Ferdig (2006) highlights, preparing teachers for technology-integrated classrooms is a far more complicated process than simply teaching technological skills. Not surprisingly, teaching with one-to-one appeared to demand constant hard work, preparedness and enthusiasm on the part of teachers. Hence, teachers were not only expected to deliver effective one-to-one classes, but the findings illustrated that they were reliant on their own individual efforts to take ahead their professional development within the programme. According to Bennett (2014), placing such an emotional burden on teachers can have diverse consequences, some of which can be positive and some negative. Bennett‘s (2014) study was conducted in higher education, but the findings can easily be applied to schools as well, where teachers do derive joy from being the frontrunners in the field of implementing new methods, but also feel the considerable emotional burden due to the increased responsibility and the challenges they have to overcome.

Sivin-Kachala and Bialo (2000) concluded from their research on the computer usage of more than 300 students that teacher training was the most noteworthy factor influencing computer use in classes. In my view training has to be conducted in a technology-rich environment where teachers are supplied with necessary devices as well as unlimited access to the Internet. In such a setting, they can be expected to learn how to use computers, tackle technical problems in the classroom and also master the software introduced with the programme. More than that, they are exposed to the methods and ways of incorporating one-to-one into the teaching of different subjects. The experts have to introduce to teachers certain guidelines on meeting curriculum standards with the use of the technology. It must be highlighted and explained extensively to teachers that one-to-one is only a tool to achieve and ensure effective classes where students become partners with teachers in classroom processes and they acquire 21$^{st}$ century skills.

Although the majority of the participant teachers would have preferred to have had both pedagogical and technical support jointly made available in advance, they still tried to use novel approaches in the one-to-one classes. According to Reynolds, Treharne, & Tripp (2003), "ICT in the curriculum has been broken-backed without the pedagogic spine to provide the necessary structure and support" (p.151). Therefore, in any one-to-one programme the pedagogical support must be made available in parallel to technical assistance.

McCarney (2004) emphasizes that the effectiveness of the integration of ICT into learning is based on teachers' acceptance of the pedagogical side of ICT deployment as a learning tool, and he further suggests that with a knowledgeable and confident teacher endless opportunities exist in the classroom for creative and innovative learning. Similarly, Windschitl and Sahl (2002) state that professional development opportunities should not focus only on the development of computer skills, but the use of technology should also be concerned with careful consideration of teachers' beliefs about what constitutes an effective pedagogy as well as how ICT access can change the traditional classroom setting and teaching style. Therefore for the successful integration of the one-to-one programme into teaching and learning, merely introducing devices and organizing training on their usage is not enough; teachers must be acquainted with the methods of employing technology as a tool in teaching and learning processes. For teachers aiming to make appropriate use of technology in education, there exists a need to be involved in special training, seminars and/or workshops on pedagogical aspects of ICT integration. Such professional development opportunities can afford teachers a chance to better plan ICT-integrated lessons, organize collaborative projects based on technology usage and utilize various types of software for teaching different subjects, with a special focus on engaging students in the learning process. Additionally, collaboration with peers, discussions on how technology can support student learning, and exploring new ways of ICT integration in the classroom have the potential to play a key role in improving instruction methods and promoting technology use.

In order to stay enthusiastic and interested in the programme implementation teachers also need the encouragement and appreciation of school leadership in parallel to pedagogical support and technical assistance. Achieving educational change is not a simple task and in order to make teaching and learning more effective, the educational leadership of school administration is absolutely necessary. Fullan (2001) points up strong school leadership as one of the factors influencing the integration process; "leadership sets the tone (provides a strong voice, builds coalitions, allocates resources); teachers make comprehensive reform possible (professional development is key, union support is vital)" (pp. 47-48).

The teachers who had school administration support were found to be confident in their skills, seeking ways to enhance their development; hence 'school leadership support' was identified as another factor influencing the integration process. Several studies have agreed, indicating school leadership as being a vital factor influencing the success of the integration process (Bebell & Kay, 2010; Lin, Lin, & Huang, 2009; Moyle 2006). In the research conducted by Moyle (2006), participants highlighted that in order to achieve successful integration of ICT into teaching and learning, the leadership must take the philosophical, pedagogical, physical and practical aspects into consideration and most importantly this should happen in an integrated way throughout the entire school, while constantly reviewing and revisiting professional development and in-school processes. Oliver, Molette & Corn (2012) conducted a study with school leaders in eleven middle and seven high schools exploring their strategies of successfully integrating computers. The research participants suggested three themes for the attention of the future implementers of ubiquitous computer initiatives: "program planning and leadership (policies, procedures); infrastructure planning (networks, software); and promoting teacher motivation and buy-in" (Oliver, Mollette & Corn, 2012, p. 125).

In a similar vein, in the findings chapter the case of the Regional School pointed up the crucial role that school leaders play in these matters, and the consequences of their decisions on the teaching and learning process. Thus the existence of school

leadership support is one of the important factors to consider in the planning and implementation of one-to-one programmes.

### 5.3.2 ICT as part of a curriculum reform

According to Bransford, Brown, & Cocking (2000) to achieve successful implementation educational innovations should be introduced at early grades and they have to be incorporated into curricula as well. They claim that as opposed to traditional methods of teaching, technology infused classes create possibilities for teachers to implement various projects and provide opportunity for promoting independent investigation by students as well as access to information resources. On the other hand, and as the findings of this study indicate, technology can be used by teachers as a tool for better adhering to curriculum standards.

In Azerbaijan the curriculum has recently undergone major changes and teachers have been introduced to newly adopted standards. Although there were teachers in the study who were trying to achieve several standards using one-to-one computing, still they were not provided with appropriate guidelines and it was only due to their own initiative and creativity that they attempted to use technology as a tool to meet the standards set for their particular subjects. The study revealed that not all teachers were enthusiastic to act similarly and this seemed to cause frustration in addition to the technical problems they had faced. Sell et al., (2012) point out that ICT tools are successfully integrated into teaching and learning when they become part of a continuing reform, but not a separate initiative. Hence ICT integration into the teaching-learning process must become a part of educational reform, for example in the case of Azerbaijan's curriculum reform it would stimulate the application of recently set standards and also encourage teachers to conduct ICT-integrated classes. Teachers' attempts to meet newly-set curricular standards with one-to-one through their self-developed methods was an indicator of their motivation. In addition to not

having specific guidelines in the one-to-one programme, there was no mention in the curriculum standards of ICT use in relation to pedagogy.

In contrast, it can be argued that high learning achievements in one-to-one classes, where new curricular standards are also being implemented, can be ensured only through the enhancement of pedagogy with one-to-one computing. Therefore while planning and implementing a curriculum reform, what ICT offers must be taken into consideration and the ways and methods to combine pedagogy with ICT for better technology-integrated curriculum classes must be addressed. According to Earle (2002), "in many instances, it has been a case of fitting the curriculum to the computer rather than the computer to the curriculum" (p. 4). Therefore prior to introducing new curriculum standards it would be desirable to integrate technology, especially one-to-one to the pedagogy of those standards, including preparation of digital textbooks, building interactive e-learning platforms, tools and other necessary e-resources for employment in classroom activities. The teaching-learning process in the one-to-one setting would become student-centered, interactive and up-to-date encouraging students to master 21st century skills, and teachers to achieve learning standards set in the subject curricula.

According to Smeets and Mooij (2001) the way teachers choose and employ software in their teaching has an undeniable impact upon learning. For example, in one-to-one classes where teachers used Web 2.0 tools and various educational websites, they managed to create a collaborative and enriched learning environment. Rutledge et al. (2007) highlight creative and collaborative lesson plans teachers prepare in the one-to-one setting. In the existing literature there is an abundance of studies that reveal teachers' ways of employing ICT in their classes, with the most prevalent uses being: spreadsheets, presentation software and web browsers (Lowther, Ross, & Morrison, 2003; Ross, Lowther, Wilson-Relyea, Weiping, & Morrison, 2003; Russell et al. 2004; Silvernail & Lane 2004; Dunleavy et al., 2007).

In this study the new methods teachers developed for conducting classes with netbooks mostly involved pervasive use of visual aids, namely the preparation of presentations and creation of e-resources using a wide array of tools available to them, such as Movie Maker, MS PowerPoint, educational websites and Web 2.0 tools. Another most common way to integrate one-to-one computing into teaching and learning was in the assessment of the students' comprehension of topics through the testing system of the Classroom Management Software. By making use of the local network installed with the CMS the teachers could instantly share files and assignments with their students. Observations showed that, if used properly and without interruption, the network largely changed the ways the teachers interacted with the students, making classroom management fast and practical alongside creating a new type of classroom communication that was considered by both teachers and students as a more convenient means for interaction than just face-to-face. The widespread usage of interactive whiteboards installed in the classrooms was also noteworthy, due to the fact that they have proved to be a helpful technological tool conducive to creating 'visual' classes with the one-to-one programme. Interestingly, the students seemed to find one-to-one classes conducted with the visual aids to be more productive than regular ones as they believed visualization helped them remember the topics better, and they perceived test results generated by the software as being more objective, quick and practical, as opposed to teachers' assessment.

The increased usage of digital visual aids can be considered an added advantage for the one-to-one programme as opposed to ordinary classes, given that the latter setting has very limited usage of visual aids in classroom processes. The items that can be regarded as visual aids in ordinary classes are the textbooks used for teaching, some posters and occasional printed out pictures teachers may bring to class. However, usage of visual aids in ordinary classes is neither required from the teachers nor regulated by any official means, so this judgment can be based only on the direct observation of classroom processes and the information gained through communication with the teachers.

As a result of introducing the new teaching methods that have been described, teachers were found gradually to change their roles to facilitators, turning themselves into learning partners and information disseminators instead of controlling every step in the teaching-learning process. In most instances they were able simply to allow their students to learn at the pace of their own choice, facilitating discovery of new ways and sources of learning. Consequently, teachers improved their roles as coaches. The classroom processes were found to be moving from a teacher-directed towards a student-centered approach that allowed students to become accountable for their own learning. As mentioned earlier, these teachers were also trying to meet the National Curriculum standards using one-to-one as a tool. One of the main goals of these new curricular standards is to accelerate the transformation process of education from a teacher-directed to a learner-centered one. However, this process can be quite lengthy, considering the fact that the education system in Azerbaijan has been teacher-directed for a long time, where students mainly take on the role of respondents. In order to transform the classroom processes into a student-centered environment, the teachers have to learn new ways of managing classes and guiding processes without constant and direct involvement, which takes skill and effort on the part of teachers to cede agency to their students, allowing them to take more responsibility for their own learning.

In line with Becker & Anderson (1998), teachers' beliefs and attitudes towards the integration of technology within the curriculum can influence the ways they utilize computers in their classes. The present research indicates that pedagogical design for the use of ICT is crucial for the success of learning. "Therefore, effective ICT integration should focus on pedagogy design by justifying how the technology is used in such a way and why" (Wang and Woo, 2007, p.149). Some studies report that the technology has an impact on performance; in order to increase this impact, researchers indicate that the curriculum design needs to be changed. Moreover, they recommend focusing on the combination of process and content, which will bring added value to the successful integration of technology (Hill, Reeves, & Heidemeier,

2000). Consequently in this research, the implementation of curriculum reform utilizing ICT is regarded as an essential factor to be considered by school leadership, policy makers and the programme developers in order to align the one-to-one initiative with the standards as a 'natural' process rather than an imposed one.

## 5.4 Arguments about the philosophy of learning

The following section describes the parents' approach to the programme implementation as well as their general ideas about the philosophy of learning, which as the present research revealed, is quite different from the viewpoints of other stakeholders.

### 5.4.1 Parents' viewpoints

The findings pointed out that the majority of the parents participating in this study were less inclined to seek evidence on which to base their judgment of the one-to-one programme, but focused more on the notions propagated though society and media, or rather their own perception or a 'best guess' as to what might be going on in the classrooms. For example, some parents tended to complain about the extended amount of time children spent with netbooks during classes, and expressed their concerns regarding the teachers using netbooks unnecessarily and excessively. However, considering the facts that one-to-one classes are inherently computer-based, frequent usage of computers should be expected and it becomes hard to judge as to what constitutes 'unnecessary' and 'excessive' usage. For the researcher, teachers' and students' accounts carried more weight, considering the fact that they were judging from their first-hand experience, while the parents' assessment was based solely on their perceptions.

Roughly half of the parents considered that students were only interested in, and attracted to, the technological side of one-to-one computing, since what they witness at home is their children getting excited about using the computer and mastering a skill or two. However, the observations also illustrated that even if students are interested in the technological side, this does not exclude the possibility of them acquiring domain knowledge. Nevertheless, this is also subject to interpretation: some parents might think students are only excited by the novelty of the provided technology, but on the other hand, grasping technological knowledge may lead to more achievement in domain knowledge acquisition.

As a result of exploring and describing parental attitudes towards the programme in detail, it was unveiled that there were two camps of parents with opposing views. Some of the parents as described above were utterly against the current ways of teaching and the extended amount of time children spent with netbooks during classes. A similar finding was reached in the study conducted by Lei and Zhao (2008), where the data revealed that more than one-third of the participant parents complained about the excessive amount of time spent on laptops.

The present study also revealed that the other group of parents did not make these kinds of claims and were more inclined to concentrate on the advantages of the programme. They saw it as a way for their children to become computer-literate and knowledgeable about technology which could help them not only throughout their studies at school but later in their careers as well.

The only opinion the two camps shared, some to a greater extent and some to a lesser, was the concern for their children's health, in particular their eyesight, as well as deterioration of their handwriting, reading and speaking skills. Several parents reflected on the damage the usage of 30 netbooks at the same time in one classroom could entail in terms of the health of their children due to the widespread belief that computers emit radiation as well as the radiation associated with wireless networks. This indicates that health related issues were a matter of utmost concern for all the

parents, and therefore they reacted with restrictions on the children's computer usage at home, which in turn negatively affected the breadth of parental support towards the programme.

It has been noted that the most frequently voiced complaint by the majority of the parents was the deterioration netbook usage could cause to their children's handwriting, reading and speaking skills. As the findings chapter depicted, (see chapter 4, section 4.4), the parents were comparing their experience at schools with that of their children, supporting each claim with specific arguments. Surprisingly, the concerns of this sort were mostly expressed by the teachers in the research of Lei and Zhao (2008) conducted in a Midwestern middle school, where teachers were found to be worried about their students not being able "to retain the ability to read and write with paper and pencil" (p.116). However, in case of the present research, the results were quite the contrary and instead teachers were very supportive. According to one of the teachers, neat handwriting is a skill achievable through practice and can be formed in a person at any age or stage of development, but critical thinking skills supersede the importance of handwriting and the delay of their development might prove problematic, as later it will be harder to develop these skills.

Similar to handwriting skills, parents also thought that children's reading skills were degrading. They did not expressly provide precise arguments to support this claim, but based on their comments some issues can be identified, which point to their possible reasoning about technology contributing to this negative trend. Parents saw their children pick up a physical book less and less. This caused them to be alarmed, because as previously mentioned, parents tended to judge from their own perspective, from how they used to study in their own time, so naturally when the children were spending minimal time with paper books they assumed that there was a reduction in reading time.

In order to fully understand the reasoning behind these claims, research is needed to examine parental attitudes in greater depth. However, based on the given data it seems safe to accept that just because parents do not have a thorough understanding of how computers work and imagination of how e-books could be used, they assume that children are not reading at all or instead of reading thoroughly they just skim through texts. This research has not gathered data to analyze whether students read more or less in one-to-one classes as opposed to ordinary classrooms, but the parents' judgment is similarly lacking in any hard supportive evidence.

Another ground on which the parents deduced that the speaking skills of their children were degrading was the lack of interaction they observed among the students. They thought that their children lacked speaking skills just because they were not reading enough fiction – a statement that is again rooted in their own experiences. They claimed that in the past people were reading paper books and it consequently helped them to develop good oratorical skills. This assessment disregards the fact that parents might not be remembering what their actual skills were in their childhood, several decades before. On the other hand, it seems an even more unfair comparison when a parent states that her speaking skills are much better than her child's, comparing the skills of adults to those of their children. This kind of comparison ignores the years of experience parents have over the children, experience which is not necessarily rooted in the parents' extensive reading of fiction.

Some of the parents would only consider those learning activities that they practiced in their childhood, again this may possibly be explained in terms of "the existence bias". The participant parents thought that in order for a student to learn something from a book, they should pick up a paper book. Similarly the study of Lei and Zhao (2008) found that "some parents preferred their children to learn from books to computers" (p.116). One parent was concerned with this issue, saying that while students just skim through the e-books they have to thoroughly read a paper book. The closest any of the parents came to understanding was one of them mentioning in

passing: “They say you can find anything there”, referring to the availability of information and texts through the netbooks.

### 5.4.2 The discrepancy in the parents’ and teachers’ opinions

Since teachers and parents valued different skills for the students’ development their views on the programme implementation were quite contrary. While parents saw the introduction of technology as a deterrent to their children’s development in terms of handwriting skills, the teachers focused more on its advantage and ascribed the development of critical thinking skills to the technology. Because the aims set by the stakeholders (i.e. teachers and parents) differed, it becomes impossible to directly compare their positions since they are focusing on different outcomes. However, while teachers chose to focus on the positive side of technology use, parents tended to concentrate more on its disadvantage, basing their judgment solely on their own experiences.

Another issue where parent and teacher opinions differed was on the amount and share of technological learning in comparison with subject domain learning that was happening in one-to-one classes. Parents claimed that their children were only interested in, and attracted to, the technological side of one-to-one computing, and they were only gaining technological knowledge and skills from this programme, not paying enough attention to their studies. However, as described in the findings chapter, teachers and students counterclaimed that there was no lack of interest in studies on the part of students, and technological learning was happening in addition to subject learning in the one-to-one setting. Since one-to-one computing is about integration of technology into education and using it for the best outcome in studies, students’ excelling in technological learning in addition to curricular studies can only enable them to learn better, and by the use of the programme’s tools, they can both

diversify and make their study processes more productive in and out of the classroom, (see chapter 4, section 4.3.1.1).

These attitudes were indicative of parents' understanding of the programme and suggest the importance of cultivating parental interest and support. It is of utmost significance to increase the parents' enthusiasm with one-to-one, since as one of the key stakeholders of the initiative they were found to have a direct influence on the students and correspondingly on the successful implementation of the programme.

This direct influence concerned parents' restricting netbook usage of their children at home. Although it has not been studied precisely to what extent and in which ways this kind of parental attitude affected the study habits of the students, it might still be assumed that parent restrictions on netbook usage impacted on student learning with netbooks at home. Since the students were dependent on their parents at home, they had to accept imposed parent restrictions on their netbook usage. The issue of parents not being as computer-savvy as their children arises with implications that the restrictions they impose may be entirely arbitrary and do not take into consideration the actual amount of time children might need for preparing their homework. The teachers held quite opposing views and did not make any kind of adjustments or changes in the conduct of one-to-one classes due to parental attitudes. In this and many similar cases, the students' opinions may have been somewhat influenced by the possibility that the research assistant could have been perceived as a representative of the Ministry of Education.

Parental agreement and support play an important role in the successful implementation of one-to-one computing initiatives (Li, 2010). At the same time there is a notable scarcity of research in this specific area. In the study conducted by Shapley et al. (2010) in 21 Texas schools, they reported the existence of only limited parental and community support after four years of implementation. In the present research 'parental support' was recorded as a factor, the absence of which could negatively influence the usage of netbooks at home, and consequently affect the

integration of one-to-one computing into learning to a degree. However, the findings of the research did not reveal any possible influence of the parents on use of netbooks in a classroom.

Considering the direct involvement of parents in determining the amount of time students could use computers at home and the influence it may have had on the programme implementation, their attitude towards the pilot can be seen to have a certain weight. Even though they spoke favorably of the one-to-one initiative, their actions did not always conform with this discourse. When asked about the advantages of using netbooks in the learning process, they almost universally supported the idea even if this support was accompanied with certain reservations. However, when comparing the netbook vs. textbook usage, they refrained from defending the idea of netbook usage and instead claimed that if a student is sufficiently motivated, he or she will be able to learn in any setting irrespective of the tools provided for these purposes. It should be understood that this kind of parental vision reflects a widespread opinion existing in post-soviet countries that, notwithstanding the opportunities and tools afforded, any child should have motivation and enthusiasm for learning.

The soundness of the judgment expressed by the parents can quite easily be challenged; the actual problem is not whether this opinion holds true, but the fact that it is widely accepted in the society. I think it provides a means by which people reassure themselves that their children are capable of accomplishing a lot, but unfortunately it also poses quite a big problem to the whole educational system, especially in post-soviet countries like Azerbaijan by placing all the confidence in the capabilities of children but blaming the educators when the results are not as great as anticipated.

Additionally parents held another perception that the study process should be hard enough for the children to attain an appropriate knowledge. They again drew on their own experiences and thought that scouring the shelves of libraries in search of

necessary information is what constitutes the hard work and extensive acquisition of knowledge. According to the parents, because information is readily accessible through the Internet the children do not read enough extra materials while searching for the necessary pieces. Thus they logically concluded that children have become lazy due to having all the essential information at their fingertips. What they tended to overlook, however, is the efficiency of the ease of access to information. In other words, parents perceive hard work as a prolonged process of attaining information. They assume that by using netbooks learners will achieve the same with less effort, but in fact when the process is accelerated students are given an opportunity to acquire greater knowledge in the same amount of time.

Given the importance of parental support in the integration process, it would be wise to communicate the programme goals and its place in curricula and pedagogy to parents, so that they gain insights into the implementation process, which in turn could be helpful in generating parental trust in school leadership and support for the programme. One could also argue that, aside from any questions concerning 'effectiveness', schools have a duty to inform parents clearly concerning the nature of, and rationale for, any major educational innovation. Tedre et al. (2011) oppose the widely accepted viewpoint that non-technical areas of one-to-one computing programs, such as teacher training, content development, etc. should be of no concern for the programme implementers and challenge this attitude by presenting and analyzing nine of what they consider as crucial considerations, among those are parental agreement and support. This aspect is considered vital and as the authors of the paper put it 'often neglected'. The current study also highlighted the significant influence parents may have on the implementation of the programme, which is not necessarily limited to one-to-one computing and may extend to the whole education system as well. Similarly changing teachers' conceptions of technology use is not enough to have any considerable impact on their teaching practices or student learning, but instead "change comes from the social capital and informal social forces in the school" (Li, 2010, p. 1). In the work of Li (2010), teacher empowerment and parental support are considered significant factors for the implementation of the

programme. In the case study conducted in an aided coeducational primary school in Hong Kong by Li (2010), the participant school wanted to ensure that the parents would be committed to the one-to-one initiative and instead of making the programme mandatory for all the classes, the administration made it voluntary, which resulted in creating a sense of mutual ownership and the parents who let their children join such classes shared the responsibility.

As has already been discussed in this section, parents seemed reluctant to support the programme wholeheartedly due to the reasons described above, such as health concerns, deterioration of handwriting skills and so on, which resulted in their limiting the time children could spend at computers and indirectly hindering the success of the programme. As a result, the principle of 'anytime, anywhere' access to information at home was disrupted due to the imposed restrictions. Considering the negative influence parents might have on the initiative it becomes necessary to think about the ways of gaining their trust and support, because "parental satisfaction is also a measure of success" (Barrios, 2004, p.26). Thus, I think, finding a way to involve parents in the programme or include them in the decision-making processes might create a sense of responsibility and urge them to be more supportive. However, this is not an easy task to achieve, because it entails quite a number of aspects and might even require a culture-specific approach.

## 5.5 Answering the research question

This study was designed to answer the following research question: "What factors influence the integration of one-to-one computing into teaching and learning?" Presenting and discussing the findings of the research disclosed the existence of certain factors influencing the one-to-one programme at three levels: teacher, student and classroom-dynamics. These factors were also scrutinized in relation to the existing body of literature on one-to-one computing.

Numerous studies have mentioned several factors behind successful integration of one-to-one programmes. For example, while Bebell and Kay (2010) consider poor implementation and lack of leadership as major factors hindering successful integration of such a programme, Drayton et al. (2010) highlight lack of time allocated to professional development of teachers as the key negative factor. The research synthesis conducted by Penuel (2006) reports positive teacher attitude to student technology use, extensive teacher professional development and access to technical support as factors influencing effective integration of a one-to-one programme. Furthermore, in the existing literature there are studies that mostly emphasize teacher readiness and teacher attitudes as the factors influencing the integration of one-to-one computing, as well as professional development, technical support and resources available for teachers (Penuel, 2006; Murphy, King, & Brown, 2007; Lowther, Inan, Ross, & Strahl, 2012). The present study has identified eight factors that significantly influence the integration of one-to-one computing into teaching and learning as presented in Figure 5.1 below. The factors placed on the left-hand side of the diagram (colored blue), are the ones that have appeared strongly in this study, and have only appeared at most to a very minor degree in other literature. They are the following:

- *Embedding ICT in Curriculum,*
- *Fostering of Exploratory Learning,*
- *Student Satisfaction,*
- *New Learning Practices.*

The remaining four factors placed on the right-hand side of the diagram (colored green), are frequently mentioned in the existing body of literature related to one-to-one computing programmes, and they have also been identified within the present study. These are:

- *Professional Development,*
- *School Leadership Support,*
- *Teacher Beliefs,*
- *Parental Support.*

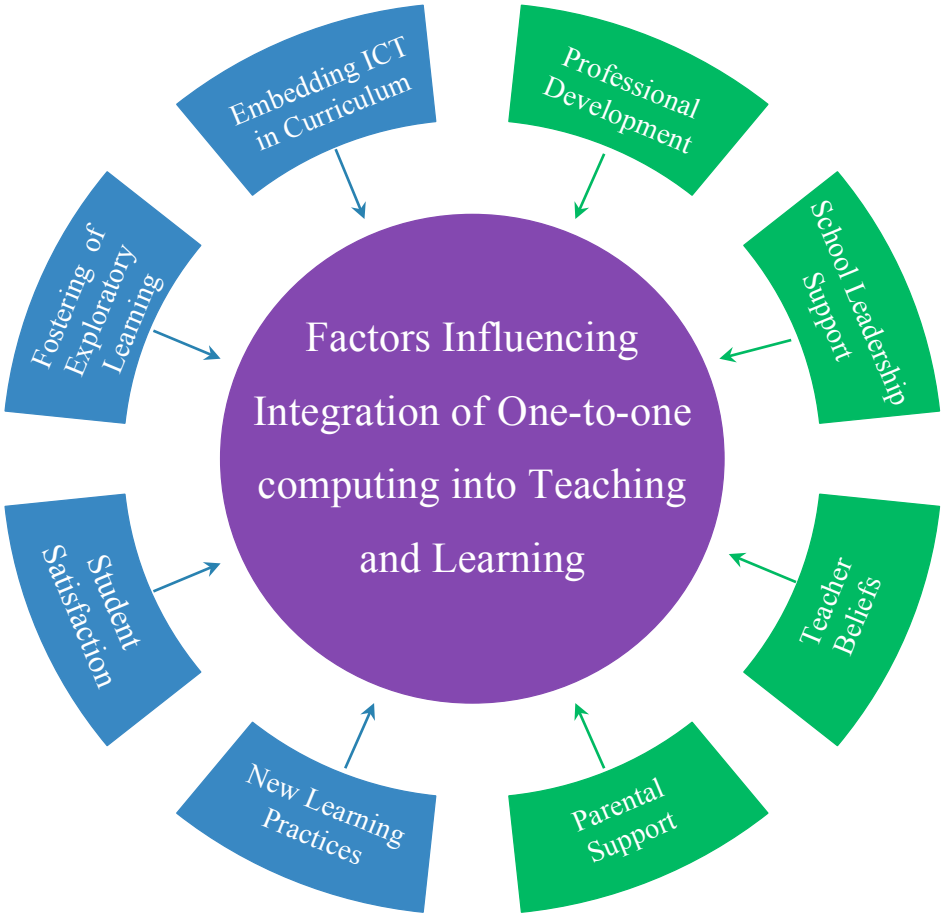



*Figure 5.1 Factors influencing the integration of one-to-one computing into teaching and learning.*

In my view, successful implementation of the programme requires extensive time and commitment on behalf of all the stakeholders involved and only consideration of their needs would lead to effective integration of one-to-one computing. Therefore illuminating factors influencing the integration of ubiquitous computing both into teaching and learning is essential in order to achieve fruitful infusion of technology into education.

### *Embedding ICT in the Curriculum*

Embedding ICT in Curriculum has been identified as another factor influencing the integration of one-to-one computing into teaching and learning. As mentioned above in the section 'ICT as part of the Curriculum Reform', (see section 5.3.2), a new curriculum reform was introduced in Azerbaijan, and the participant teachers were expected to meet newly-introduced standards and conduct classes in the one-to-one setting simultaneously. The enthusiastic teachers who were personally interested in the implementation of the curriculum reform and the one-to-one programme used technology to meet new curriculum standards, while less motivated teachers completely disregarded the programme, since the technology component was not included into the new curriculum reform and was not perceived as a requirement. Although motivated teachers were found to integrate technology into the curriculum, the implementation process was still somewhat sporadic.

As curriculum reforms are more overarching than educational technology programmes, ICT should be embedded in curriculum for teachers to use as a tool to meet the standards. The kind of integration will lead to the success of one-to-one computing or any other prospective educational technological programme that may be introduced in the future. Including ICT into the curriculum reform prior to introducing one-to-one in schools will assist teachers to achieve better technology infusion in their classes.

### *Fostering of Exploratory Learning*

Fostering of exploratory learning was revealed to be one of the major factors positively influencing the integration of one-to-one computing into teaching and learning. The students' natural curiosity merged with their aptitude for innovation and the fascination derived from new devices resulted in high levels of motivation to master the technology; and as a result, students strove to find various applications,

they began to study more actively and took charge of their own learning. Since the students were enthusiastic about the usage of technology in schools and beyond, they were more motivated to dig deeper, search for additional information and enrich the content of their studies. As a result of their aptitude for innovation and curiosity, some of the students mastered the technology well enough to extend a helping hand both to their peers and the teachers. Their interest in technology motivated them to learn more about netbooks and various types of software, which had a spillover effect onto the learning domain as well.

## *Student Satisfaction*

In the teaching-learning process students are expected to be armed with 21st century skills. In order for students to be able to acquire, apply and extend required knowledge and skills they have to be encouraged in, and satisfied with, the learning process. The study found that most of the students were satisfied with the introduction of technology into schools since, as they claimed, it made the learning process more pleasurable. Therefore, the students were motivated to use netbooks for study purposes. Accordingly, student satisfaction with the usage of netbooks was one of the factors that positively influenced the integration of one-to-one computing into teaching and learning. It was revealed that when students were satisfied with their learning process they attempted to be responsible for their own studies, becoming agents of their learning, which was crucial in the gradual transformation from teacher-directed to student-centered classrooms.

## *New Learning Practices*

The programme implementation has brought along the adoption of a set of new learning practices using various tools: be it software or Web 2.0 tools or other applications, which tended to largely influence the teaching and learning processes within the one-to-one setting. The availability of *new learning tools* made it easier and more convenient for students to access information and present the acquired

knowledge in a clear and precise manner. Such tools were also used by the teachers to scaffold one-to-one classes.

The new tools also led to creating new learning practices using netbooks in individual or collaborative forms. While one can argue that individual and collaborative learning existed in regular classes, this research further revealed that those practices were taken to a whole new level with one-to-one, where technology encouraged/simplified/accelerated the process, motivating students. The new learning practices were found to positively affect the integration of one-to-one computing into teaching and learning because with those practices students became more interested and seemed to enjoy their studies.

## *Professional Development*

Professional Development of teachers was identified as another factor positively influencing the integration of technology into teaching and learning, given the fact that especially at the early stages of the programme implementation teachers needed to be exposed, both theoretically and practically, to one-to-one computing and the relevant guidelines on the integration of ICT with pedagogy. Therefore it is important to underline that in technology integration programmes, if teachers are equipped with required technological skills as well as pedagogical expertise on how to integrate ICT with pedagogy, the potential for attaining greater success in the programme implementation increases. Teachers require encouragement to use ICT as a tool to conduct classes effectively. When the provision of professional development of teachers occurs at an initial stage, and is kept as a continuous process, the chances of their mastering these skills are bound to increase. When classroom processes are taking place, there might arise a need of support for teachers and one way to ensure it seems to be for the teachers working at the same school or different schools to be encouraged to organize peer support groups to assist each other and share their experiences. The lack of *professional development* in the researched programme was hindering the integration process and also negatively

affected some teachers' motivation and enthusiasm. *Professional development* was one of the aspects that teachers themselves saw as a motivator to overcome daily obstacles. They also viewed the opportunity for professional development as a way to build up their capacity, which acted as an incentive and had a positive effect on the implementation of the programme.

## *School Leadership*

School Leadership's support and the form of the implementation of the programme at school level proved to be a significant factor influencing the integration. The importance of the bottom-up approach to the implementation of the programme has to be taken into account. Although the programme was administered by the Ministry of Education, it was actually independently implemented at school level by the management and the ministry did not interfere much with the process. The school leadership's understanding and acceptance of such initiatives therefore is a key aspect to consider in the development and implementation of the one-to-one programme. Given this kind of authority over the programme implementation, it is only natural that *school leadership support* has a major influence both in day-to-day management, as well as in crafting general policies. The different approach taken by one of the schools explored in this study, in which the netbook distribution ratio was altered without consulting the administering agency, serves as a proof that decisions made by the *school leadership* were significantly influencing the integration.

## *Teacher Beliefs*

Needless to say, teachers play crucial roles in the implementation process, hence their belief in the programme and its possible positive outcomes can lead to a positive effect. The study illustrated that those teachers who believed in the benefits of the programme were more active and enthusiastic implementers notwithstanding the obstacles that tended to occur along the way; while those who lacked such a belief instead used these obstacles as an excuse to avoid conducting one-to-one

classes. Therefore, it becomes apparent that *teacher beliefs* can have a positive or negative influence on the integration of one-to-one computing into teaching and learning.

### *Parental Support*

This study examined the influence of parents on the programme implementation. It was revealed that in order to have *parental support* it is important to promote their understanding of the programme so that they encourage their children to study with one-to-one. In order to cultivate the *support of parents* it is necessary to familiarize parents with the programme thoroughly and involve them in classroom or school activities. This study found that there was a lack of *parental support* for the programme which could have had some negative effect on certain elements of the programme implementation and to some extent hindered the integration of one-to-one computing into learning.

The factors set out in Figure 5.1 each carry their individual weight in terms of the influence on the overall integration process, but, to a certain degree, they are also interconnected with each other. Therefore, each factor has to be given a proper consideration, preferably in an integrated manner in order to achieve desired outcomes in the process of the integration of one-to-one computing into teaching and learning.

## 5.6 Limitations

There were certain limitations to this study, which may have influenced the outcome of the research to some extent, and therefore those aspects have to be properly discussed and taken into consideration. The fact that I was not able to personally participate in the data collection process, the risks of subjective interpretation of the

gathered data, small sample size, lack of generalizability and scarcity of existing literature in the field of one-to-one computing created particular constraints to the research process.

As I have already discussed extensively in the methodology chapter, due to the fact that I am an employee of the Ministry of Education (see chapter 3, section 3.3) I was unable to participate in the process of data collection in order not to intimidate research participants or in any way influence the answers received during interviews and focus group discussions. Usually government agencies and government representatives in Azerbaijan are viewed as authoritative figures with certain power, which understandably could have had a considerable influence on teachers' performance, forcing them to respond in a way that they thought the interviewer wanted to hear. This perceived authority could possibly also have influenced children to provide positive feedback, believing that the interviewer, being a representative of the implementing agency, would only want to hear good things about the programme. Parents, on the other hand, are the stakeholders who would most probably be the least influenced by the presence of a government representative, because they usually relate to educational authorities with a certain degree of criticism.

Recognizing this limitation at the initial stage of the study, I hired an assistant to replace me in conducting classroom observations, interviews and focus-group discussions, which was aimed at diminishing the possible influence on the respondents' answers. However, such an influence could not have been completely removed, since whoever inquired about the programme, was bound to be perceived as an interested party and the programme stakeholders would have assumed that this person is looking for positive feedback. In other words, the goal of hiring an assistant was not to completely remove this limitation, but to reduce the risk as much as possible. In my opinion this goal was reached, but the provided answers may still have been influenced to a certain extent.

Additionally, my not being able to personally participate in the data collection process, also prevented me from directing the interviews and focus-group discussions to elicit information I considered intriguing, or delving deeper into the issues of my interest. However, the interview questions and focus-group discussion topics were pre-determined by myself, and the research assistant managed to gather valuable data using those questions. On the other hand, since classroom observations were video-recorded, and interviews, focus-group discussions were audio-recorded I had an opportunity to properly analyze all responses.

Similarly, there was a potential for my position to influence the outcomes of the data collection process, since being personally involved in the implementation of one-to-one pilot project in Azerbaijani schools, I might have also viewed only the positive results; and subconsciously ignored the problems raised by the stakeholders. Having employed qualitative research methods to analyze the gathered data, the risks of subjective interpretation were much higher than it would have been in a quantitative study, but by recognizing the presence of such risks at the initial stage of the data analysis, I managed to reduce the potential bias, if not completely remove it.

Another aspect of the study that can be considered a limitation was the small sample size, since in Azerbaijan the one-to-one programme was still in a pilot stage and not so many schools were involved in implementation. A similar, but not identical, programme is being implemented in the neighboring country Georgia. However, due to significant differences in characteristics, as well as difficulties in accessing the Georgian schools, I could not expand the sample size.

The findings and conclusions of this research can be expected to coincide with other schools implementing one-to-one programmes in Azerbaijan, however, it is hard to claim with any degree of confidence that the outcomes of the present study are generalizable outside the studied sample. Another problem with the generalizability is that the funding of the project has not been continued and the one-to-one programme is currently not being implemented in Azerbaijani schools, so even if

there was interest in acquiring additional data in an attempt to make this study more generalizable, this would be impossible due to the closure of the programme.

The scarcity of existing literature on the topic is yet another limitation. The research on one-to-one programmes is practically non-existent in Azerbaijan. Studies in other countries, notwithstanding the scale of the programmes implemented, usually report on the status of implementation rather than the actual progress of the programme integration. There remains a myriad of aspects that are not sufficiently addressed in the literature, which in turn limits the ability of current studies to rely on an existing body of knowledge.

## 5.7 Summary

Based on the findings of this study and considering the work of other scholars who have conducted research in the field of one-to-one programmes, it becomes apparent that learning practices are changing in the classes where technology is integrated. Additionally, teachers are developing new methods of scaffolding classes which have a considerable impact on the overall teaching and learning.

It is important to note that with the implementation of the one-to-one programme and consequently the alteration of teaching and learning practices, students' confidence has grown contributing to the success of the programme. The mere fact that students have formed opinions and ideas about the best ways to improve the implementation points up their confidence and belief in one-to-one computing. As a result of the introduction of the technology, classroom processes have undergone certain changes, the most notable of which is the promotion of individualized and collaborative learning practices, both encouraged in parallel by the usage of netbooks.

As mentioned above, teachers are afforded a possibility to develop new teaching methods and, as this research illustrated, teacher beliefs play an important role in the overall implementation of the programme. However, there are certain shortcomings that need to be addressed in order to improve the programme, most importantly the support that teachers need in tackling the problems that arise on a daily basis.

Parents of the children participating in one-to-one computing programme are important stakeholders with a considerable amount of influence on its implementation. The research has revealed that a group of parents strictly oppose the usage of technology in classrooms and at home, while another group reflects more on the advantages of the innovation. The former group tended to arbitrarily restrict netbook usage at home, discouraging their children to use technology, thus indirectly affecting the implementation.

All the above-mentioned factors exerted a certain amount of impact on the degree of success of the implementation of the programme and should be taken into consideration when developing such initiatives.

# 6 Final remarks

## 6.1 Conclusions

The purpose of this study was to identify factors influencing the integration of a one-to-one programme into teaching and learning in Azerbaijani schools. An innovative programme that involves the application of new technology in classrooms, that otherwise make limited or almost no use of computers, can prove challenging in any environment. There is also a myriad of technical and non-technical factors that either positively or negatively influence the integration process. This study sought to explore such factors by posing the following research question: "What factors influence the integration of one-to-one computing into teaching and learning?"

There were eight major factors identified within this research which had a significant influence on the integration of the one-to-one computing programme into teaching and learning. Taking into consideration the literature reviewed on the subject, it can be asserted that four of the identified factors have appeared strongly within this study, but have made very minor appearances in other relevant studies. While the remaining four factors that have also been identified within this study, are frequently mentioned in the existing body of literature.

This study revealed that the provision of technology fostered exploratory learning in students and the availability of a vast amount of information enabled by anytime and anywhere access to netbooks and the Internet contributed to further increasing their interest in classes. The frequent interaction with the provided computing devices and the practice of solving by themselves any technical issues that arise, helps students become fluent with netbook usage, which in turn leads to better research skills and the accumulation of not only technological, but domain knowledge as well, i.e. acquisition of knowledge and skills that feature in the curriculum. This practice also has a potential to raise the self-efficacy of students and increase their confidence in

themselves as autonomous agents, which can likely lead to a greater level of engagement in school processes. Another factor that increased student interest and engagement with study processes was the new learning practices that emerged with the introduction of technology into classrooms that proved to be more interactive, providing students with better opportunities at potential forms of knowledge.

The study has found that the majority of students were happy with the introduction of technology in schools and this satisfaction easily translated into greater interest in their own learning. The cause of student satisfaction could be attributed to joy derived from the new devices and the connectivity and diversity of activities they offered. Students' satisfaction with the programme helped them to take charge and become agents of their own learning. This shift in their attitude also resulted in making students more demanding in terms of knowledge acquisition, expressed mainly in their efforts and requirement to get more information from the teacher or from provided resources. There also were signs of transforming classrooms from heavily teacher-directed to a more student-centered places.

This study has revealed a variety of issues related to the context of technology usage in the school. In the light of the ongoing curriculum reform in Azerbaijan and the attempts to better integrate ICT into teaching and learning, this research asserts that integrating ICT into the curriculum is of vital significance. Making ICT an integral part of curricula has a potential to ease the integration of technology into teaching and learning, as well as to overcome the obstacles that currently often arise in classrooms. It is possible that some teachers might have negative beliefs towards the practicality of technology usage and correspondingly, this attitude might result in the teachers' avoidance of integrating technology into their practices. Such negative beliefs, mixed with the complexities of using technology in teaching creates a setting in which teachers will most probably avoid the inconvenience rather than face up to the challenge. Therefore, when a government makes a large-scale investment in a one-to-one programme and all students are equipped with computers, actual usage should not hinge on the personal opinions of teachers. Embedding ICT into

curriculum has the potential to both safeguard against decisions made based on subjective perceptions and serve as a guide to facilitate teachers' efforts in integrating technology.

One of the reasons for the lack, or at times complete avoidance, of computer usage by some teachers seems to stem from their inability to fluently handle the new technology. As opposed to the fluency demonstrated by students in handling technology, when faced with an obstacle some teachers choose to revert back to more traditional teaching practices. In other words, it is the lack of technological skills that hinders the process of integration, which can be addressed by ensuring better opportunities for professional development. In this and many other studies in the field, as discussed in the literature review, professional development is identified as one of the major factors influencing the integration of technology into teaching and learning. This study concludes that the professional development of teachers, both in terms of pedagogical and more refined ICT skills, can have a positive influence on the integration of the one-to-one programme in a number of diverse ways. This influence encompasses aspects such as making better use of technology for teaching purposes, effectively resolving technical problems as they arise, becoming better facilitators of learning, and on a personal level possibly achieving greater job satisfaction. This study emphasizes the importance of conducting activities aimed at teachers' professional development, both prior to the commencement of the programme implementation, as well as later on, parallel to the implementation stage. The creation of teacher peer support networks in schools, within which teachers share knowledge and expertise by helping each other with problems that arise could be another less formal and less time-consuming alternative to training sessions aimed at teacher professional development.

It is an established practice to address teachers' professional development through training sessions. However, this often requires teachers to allocate extra time for attending these courses, which may coincide with school hours. Correspondingly, the support and goodwill on behalf of the school leadership to allow teachers to attend

these courses and also to create such opportunities is of paramount importance. This study has illustrated that other than professional development, school leadership has a great influence on the overall process of the one-to-one integration into teaching and learning, which can be attributed to the extensive authority granted to them by the programme implementing institutions on a government level.

The search for factors influencing the one-to-one integration into teaching and learning illustrated that not only school leadership, but also all stakeholders, including teachers, have a capacity to affect the entire programme implementation. Therefore, this study has also concluded that if teachers believe in the benefits of integrating technology into their teaching practices, they are more prone to do so and tend to make more extensive use of the equipment that is provided. Many other scholars have also identified teacher beliefs as an influential factor in terms of technology integration into classroom processes, and the present study reaffirms this claim.

As far as the influence of the stakeholders on the programme is concerned, yet another significant factor appeared to be parental support, as identified by this and several other studies. Parental control over the frequency and duration of students' usage of netbooks at home affects the one-to-one programme implementation. Taking this into consideration, it is important to raise awareness among parents about the advantages that computer usage can bring. Anytime and anywhere access to computers is an integral part of one-to-one computing initiatives and students should be allowed to use computers at home as well, without being dependent on the decisions of their parents. Therefore, cultivating parental support is important for the successful integration of one-to-one computing into teaching and learning.

## 6.2 Implications of the study

This research indicates that equipping schools with technology, ensuring professional development and many other aspects of the one-to-one computing programme require a large amount of funding, and since it may take decades for the investment in education to yield positive outcomes, it becomes hard to secure government support for these kinds of programmes. It is especially the case in developing countries such as Azerbaijan, where due to the limited funding the one-to-one computing pilot programme was initiated in 15 schools but was not expanded further.

The study has implications in terms of the lack of incentives for teachers to take on extra workload and continue integrating technology into their teaching practices, which can also be attributed to the limited funding allocated to the programme. This results in an inability on behalf of programme implementers to offer teachers incentives, based on their professional development achievements and performance, for the purposes of bolstering the enthusiasm needed to ensure persistent usage of technology within classrooms.

Those teachers who find fulfillment and derive job satisfaction from the introduced innovation in teaching do make use of technology without being offered additional incentives. However, this study indicates that such teachers face other kind of complications. More specifically, the majority of teachers, especially the ones working in the regions, do not have the necessary tools and access to appropriate equipment, and in rare cases when they have such tools, the content is still not enough to be fully used for teaching purposes. Therefore the importance of professional development increases even more in this context. Additionally, in the case of some teachers, the methods of scaffolding classes have not been altered for years, and in certain instances decades, so for these teachers it proves challenging to

transition to new modes of teaching by making extensive use of the technology provided.

Parents of the students studying in one-to-one classes during the pilot programme demonstrated ambivalent attitudes towards the project, and they were even opposed to their children using technology "excessively", which they seemed to define as using computers for more than half of the class time. This kind of lack of community support for the programme diminishes the chances of its successful implementation.

Since this study has identified specific factors influencing the integration of one-to-one computing into teaching and learning, the implication is that these findings might be useful for correcting the mistakes that have been made previously. If the programme implementation continues, these factors can serve as points of reference for achieving a better quality of implementation.

## 6.3 Further research areas

This study suggests several areas for further research. Firstly, a mixed methods research study may be conducted which would utilize both quantitative and qualitative approaches to assess the progress made over a certain period of time in one-to-one and ordinary classes. Such a study has a potential to measure the programme success assessing students' achievement results and the viewpoints of both teachers and parents. In the case of the continuation of the one-to-one programme in Azerbaijan, this kind of study could compare test scores of one-to-one computing programme students to those of students in ordinary classes thus providing quantitative data about whether students utilizing technology for their studies outperform others or not. I decided not to gather data on test results during this research, since not all classes were being conducted in the one-to-one setting, and the frequency and quality of computer usage had not been assessed.

Correspondingly, as a next step, students' test results before and after the programme implementation could be compared or a systematic approach can be adopted to evaluate the programme based on student achievement. Such an exercise in comparison could prove useful for providing hard evidence regarding the benefits and the degree of success of the one-to-one programme implementation, which in turn, if positive, could convince both parents and policy-makers of the programme's value.

When analyzing the findings of this study, there emerged signs of technology affecting the literacy practices of students. A study could be conducted that would explore this aspect, namely as to how the introduction of the netbooks impacts the literacy practices that were required and developed within the classrooms.

The present research has also determined that integrating ICT into the school curriculum, a part of the ongoing education reform in Azerbaijan, is of paramount importance. Thus, in order to explore and better understand the best ways of achieving such integration this issue has to be probed more deeply. The factors identified in this research indicate that teachers may face a number of problems when trying to make ICT part of their teaching practices, therefore, there is a need to implement a study that would concentrate on the ways of making the process of ICT integration into the curriculum more effective, exploring possible solutions to frequently arising problems.

As identified within this research, students are becoming more demanding in their studies, while teachers often face the problem of limited educational e-resources and have to dedicate personal time to creating, finding, and becoming familiar with materials for teaching purposes. Hence, there arises a need for exploring the types of content that teachers and students prefer to use. By studying the existing materials that teachers create and the types of resources students find the most interesting, it would become possible to make such content more readily available within the one-

to-one setting, which could in turn contribute to the successful implementation of the programme.

This study also indicates that school administrations currently have the authority to make adjustments to the core principles of the one-to-one programmes being implemented in their schools. There is a need to explore the existing regulatory framework that allows or limits the authority of school administrations towards the one-to-one programme-related decisions. Additionally, the options of better streamlining the regulations should be studied by analyzing case studies conducted in other countries. Since completely limiting the decision-making power of school administrations could possibly hinder the smooth and effective implementation of the programme, it should be researched as to where the line has to be drawn: what are the core components of the one-to-one programme that are to remain unaltered and what sort of day-to-day operational decisions should be left to school administrations. Such a research has a potential to yield very useful policy recommendations in terms of the one-to-one computing programme implementation.

Parents were anticipated to be the stakeholders with the least influence on the programme since they had minimum visible and direct contact with the actual implementation process. However, as this study determined, parents, in some respects, play a considerable role in the overall process. The positive or negative attitudes of parents can be a decisive factor in determining whether they allow their children to use computers for educational purposes or not. Therefore, it is necessary to study a larger sample of parents to measure the influence they can exert on the implementation and the possible ways of raising awareness in the communities regarding computer usage in order to avoid the wide-spread misconceptions concerning the destructive influence of computers.

## 6.4 Policy recommendations

Drawing on the findings of this research and the conclusions drawn from these findings, it is advisable for the one-to-one programme implementing authorities to pay close attention to the issues related to curriculum. The successful integration of one-to-one computing into teaching and learning requires the introduction of proper changes in curricula, which would result in encouraging teachers to allocate more time to technology usage during classes as well as removing the current practice of having teachers decide when and how to use technology based on their personal beliefs towards and interest in the programme.

When considering the massive deployment of the one-to-one programme across the schools of the country, it is inadvisable to impose the programme onto schools that are not ready to integrate technology into teaching and learning. In order to assess the preparedness of any given school being considered for one-to-one programme adoption, a set of criteria should be developed, which would include the major aspects affecting programme integration as described in this study, such as the level of professional development of teachers, their readiness to use and integrate technology into teaching practices, the possibility of peer support within a particular school, as well as the support and management capabilities of school administration. By using these criteria, the chance of selecting the right schools increases and therefore the possibilities of successful integration of one-to-one computing into teaching and learning also grow.

The preparation phase of the programme is certainly crucial and the correct deployment can play a very significant role in the programme success later on. Additionally, monitoring the progress of the one-to-one programme integration is also very important. As the findings of this research illustrated, the administration of the Regional School altered the ratio of computer distribution in classes, removing the programme's core element – one computer per one student. In order to safeguard

against such instances of changing the essence of the entire programme, specialized monitoring groups should be established within the MoE or local education departments, which would be comprised of experts in the education field with comprehensive knowledge of one-to-one programme requirements. The monitoring groups should be used to evaluate the quality of programme implementation on a monthly or quarterly basis, using specially developed assessment tools and should report findings back to the agency responsible for implementing the programme. The accumulated data can then be analyzed and used to apply necessary changes to the programme implementation processes.

While in the case of countrywide deployment, such monitoring groups could prove useful, there is however certainly a need to engage parents and a community at large in the processes of utilizing technology within classes as well as at home. It is necessary to raise awareness among parents regarding the benefits of using technology for learning and on the other hand, the community of parents should be offered a platform for expressing their views regarding the programme. By involving parents in school activities, they might share the responsibility of making better use of the technology that is provided and encourage their students to use it more productively at home for studies.

It is also worth mentioning here that communities of parents directly involved in the one-to-one computing programme integration should be consulted both prior to and during the programme implementation. To reiterate, an innovative programme such as one-to-one has much better chances of success if all concerned stakeholders see eye-to-eye about it and perceive it as a common cause that affects everybody.

On the other hand, extensive work should be conducted in order to raise awareness of the benefits of the one-to-one computing programme within communities of parents, because as this research has illustrated, proper technology usage can lead to domain learning, proving the effectiveness and practicality of this innovation. If the

benefits of the programme are well-understood by all stakeholders, there would be less incentive for them to oppose it, and more interest in supporting it.

## 6.5 The last word

This study adds to the emerging body of knowledge on one-to-one programmes by identifying specific factors that influence the integration process. The most important conclusions reached within this research are the following: integrating ICT into curriculum is of vital importance, as this has the potential to ensure the effectiveness of utilizing technology within classrooms; with the introduction of technology, students are becoming more demanding in terms of knowledge acquisition, i.e. students are showing more initiative in their learning which translates into a greater interest towards technological learning, leading in turn to domain learning.

The findings of this research can be used by one-to-one programme implementing authorities to take precautionary measures when expanding it in Azerbaijani schools; and in general the factors identified in this study can serve as reference points for assessing the quality of technology integration into teaching and learning.

# 7 References

ABELL FOUNDATION. (2008). One-to-One Computing in Public Schools: Lessons from "Laptops for All" Programs. Retrieved 03 12, 2016, from http://www.abell.org/sites/default/files/publications/ed_onetoone_908.pdf

ADELMAN, N., DONNELLY, M. B., DOVE, T., TIFFANY-MORALES, J., WAYNE, A., & ZUCKER, A. A. (2002). *The integrated studies of educational technology: Professional development and teachers' use of technology*, Menlo Park, CA: SRI International.

AKKER, J., KEURSTEN, P., & PLOMP, T. (1992). The integration of computer use in education. *International Journal of Educational Research*, 17, (1), 65-76.

ALDERSON, P., & MORROW, V. (2004). *Ethics, Social Research and Consulting with Children and Young People.* Ilford: Barnardo's.

ANDERSON, R. E., & DEXTER, S. L. (2000). *School Technology Leadership: Incidence and Impact. Teaching, Learning, and Computing: 1998 National Survey*, Report #6. Minneapolis: Center for Research on Information Technology and Organizations.

AZERBAIJANS.COM. (N.D.). *The education reforms in Azerbaijan*. Retrieved from: http://www.azerbaijans.com/content_1729_en.html

BALANSKAT, A. (2013). *Introducing Tablets in Schools: The Acer-European Schoolnet Tablet Pilot*. Brussels: European Schoolnet (EUN Partnership AISBL).

BARRIOS, T., AMBLER, J., ANDERSON, A., BARTON, P., BURNETTE, S., FEYTEN, C., YAHN, C. (2004). *Laptops for Learning*. Final Report and Recommendations of the Laptops for Learning Task Force. Available from http://etc.usf.edu/l4l/report.pdf.

BASCH, C. (1987). Focus group interview: an underutilized research technique for improving theory and practice in health education. *Health Education Quarterly*, 14, (4), 411-448.

BAYRAMOV, F., IBRAHIMOVA, N., & BABAZADEH, I. (2014). Azerbaijan's accession to the WTO - Assessing the macroeconomic consequences for the economy of Azerbaijan. *Policy Paper*. Baku: Konrad-Adenauer-Stiftung - Regional Program South Caucasus.

BEBELL, D. (2005). *Technology Promoting Student Excellence: An Investigation of the First Year of 1:1 Computing in New Hampshire Middle Schools*. Technology and Assessment Study Collaborative. Chestnut Hill, MA: Boston College.

BEBELL, D., & KAY, R. (2010). One to One Computing: A Summary of the Quantitative Results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment*, 9, (2), 1-60.

BEBELL, D., & O'DWYER, L. M. (2010). Educational Outcomes and Research from 1:1 Computing Settings. *Journal of Technology, Learning, and Assessment*, 9, (1), 1-16.

BECKER, H. J., & ANDERSON, R. E. (1998). Validating Self-Report Measures of the 'Constructivism' of Teachers' Beliefs and Practices. *Paper presented at the 1998 meeting of the American Educational Research Association*. San Diego, CA.

BEELAND, JR., W. D. (2002). Student Engagement, Visual Learning, and Technology: Can Interactive Whiteboards Help? *Annual Conference of the Association of Information Technology for Teaching Education.* Trinity College, Dublin.

BENNETT, L. (2014). Putting in more: emotional work in adopting online tools in teaching and learning practices. *Teaching in Higher Education*, 19, (8), 919-930.

BERG, B. L. (2001). *Qualitative Research Methods for the Social Sciences*, 4th ed. Boston: Allyn & Bacon.

BETCHER, C., & LEE, M. (2009). *The Interactive Whiteboard Revolution - Teaching with IWBs*. Victoria: ACER Press.

BIELEFELDT, T. (2006). Teaching, Learning, and One-to-One Computing. *National Educational Computing Conference.* San Diego, CA: International Society for Technology in Education.

BINGIMLAS, K. A. (2009). Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of Literature. *Eurasia Journal of Mathematics, Science and Technology Education*, 5, (3), 235-245.

BLOOR, M., FRANKLAND, J., THOMAS, M., & ROBSON, K. (2001). *Focus Groups in Social Research*. London: SAGE Publications Ltd.

BONIFAZ, A., & ZUCKER, A. A. (2004). *Lessons Learned About Providing Laptops for All Students*. Education Development Center, Inc. Newton, MA.

BRANSFORD, J. D., BROWN, A. L., & COCKING, R. R. (2000). *How People Learn: Brain, Mind, Experience and School*. Washington, D.C.: National Academy Press.

BRUMMELHUIS, A. C. (1995). *Models of Educational Change: The Introduction of Computers in Dutch Secondary Educatio*n [A thesis]. Enschede: University of Twente.

CABINET OF MINISTERS OF THE AZERBAIJAN REPUBLIC. (2006, OCTOBER 30). General Education Concept (National Curriculum) In Azerbaijan Republic. Republic of Azerbaijan. Retrieved April 8, 2016, from http://portal.edu.az/index.php?r=article/item&id=194&mid=5&lang=en

CAVANAGH, S. (1997). Content Analysis: Concepts, Methods and Applications. *Nurse Researcher*, 4, 5-16.

CENTER FOR DIGITAL EDUCATION. (2008). *K-12 2.0 - A Complete Guide to One-to-One Computing in the K-12 Environmen*t. Folsom: e.Republic, Inc.

CHARMAZ, K. (2000). Constructivist and Objectivist Grounded Theory. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE Handbook of Qualitative Research* (2nd ed., pp. 509-535). Thousand Oaks, CA: SAGE Publications.

CHARMAZ, K. (2005). Grounded Theory in the 21st Century: Applications for Advancing Social Justice Studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE Handbook of Qualitative Research*, (3rd ed., pp. 507-535). Thousand Oaks, CA: SAGE Publications.

CHARMAZ, K. (2006). *Constructing Grounded Theory A Practical Guide Through Qualitative Analysis*. London: SAGE Publications.

CLARIANA, R. (2009). Ubiquitous wireless laptops in upper elementary mathematics. *Journal of Computers in Mathematics and Science Teaching*, 28, (1), 5-21.

COCKS, I. (2006). The ethical maze: Finding an inclusive path towards gaining children's agreement to research participation. *Childhood,* 13, 247-266.

CONFERENCE "REFORM OF THE EDUCATION SYSTEM IN AZERBAIJAN FOR A SUSTAINABLE FUTURE". (2005). Record of the visit of the Azerbaijan Delegation to UNESCO 5-7 July, 2005. Paris: Division of Educational Policies and Strategies - UNESCO.

CRESWELL, J. W. (2003). *Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed. Lincoln: SAGE Publications.

CRESWELL, J. W. (2007). *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. (2nd edn.). Thousand Oaks, CA: SAGE Publications.

CRESWELL, J. W. (2012). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

CROOK, C. (1994). *Computers and the Collaborative Experience of Learning*. New York: Routledge.

CUBAN, L. (1986). *Teachers and Machines: Classroom Use of Technology since 1920*. New York and London: Columbia University Press.

CUBAN, L. (2001). *Oversold and Underused: Computers in the Classroom*. Cambridge, MA and London: Harvard University Press.

DAITZMAN, P. (2003). *Evaluation of the national model laptop program—technology literacy, a dimension of information literacy: A journey into the global learning community, November 2002- June 2003.* New Haven, CT: East Rock Global Magnet School.

DAVIS, N., PRESTON, C., & SAHIN, I. (2009). ICT teacher training: Evidence for multilevel evaluation from a national initiative. *British Journal of Educational Technology*, 40, (1), 135-148. doi:10.1111/j.1467-8535.2007.00808.x

DAWSON, K., CAVANAUGH, C., & RITZHAUPT, A. D. (2006). Florida's EETT Leveraging Laptops Initiative and Its Impact on Teaching Practices. *Journal of Research on Technology in Education*, 41, (2), 143-159.

DENNING, T. (1995). *IT and student motivation - a collaborative study of staff and student attitudes and experiences*. Keele: Keele University.

DENZIN, N. K. (1970). *The Research Act: A Theoretical Introduction to Sociological Methods*. New York: McGraw-Hill Book Company.

DENZIN, N. K., & LINCOLN, Y. (EDS.) (2005). *The SAGE handbook of Qualitative Research* (3rd edn.). London: SAGE.

DIENER, E., & CRANDALL, R. (1978). *Ethics in Social and Behavioral Research*. Chicago: University of Chicago Press.

DONOVAN, L., GREEN, T., & HARTLEY, K. (2010). An examination of one-to-one computing in the middle school: Does increased access bring about increased student engagement? *Journal of Educational Computing Research*, 42, (4), 423-441.

DONOVAN, L., HARTLEY, K., & STRUDLER, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education*, 39, (3), 263-286.

DRAYTON, B., FALK, J. K., STROUD, R., HOBBS, K., & HAMMERMAN, J. (2010). After Installation: Ubiquitous Computing and High School Science in Three

Experienced, High-Technology Schools. *Journal of Technology, Learning and Assessment*, 9, (3), 1-57.

DUNCOMBE, J., & MARSDEN, D. (1996). Can we research the private sphere? Methodological and ethical problems in the study of the role of intimate emotion in personal relationships. In S. E. Lyon, & L. Morris (eds), *Gender Relations in Public and Private: New Research Perspectives.* London: Palgrave Macmillan.

DUNLEAVY, M., DEXTERT, S., & HEINECKET, W. F. (2007). What added value does 1:1 student to laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning*, 23, 440-452.

EARLE, R. S. (2002). The Integration of Instructional Technology into Public Education: Promises and Challenges. *ET Magazine*, 42, (1), 5-13.

EDUCATION LAW OF THE REPUBLIC OF AZERBAIJAN. (N.D.). http://edu.gov.az/en/page/451/5244

EDUTOPIA TEAM. (2008). Why Integrate Technology into the Curriculum?: The Reasons Are Many. Retrieved from George Lucas Educational Foundation: http://www.edutopia.org/technology-integration-introduction

EIDELMAN, S., CRANDALL, C. S., & PATTERSHALL, J. (2009). The Existence Bias. *Journal of Personality and Social Psychology*, 97, (5), 765-775.

EISNER, E., & PESHKIN, A. (1990). *Qualitative Inquiry in Education: The Continuing Debate*. New York: Teachers College Press.

ELLSWORTH, J. B. (2000). *Surviving Change: A Survey of Educational Change Models*. Syracuse: Clearinghouse on Information & Technology.

ERSHOV, P. A. (1985). Что такое информатика? Урок для учителя [What is Informatics? A lesson for a teacher]. *Учительская газета [The Teachers' Newspaper]*.

ERTMER, P. A. (2005). Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration*? ETR&D*, 59, (4), 25-39.

FAIRMAN, J. (2004). *Trading Roles: Teachers and Students Learn with Technology*. Maine Education Policy Research Institute. Orono, ME: The University of Maine Office.

FERDIG, R. E. (2006). Assessing technologies for teaching and learning: understanding the importance of technological pedagogical content knowledge. *British Journal of Educational Technology,* 37, (6), 749-760.

FIES, C., & MARSHALL, J. (2006). Classroom Response Systems: A Review of the Literature. *Journal of Science Education and Technology*, 15, (1), 101-109.

FLEISCHER, H. (2012). What is our current understanding of one-to-one computer projects: A systematic narrative research review. *Educational Research Review*, 7, (2), 107–122.

FRANKLIN, C. (2007). Factors that influence elementary teachers use of computers. *Journal of Technology and Teacher Education*, 15, (2), 267-293.

FULLAN, M. G. (1993). Why teachers must become change agents. *Educational Leadership*, 50, (6), 12-17.

FULLAN, M. G. (2001). *Leading in a culture of change*. San Francisco: Jossey-Bass.

FULLAN, M. G. (2007). *The new meaning of educational change*. New York: Teachers College Press.

GARET, M., PORTER, A., DESIMONE, L., BIRMAN, B., & YOON, K. (2001). What Makes Professional Development Effective? Results From a National Sample of Teachers. *American Educational Research Journal*, 38, (4), 915-945.

GASS, S. M., & MACKEY, A. (2000). *Stimulated Recall Methodology in Second Language Research*. Mahwah: Lawrence Erlbaum Associates, Inc.

GARTHWAIT, A., & WELLER, H. G. (2005). A Year in the Life: Two Seventh Grade Teachers Implement One-to-One Computing. *Journal of Research on Technology in Education*, 37, (4), 361-377.

GILGUN, J. (2011). *Reflexivity and Qualitative Research* [Kindle version]. Available from: https://www.amazon.com/Reflexivity-Qualitative-Research-Current-Issues-ebook/dp/B004LLIF10

GLASER, B., & STRAUSS, A. L. (1967). *The Discovery of Grounded Theory*. Chicago: Aldine.

GOMM, R., HAMMERSLEY, M., & FOSTER, P. (2000). *Case Study Method - Key Issues, Key Texts*. London, Thousand Oaks and New Delhi: SAGE Publications Ltd.

GOVERNMENT OF AZERBAIJAN. (2012). Azerbaijan 2020: Look into the Future – Concept of Development. Ratified by a presidential decree on 29.12.2012. Available from http://www.president.az/files/future_en.pdf

GRANT, M. M., ROSS, S. M., WANG, W., & POTTER, A. (2005). Computers on wheels: an alternative to 'each one has one'. *British Journal of Educational Technology*, 36, (6), 1017-1034.

GRAY, J. (2010). Probing the Limits of Systemic Reform: The English Case. In A. Hargreaves, A. Lieberman, M. Fullan, & D. Hopkins (Eds.), *Second International Handbook of Educational Change*, (pp. 293-307). New York: Springer.

GREAT MAINE SCHOOLS PROJECT. (2004). *One-to-One Laptops in a High School Environment - Piscataquis Community High School Study*. Portland: Mitchell Institute and Bill & Melinda Gates Foundation.

GRIMES, D., & WARSCHAUER, M. (2008). Learning with Laptops: A Multi-Method Case Study. *Educational Computing Research*, 38, (3), 305-332.

GRUNBERG, J., & SUMMERS, M. (1992). Computer Innovation in Schools: a review of selected research literature. *Journal of Information Technology for Teacher Education*, 1, (2), 255-276.

HAMMERSLEY, M. (1992). *What's Wrong with Ethnography*. London and New York: Routledge.

HAMMERSLEY, M., & ATKINSON, P. (2007). *Ethnography: Principles in Practice*. New York: Taylor & Francis.

HARGREAVES, A., EARL, L., & RYAN, J. (2003). *Schooling for Change: Reinventing Education for Early Adolescents*. London /Washington, D.C: The Falmer Press (Taylor & Francis e-Library).

HARGREAVES, A., EARL, L., MOORE, S., & MANNING, S. (2001). *Learning to Change: Teaching Beyond Subjects and Standards*. San Francisco: Jossey-Bass Inc., A Wiley Company.

HEW, K. F., & BRUSH, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development,* 55, (3), 223-252.

HILL, J. R., REEVES, T. C., & HEIDEMEIER, H. (2000). *Ubiquitous Computing for Teaching, Learning, and Communicating: Trends, Issues & Recommendations*. Athens: Department of Instructional Technology College of Education The University of Georgia.

HOLCOMB, L. B. (2009). Results & Lessons Learned from1:1 Laptop Initiatives: A Collective Review. *TechTrends*, 53, (6), 49-55.

HOLMES, P. (2008). On Your Bikes! *Teacher: The National Education Magazine*, Aug 2008, 60-61. Available from: http://search.informit.com.au/documentSummary;dn=348691145148986; res=IELAPA

HUTCHINSON, S. A. (2005). Education and Grounded Theory. In R. Sherman & R. Webb (Eds.), *Qualitative Research in Education: Focus and Methods, (pp. 122-139)* London and New York: RoutledgeFalmer.

INAN, F. A., & LOWTHER, D. L. (2010). Laptops in the K-12 classrooms: Exploring factors impacting instructional use. *Computers & Education*, 1-8. doi:10.1016/j.compedu.2010.04.004

INTEL WORLD AHEAD PROGRAM: EDUCATION. (2012). Integrating technology to improve teaching and learning. http://www.intel.com/content/www/us/en/world-ahead/intel-world-ahead-program-education.html

JAMES, C. (2010). The Psychodynamics of Educational Change. In A. Hargreaves, A. Lieberman, M. Fullan, & D. Hopkins (Eds.), *Second International Handbook of Educational Change*, (pp. 47-64). New York: Springer.

JANDRIC, P., & CUBAN, L. (2015). The dubious promise of educational technologies: Historical patterns and future challenges. *E-Learning and Digital Media*, 12, (3-4), 425-439.

KARIMOVA, Y., KAZIMZADE, E., & SILOVA, I. (2014). Azerbaijan: The role of teachers in curriculum reform. In N. Ivanenko (Ed.), *Education in Eastern Europe and Eurasia*, (pp.4-6). London, New Delhi, New York and Sydney: Bloomsbury.

KIM, H.-Y., & MARSHALL, W. (2009). The Effect of a Technology Leadership Workshop on Principals' Five Dimensions of Technology Leadership. In G. Siemens, & C. Fulford (Eds.), *EdMedia: World Conference on Educational Media and Technology*, (pp. 2415-2420). Honolulu: Association for the Advancement of Computing in Education (AACE).

KITZINGER, J. (1994). The methodology of focus groups: The importance of interaction between research participants. *Sociology of Health and Illness*, 18, 103-121.

KLIEGER, A., BEN-HUR, Y., & BAR-YOSSEF, N. (2010). Integrating Laptop Computers into Classroom: Attitudes, Needs, and Professional Development of Science Teachers—A Case Study. *Journal of Science Education and Technology*, 19, (2), 187-198.

KRAFT, P. N. (1999). *Educator's Guide to Collecting and Using Data: Evaluating Literacy Programs Using Self-study*. RMC Research Corporation.

KRUEGER, R. A. (1994). *Focus groups: A practical guide for applied research* (2nd edn.). Thousand Oaks, CA: SAGE.

KRUEGER, R. A., & CASEY, M. (2000). *Focus groups. A practical guide for applied research* (3rd edn.). Thousand Oaks, CA: SAGE Publications.

KVALE, S. (1996). *InterViews: An Introduction to Qualitative Research Interviewing*. Thousand Oaks, CA: SAGE.

LANE, D. M. M. (2003). *The Maine Learning Technology initiative impact on students and learning.* Portland: Center for Education Policy, applied research, and evaluation, University of Southern Maine.

LANGRIDGE, D. (2007). *Phenomenological psychology: theory, research and method*. London: Pearson Education Ltd.

LARKIN, K. (2011). You use! I use! We use! Questioning the orthodoxy of one-to-one computing in primary schools. *Journal of Research on Technology in Education,* 44, (2), 101-120.

LEI, J. (2010). Conditions for ubiquitous computing: What can be learned from a longitudinal study. *Computers in the Schools: Interdisciplinary Journal of Practice, Theory, and Applied Research*, 27, (1), 35-53.

LEI, J., & ZHAO, Y. (2008). One-to-one Computing: What Does it Bring to Schools? *Educational Computing Research*, 39, (2), 97-122.

LI, S. C. (2010). Social capital, empowerment and educational change: a scenario of permeation of one-to-one technology in school. *Journal of Computer Assisted Learning*, 1-12. doi: 10.1111/j.1365-2729.2010.00350.x

LIAMPUTTONG, P. (2011). *Focus Group Methodology: Principle and Practice*. Thousand Oaks, CA: SAGE.

LICHTMAN, M. (2006). *Qualitative Research in Education: A user's guide*. Thousand Oaks, CA: SAGE Publications.

LIGHT, D., MCDERMOTT, M., & HONEY, M. (2002). *Project Hiller: The impact of ubiquitous portable technology on an urban school.* New York: Center for Children and Technology, Education Development Center.

LIN, C.-D., LIN, M.-J., & HUANG, Y.-F. (2009). The Influence of Leadership Styles to the in-Service Teachers' Integrating IT into Teaching and Learning. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen, & D. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2009*, (pp. 2409-2418). Chesapeake: Association for the Advancement of Computing in Education (AACE).

LIVINGSTON, P. (2009). *1-to-1 learning: laptop programs that work* (2nd ed.). Washington DC: International Society for Technology in Education (ISTE).

LOMMEL, J. M. (1992). The coming of computer age in soviet general education, 1985-90. In J. Dunstan (Ed.), *Soviet Education under Perestroika*, (pp. 30-57). London and New York: Routledge.

LOWTHER, D. L., INAN, F. A., STRAHL, D. J., & ROSS, S. M. (2008). Does technology integration "work" when key barriers are removed? *Educational Media International*, 45, (3), 195–213.

LOWTHER, D. L., ROSS, S. M., & MORRISON, G. M. (2003). When Each One Has One: The Influences on Teaching Strategies and Student Achievement of Using Laptops in the Classroom. *ETR&D*, 51, (3), 23-44.

LOWTHER, D. L., INAN, F. A., ROSS, S. M., & STRAHL, D. J. (2012). Do one-to-one initiatives bridge the way to 21st century knowledge and skills? *Journal of Educational Computing Research*, 46, (1), 1-30.

LYLE, J. (2003). Stimulated Recall: A Report on its Use in Naturalistic research. *British Educational Research Journal*, 29, (6), 861-878.

MAINE.GOV. (2013). Retrieved from About Maine Learning Technology Initiative (MLTI): http://maine.gov/mlti/about/index.shtml

MALTERUD, K. (2001). Qualitative Research: Standards, challenges and guidelines. *The Lancet*, 358, 438-488.

MANINGER, M. R., & HOLDEN, M. (2009). Put the textbooks away: Preparation and support for a middle school one-to-one laptop initiative. *American Secondary Education*, 38, (1), 5-33.

MARDANOV, M. (2009). Information Technologies in education is the most effective tool. *Elektron Tehsil [e-education]*, 1, 6-8.

MARDIS, M. A., HOFFMAN, E. S., & MARSHALL, T. E. (2008). A new framework for understanding educational digital library use: re-examining digital divides in U.S. schools. *International Journal on Digital Libraries*, 9, (1), 19-27.

MAXWELL, C., & BOYLE, M. (1995). Risky heterosexual practices amongst women over 30; gender, power and long-term relationships. *AIDS Care*, 7, (3), 277-293.

MAXWELL, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review*, 62, 279-300.

MAXWELL, J. A. (2005). *Qualitative Research Design: An Interactive Approach*. Thousand Oaks, London and New Delhi: SAGE Publications.

MCCARNEY, J. (2004). Effective models of staff development in ICT. *European Journal of Teacher Education*, 27, (1), 61-72.

MCGRAIL, E. (2005). Teachers, technology, and change: English teachers' perspectives. *Journal of Technology and Teacher Education*, 13, 5-24.

MIDGLEY, W., DAVIES, A., OLIVER, M. E., & DANAHER, P. A. (EDS.). (2014). *Echoes - Ethics and Issues of Voice in Education Research*. Rotterdam: Sense Publishers.

MINISTRY OF EDUCATION. (2009). State Program on Informatization of Educational System in the Republic of Azerbaijan in 2008-2012. Retreived from http://portal.edu.az/index.php?r=article/item&id=222&lang=en

MINISTRY OF EDUCATION. (2013). The State Strategy on the Development of Education in the Republic of Azerbaijan, 2013. Retrieved April 12, 2016, from Azərbaycan Prezidenti: http://www.president.az/articles/9779

MOLINA, A., SUSSEX, W., & PENUEL, W. R. (2005). *Training Wheels evaluation report*. Menlo Park, CA: SRI International.

MOUZA, C. (2008). Learning with Laptops: Implementation and Outcomes in an Urban, Under-Priveleged School. *Journal of Research on Technology in Education*, 40, (4), 447-472.

MOYLE, K. (2006). *Leadership and Learning with ICT Voices from the profession*. Canberra: Teaching Australia - Australian Institute for Teaching and School Leadership.

MURPHY, D. M., KING, F. B., & BROWN, S. W. (2007). Laptop Initiative Impact: Assessed Using Student, Parent and Teacher Data. *Computers in the Schools*, 24, (1-2), 57-73.

NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL. (2007). *National Statement on Ethical Conduct in Human Research*. Canberra: Australian Government. Retrieved from https://www.nhmrc.gov.au

NIX, L., PASTEUR, A., & SERVANCE, M. A. (1988). A focus group study of sexually active black male teenagers. *Adolescence,* 23, (91), 741-751.

OLIVER, K. M., MOLLETTE, M., & CORN, J. (2012). Administrative Perspectives on the Implementation of One-to-One Computing. *Journal of Information Technology and Application in Education*, 1, (4), 125-142.

OLIVER, K. M., & CORN, O. J. (2008). Student-reported differences in technology use and skills after the implementation of one-to-one computing. *Educational Media International*, 45, (3), 215-229.

ORB, A., EISENHAUER, L., & WYNADEN, D. (2000). Ethics in Qualitative Research. *Journal of Nursing Scholarship*, 33, 93-96.

PAPERT, S. (1980). *Mindstorms - Children, Computers and Powerful Ideas*. New York: Basic Books, Inc.

PATTON, M. Q. (1990). *Qualitative Evaluation and Research Methods*. Beverly Hills, CA: SAGE Publications.

PAYNE, G., & WILLIAMS, M. (2005). Generalization in Qualitative Research. *Sociology*, 39, (2), 295-314.

PEA, R. D. (1997). Learning and Teaching with Educational Technologies. In H. J. Walberg, & G. D. Haertel (Eds.), *Educational psychology: Effective practices and policies*, (pp. 274-296). Berkeley, CA: McCutchan Publishers.

PEDERSEN, S., & LIU, M. (2003). Teachers' Beliefs about Issues in the Implementation of a Student-Centered Learning Environment. *ETR&D*, 51, (2), 57-76.

PENUEL, W. R. (2006). Implementation and Effects of One-to-One Computing Initiatives: A Research Synthesis. *Journal of Research on Technology in Education*, 38, (3), 329-348.

PENUEL, W. R., FISHMAN, B. J., YAMAGUCHI, R., & GALLAGHER, L. P. (2007). What Makes Professional Development Effective? Strategies That Foster Curriculum Implementation. *American Educational Research Journal*, 44, (4), 921-958.

POWELL, E. (2005). Conceptualizing and Facilitating Active Learning: Teachers' Video-stimulated Reflective Dialogues. *Reflective Practice*, 6, 407-418.

RABAH, J. (2015). Benefits and Challenges of Information and Communication Technologies (ICT) in Quebec English Schools. *The Turkish Online Journal of Educational Technology*, 14, (2), 24-31.

RAULSTON, C. G. (2009). *Analyses of Teachers' Perceptions and Attitudes of a Teacher Laptop Initiative - A Dissertation*. Tuscaloosa, AL: The University of Alabama.

REYNOLDS, D., TREHARNE, D., & TRIPP, H. (2003). ICT—the hopes and the reality. *British Journal of Educational Technology*, 34, (2), 151–167.

RICHARDSON, J. W. (2011). Challenges of Adopting the Use of Technology in Less Developed Countries: The Case of Cambodia. *Comparative Education Review*, 55, (1), 8-29.

RICHARDSON, J. W., MCLEOD, S., FLORA, K., SAUERS, N. J., KANNAN, S., & SINCAR, M. (2013). Large-scale 1:1 computing initiatives: An open access database. *International Journal of Education and Development using Information and Communication Technology*, 9, (1), 4-18.

RICHARDSON, J. W., FINHOLT-DANIEL, M., SALES, G., & FLORA, K. (2012). Shifting pedagogical space: Egyptian educators' use of Moodle. *International Journal of Education and Development using Information and Communication Technology*, 8, (2), 92-106.

RICHARDSON, V. (1990). Significant and Worthwhile Change in Teaching Practice. *Educational Researcher*, 19, (7), 10-18.

ROCKMAN, S. (2003). Learning from Laptops. *Threshold Magazine*, 1, (1), 24-28.

ROSCHELLE, J., & PEA, R. D. (2002). A walk on the WILD side: How wireless handhelds may change computer-supported collaborative learning. *International Journal of Cognition and Technology*, 1, (1), 145–168.

ROSS, J. (2010). Was that Infinity or Affinity? Applying Insights from Translation Studies to Qualitative Research Transcription. *Forum Qualitative Sozialforschung/Forum:Qualitative Social Research*,11 (2).

ROSS, S. M., LOWTHER, D. L., WILSON-RELYEA, B., WEIPING, W., & MORRISON, G. R. (2003). *Anytime, Anywhere Learning - Final Evaluation Report of the Laptop Program: Year 3*. Memphis: The University of Memphis. Retrieved from http://www.memphis.edu/crep/

RUSSELL, M., BEBELL, D., & HIGGINS, J. (2004). Laptop Learning: A Comparison of Teaching and Learning in Upper Elementary Classrooms Equipped with Shared Carts of Laptops and Permanent 1:1 Laptops. *Journal of Educational Computing Research* , 30, (4), 313-330.

RUSSELL, M., BEBELL, D., COWAN, J., & CORBELLI, M. (2003). An AlphaSmart for each student: Do teaching and learning change with full access to word processors? *Computers and Composition*, 20, (1), 51-76.

RUTLEDGE, D., DURAN, J., & CAROLL-MIRANDA, J. (2007). Three Years of the New Mexico Laptop Learning Initiative (NMLLI): Stumbling Toward Innovation. *AACE Journal*, 15, (4), 339-366.

SANDBERG, J. (2005). How Do We Justify Knowledge Produced Within Interpretive Approaches? *Organizational Research Methods*, 8, 41-68.

SANDHOLTZ, J., RINGSTAFF, C., & DWYER, D. (1997). *Teaching with Technology: Creating student centered classrooms*. New York: Teachers College Press.

SARAMA, J., CLEMENTS, D. H., & HENRY, J. (1998). Network of Influences in an Implementation of a Mathematics Curriculum Innovation. *International Journal of Computers for Mathematical Learning*, 3, (2), 113-148.

SAUERS, N. J., & MCLEOD, S. (2012). *What Does the Research Say about School One-to-one Computing Initiatives?* UCEA Center for the Advanced Study of Technology Leadership in Education, University of Kentucky.

SCRIMSHAW, P. (2004). *Enabling Teachers to Make Successful Use of ICT*. ICT Research. British Educational Communications and Technology Agency (BECTA).

SELL, G. R., CORNELIUS-WHITE, J., CHANG, C.-W., MCLEAN, A., & ROWORTH, W. R. (2012). *A Meta-Synthesis of Research on 1:1 Technology Initiatives in K-12 Education*. Ozarks Educational Research Initiative - Institute for School Improvement, Springfield: Missouri State University.

SEVERIN, E., & CAPOTA, C. (2011). *One-to-One Laptop Programs in Latin America and the Caribbean - Panorama and Perspectives. Technical Notes*. Inter-American Development Bank.

SHANOR, R. D. (1985). *Behind the Lines*. New York: St. Martin's Press.

SHAPLEY, K., SHEEHAN, D., MALONEY, C., & CARANIKAS-WALKER, F. (2010). Evaluating the Implementation Fidelity of Technology Immersion and its Relationship with Student Achievement. *The Journal of Technology, Learning, and Assessment*, 9, (4), 1-69.

SIGMA. (2011). Midterm Observational Study. Baku.

SILVERMAN, D., & MARVASTI, A. (2008). *Doing Qualitative Research: A Comprehensive Guide*. Thousand Oak: SAGE Publications.

SILVERNAIL, D. L., & HARRIS, W. J. (2003). *The Maine Learning Technology Initiative - Teacher, student, and school perspectives: Mid-year evaluation report*. Portland: Maine Education Policy Research Institute, University of Southern Maine.

SILVERNAIL, D. L., & LANE, D. M. M. (2004). *The impact of Maine's one-to-one laptop program on middle school teachers and students: Phase one summary evidence*. Portland, ME: Maine Education Policy Research Institute, University of Southern Maine.

SIVIN-KACHALA, J., & BIALO, E. (2000). *2000 Research report on the effectiveness of technology in schools*. Washington D.C.: Software and Information Industry Association.

SMEETS, E., & MOOIJ, T. (2001). Pupil-centred learning, ICT, and teacher behavior: observations in educational practice. *British Journal of Educational Technology*, 32, (4), 403-417.

SPIRES, A. H., OLIVER, K., & CORN, J. (2012). The New Learning Ecology of One-to-One Computing Environments: Preparing Teachers for Shifting Dynamics and Relationships. *Journal of Digital Learning in Teacher Education*, 28, (2), 63-72.

STATE STATISTICAL COMMITTEE. (2015). The State Statistical Committee of the Republic of Azerbaijan. Retrieved 03 30, 2016, from http://www.azstat.org/MESearch/details

STAVERT, B. (2010). One-to-One Computers in Schools: 2010 Literature Review. NSW: Department of Education and Training, Digital Education Revolution.

STORZ, G. M., & HOFFMAN, R. A. (2013). Examining response to a one-to-one computer initiative: Student and teacher voices. *RMLE Online: Research in Middle Level Education*, 36, (6), 1-18.

STRAUSS, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge: Cambridge University Press.

STRAUSS, A. L., & CORBIN, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: SAGE Publications.

SUHR, A. K., HERNANDEZ, A. D., GRIMES, D., & WARSCHAUER, M. (2010). Laptops and fourth-grade literacy: Assisting the jump over the fourth-grade slump. *Journal of Technology, Learning, and Assessment*, 9, (5), 1-46.

TANNER, H., & JONES, S. (2007). Learning from Children about their Learning with and without ICT. *Mathematics: Essential Research, Essential Practice*, 2, 708-716.

TEDRE, M., HANSSON, H., MOZELIUS, P., & LIND, S. (2011). Crucial Considerations in One-to-One Computing in Developing Countries. In P. Cunningham, & M. Cunningham (Eds.), *IST-Africa 2011 Conference Proceedings*, (pp. 1-11). Iringa: IIMC International Information Management Corporation.

THE WORLD FACTBOOK - AZERBAIJAN. (N.D.). https://www.cia.gov/library/publications/the-world-factbook/geos/aj.html

THOMSON, P. (2010). Involving Children and Young People in Educational Change: Possibilities and Challenges. In A. Hargreaves, A. Lieberman, M. Fullan, & D. Hopkins (Eds.), *Second International Handbook of Educational Change,* (pp. 809-824). New York: Springer.

TRIMMEL, M., & BACHMANN, J. (2004). Cognitive, social, motivational and health aspects of students in laptop classrooms. *Journal of Computer Assisted Learning*, 20, (2), 151-158.

TURCANO, M. (2012*). Assessing Education with Computers in Georgia.* EduTech – A World Bank Blog on ICT use in Education. Retrieved from: http://blogs.worldbank.org/edutech/georgia

UNESCO INSTITUTE FOR STATISTICS. (2014). *Information and Communication Technology (ICT) in Education in Asia - A comparative analysis of ICT integration and e-readiness in schools across Asia.* Montreal, Quebec: UNESCO Institute for Statistics. http://dx.doi.org/10.15220/978-92-9189-148-1-en

VANNATTA, R. A., & FORDHAM, N. (2004). Teacher Dispositions as Predictors of Classroom Technology Use. *Journal of Research on Technology in Education*, 36, (3), 253-271.

WANG, Q., & WOO, H. L. (2007). Systematic Planning for ICT Integration in Topic Learning. *Educational Technology & Society*, 10, (1), 148-156.

WARSCHAUER, M. (2007). Information literacy in the laptop classroom. *Teachers College Record*, 109, (11), 2511-2540.

WARSCHAUER, M., GRANT, D., REAL, D. G., & ROUSSEAU, M. (2004). Promoting academic literacy with technology: Successful laptop programs in K–12 schools. *System*, 32, (14), 5250538.

WEISER, M., GOLD, R., & BROWN, J. S. (1999). The origins of ubiquitous computing research at PARC in the late 1980s. *IBM Systems Journal*, 38, (4), 693-696.

WEISS, R. S. (1994). *Learning from Strangers: The Art and Method of Qualitative Interview Studies.* New York: The Free Press.

WELLS, J. (2007). Key design factors in durable instructional technology professional development. *Journal of Technology and Teacher Education*, 15, (1), 101–122.

WESTON, M. E., & BAIN, A. (2010). The End of Techno-Critique: The Naked Truth about 1:1 Laptop Initiatives and Educational Change. *Journal of Technology, Learning and Assessment*, 9, (6), 6-19.

WINDSCHITL, M., & SAHL, K. (2002). Tracing Teachers' Use of Technology in a Laptop Computer School: The Interplay of Teacher Beliefs, Social Dynamics, and Institutional Culture. *American Educational Research Journal*, 39, (1), 165-205.

WORLD BANK GROUP. (2015). *World Bank Group – Azerbaijan Partnership Program Snapshot*. Retrieved from: http://www.worldbank.org/content/dam/Worldbank/document/Azerbaijan-Snapshot.pdf

YARMAKHOV, B. (2012). *"1 computer: 1 student" - educational model of mobile learning at school.* Moscow: AMIprint.

ZHAO, Y., & FRANK, K. A. (2003). Factors Affecting Technology Uses in Schools: An Ecological Perspective. *American Educational Research Journal*, 40, (4), 807–840.

ZUCKER, A. A., & HUG, S. T. (2007). *A Study of the 1:1 Laptop Program at the Denver School of Science & Technology*. Denver: Denver School of Science and Technology.

ZUCKER, A. A., & MCGHEE, R. (2005). *A study of one-to-one computer use in mathematics and science instruction at the secondary level in Henrico County Public Schools*. Arlington VA: SRI International.

ZUCKER, A.A., & LIGHT, D. (2009). Laptop Programs for Students. *Science*, 323, (5910), 82-85.

# 8 Appendices

## 8.1 Appendix 1: Map of the Republic of Azerbaijan

## 8.2 Appendix 2: Specifications of the devices provided to schools

| Technical Characteristics | 2 in 1 | Netbook | Notebook |
|---|---|---|---|
| **Processor** | Intel Bay Trail Entry Z3735F Quad Core 1.33 GHz | Intel Celeron N2806 (1.6 GHz) | Intel Bay Trail Entry Z3735F Quad Core 1.33 GHz up to 1.83 GHz |
| **OS** | Windows 8.1 Pro with Office | Windows 8.1 Pro with Office | Windows 8.1 Pro with Office |
| **Ram** | 2GB | 2GB | 2GB |
| **Hard drive** | 32GB | 32GB | 32GB |
| **Display size** | 10.1", multi-touch | 10.1" | 11.6" |
| **Wi-Fi & Bluetooth** | Wi-Fi 802.11b/g/n Bluetooth 4.0 | Wi-Fi 802.11b/g/n Bluetooth 4.0 | Wi-Fi 802.11 b/g/n, Bluetooth 4.0 |
| **HDMI** | Yes(Micro) | Yes | Yes |
| **Micro USB/ Full USB** | Yes(Both) | Yes (2.0 and 3.0) | Yes (2.0) |
| **Camera** | Yes | Yes | Yes |
| **Keyboard** | Yes | Yes | Yes |
| **Battery** | 2 Cell Polymer 6300mAh | 2 Cell Polymer 3200 mAH | 5000 mAh |

## 8.3 Appendix 3: Type of the data

| *Research Methods* | Sample Group | Capital School 1 | Capital School 2 | Regional School | Total |
|---|---|---|---|---|---|
| **Classroom Observation** | Teachers, Students | 2 | 2 | 2 | 6 |
| **Follow-up Interview** | Teachers of Observed Classes | 2 | 2 | 2 | 6 |
| **Individual Interview** | Students from Observed Classes | 5 | 4 | 4 | 13 |
| **Focus Group Discussion** | Parents whose children participated in individual interviews | 4 | 4 | 4 | 12 |
| **Focus Group Discussion** | Teachers of Observed Classes | 2 | 2 | 2 | 6 |

## 8.4 Appendix 4: Letter draft for school principals

**Dear School Principal,**

I would like to bring to your attention that I am currently conducting a research on "Factors influencing the integration of One-to-one computing into learning and teaching". The aim of the research is to closely monitor learning-teaching process and explore issues affected by this new programme in schools that have joined One-to-one computing initiative.

Within the framework of this research, 40-45 minute-long classroom observations, follow-up interviews with teachers and 40-60 minute-long individual interviews with students will be conducted. As part of the research, it is expected to hold 60-80 minute-long focus group discussions with parents and teachers. We assure you on the confidentiality of the information provided by research participants.

I kindly ask your consent for participation in the research as your school has joined in One-to-one computing project. I would like to note that in case of your consent, the above-mentioned observations and interviews will be held by the research assistant Sabina Savadova.

The research assistant's contact details: XXXX; email: XXXX.

**Sincerely,**
**Researcher**
**Samir Mammadov**

# Participant Consent Form

I carefully read the information provided with this form and I agree to participate in the research based on the above-mentioned circumstances.

---

Principal's name and surname

---

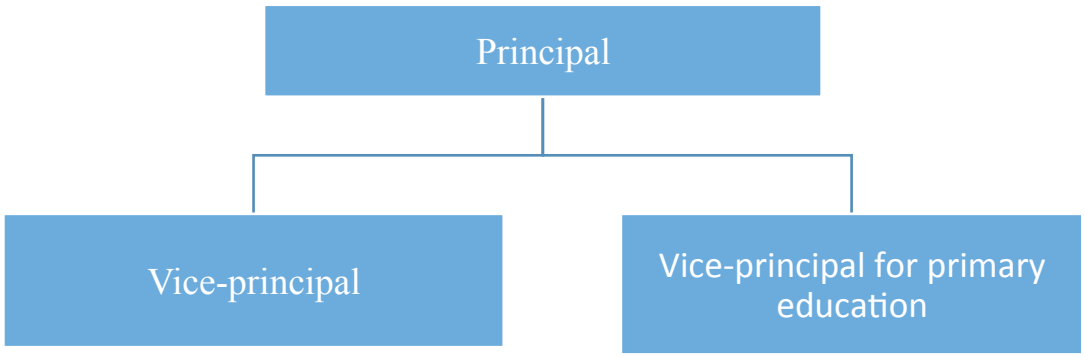
Principal's signature

Date

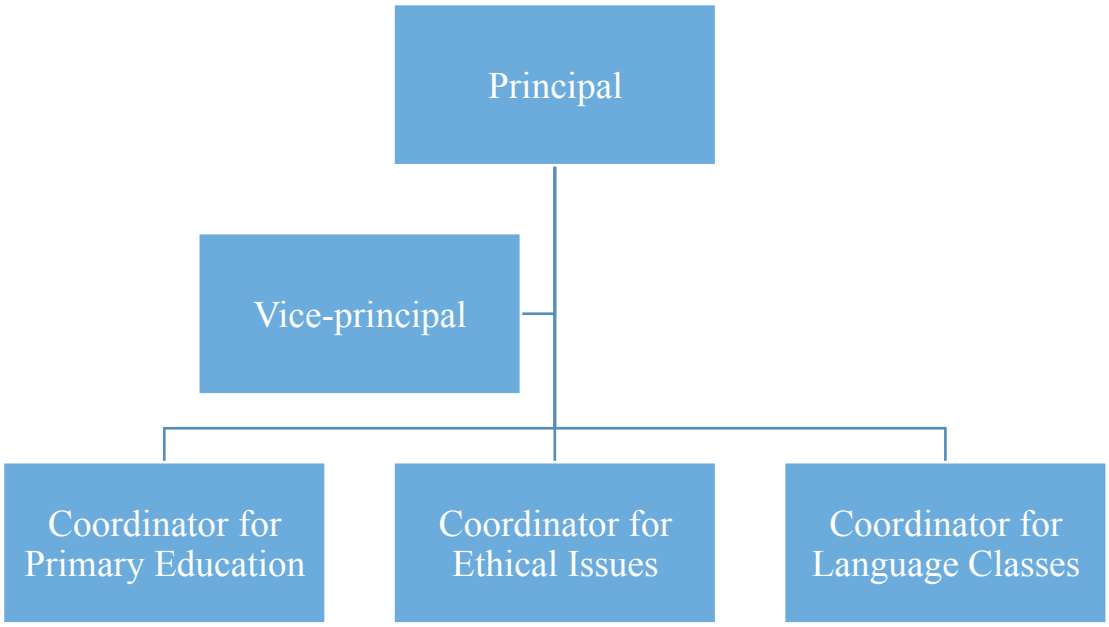
## 8.5 Appendix 5: Brief information about schools and organizational charts

| | Capital School 1 | Capital School 2 | Regional School |
|---|---|---|---|
| **Year Founded** | 1992 | 1863 | 2008 |
| **Number of Students** | 1129 | 2416 | 412 |
| **Number of Teachers** | 122 | 190 | 55 |
| **Language of Instruction** | Azerbaijani and Russian | Azerbaijani and Russian | Azerbaijani |
| **Joined one-to-one computing** | 2008 | 2010 | 2012 |

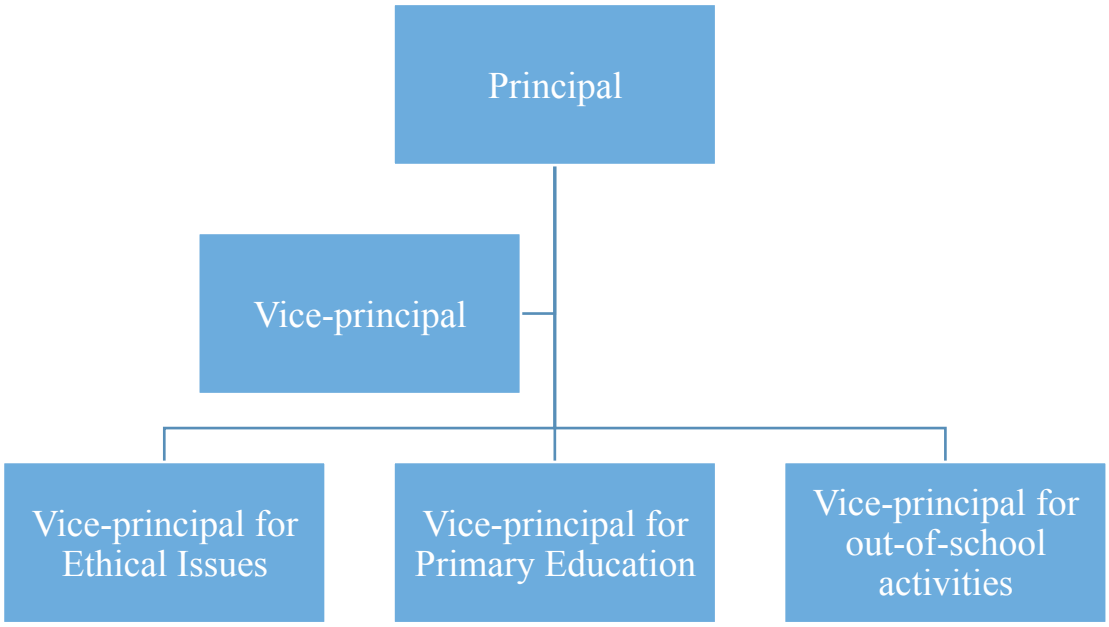
***Capital School 1***



***Capital School 2***




***Regional School***



## 8.6 Appendix 6: Brief information about the organization and the training it provided

**Madad Azerbaijan**

**Moscow Avenue 1058/34**
**Baku, Azerbaijan**
**Website: madat.net**
**Phone: +994 12 530 82 95**

Madad Azerbaijan is the national organization whose mission is to provide educational solutions for professional development of teachers and introduce innovations in learning accessible to educators, businesses, and policymakers. Madad Azerbaijan was founded in 1999 and officially registered in 2000. With more than 15 years of experience and international expertise, Madad Azerbaijan has contributed to the development of education, ICT, socio-economic, and health sectors in the Republic of Azerbaijan through its creative and constructive approach.

Madad Azerbaijan has successfully developed an independent identity and a diverse portfolio of innovative, relevant and sustainable programs in such spheres as development of education, ICT application and deployment in education, governance, and health reconstruction and building of school institutions, development of local communities, public health services and enterprise development. Since 2005 Madad Azerbaijan in partnership with the Government of Azerbaijan implements one of the five strands of the State Program on Integration of ICT in Education.

**Why Madad?**

- The first national organization to bring modern technologies and interactive teaching methodologies into the education system of Azerbaijan;
- Effective environment for integration and practical usage of international experience into the Azerbaijani education system;

- Training programs are being prepared according to international standards and in cooperation with prominent organizations;
- The main partners of such education programs are Microsoft, Intel and Relief International – Schools Online;
- The first and sole organization in Azerbaijan operating based on the "ICT Competency Framework for Teachers" standards approved by UNESCO Institute on Information Technologies in Education.

**Goals of the trainings**

- ✓ Student-centered and interactive teaching methods (Individual approach)
- ✓ Subject-based programs
- ✓ Efficient use of information technologies
- ✓ Teachers' participation both as a learner and a teacher
- ✓ Research-based lessons

## 8.7 Appendix 7: Specifications of the equipment provided to schools

| **ActivBoard 300 Pro Interactive whiteboard** | **PRODUCT SPECIFICATIONS** |
|---|---|
| **Internal Resolution** | 2730 points (lines) per inch |
| **Output Resolution** | 200 points (lines) per inch |
| **Tracking Rate** | 200 inches per second providing a fast response to pen commands |
| **Output Rate** | 120 coordinate pairs per second |
| **User Input** | Cordless battery-free pen incorporating tip switch and side switch for full mouse functionality (ActivPen) |
| **Digitizing Technology** | Passive Electromagnetic |
| **Power Requirement** | Mains Powered; 18V Power Supply Unit |
| **Connection to Computer** | USB 2.0, 1 x 5m USB data cable supplied |
| **Screen Surface** | Low Glare Melamine |
| **Certifications** | UL, CE, FCC |
| **Operating Temperature** | 0°C to +50°C (14°F to 122°F) |
| **Storage Temperature** | -20°C to +70°C (-4°F to 158°F) |
| **Storage Humidity** | 0% to 90% (non-condensing) |
| **Dual User Functionality** | 2 Instructor and 2 Participant ActivPens included |
| **Integrated USB Sound** | Two integrated slim-line speakers and amplifier (with controls, inputs and outputs) |
| **Packed Contents List** | ActivBoard, 2 ActivPens (Instructor), 2 ActivPens (Participant), 1 Amp PSU, Wall Mounting Brackets, Installation Guide, Access to ActivInspire Professional Edition and Promethean ActivOffice via download (ActivInspire Professional Edition is also available on DVD on request) |

## Integrated USB sound specifications

| | |
|---|---|
| **Amplifier Power Output** | 20W per channel RMS (<1% distortion) |
| **Controls** | Volume, Bass, Treble, on/off |
| **Amplifier Frequency Response** | 40Hz to 18kHz +/-3dB (at 1W) |
| **USB Sound** | USB Sound supported for Minimum System Requirements stated |
| **Connectivity – Inputs (4)** | Stereo PC, Stereo CD/DVD, Mono Auxiliary, Microphone to PC |
| **Connectivity – Outputs (2)** | 2 Stereo |
| **Power Requirement** | 18V 3.3 Amp |

## Interactive Display

| | |
|---|---|
| **ActivBoard Size** | 78in |
| **Resolution** | 12800 x 9200 |
| **Screen Formats** | 4:3 |
| **Overall Dimensions** | 1868mm x 1329mm (73.5in x 52.3in) |
| **Active Area Dimensions** | 1628mm x 1175mm (64in x 46in) |
| **Active Area Diagonal** | 2000mm (78.7in) |
| **Actual Image Diagonal** | 1958mm (77.1in) |
| **Board Weight** | 28kg (61.7lb) |
| **Packed Weight** | 43kg (94.7lb) |
| **Packed Dimensions** | 2025mm x 1500mm x 110mm (79.9in x 59in x 4.3in) |

## Minimum system requirements

| | |
|---|---|
| **Operating Systems** | Windows XP SP2 and above (XP/Vista/7); Mac OSX 10.4.11 – 10.6.1 (Tiger/Leopard/Snow Leopard); Linux Ubuntu 9.04, 9.10; Debian |
| **PC** | Pentium 4 – 1 GHz processor (800MHz for Vista), 512 MB of RAM, 1024x768 resolution, 1.5 GB of free disk space |
| **Mac** | Macintosh Intel Processors (Universal Binary), 512 MB of RAM, 1024x768 resolution, 3.0 GB of free disk space |

## Epson-EB-S18

*http://www.epson.eu/products/projectors/mobile/epson-eb-s18*

| ***Description*** | **Specification** |
|---|---|
| ***Projection System*** | 3LCD Technology |
| ***LCD Panel*** | 0.55 inch |
| ***Colour Light Output*** | 3,000 Lumen-2,100 Lumen (economy) |
| ***White Light Output*** | 3,000 Lumen - 2,100 Lumen (economy) In accordance with ISO 21118:2012 |
| ***Resolution*** | SVGA, 800 x 600, 4:3 |
| ***Aspect Ratio*** | 4:03 |
| ***Contrast Ratio*** | 10,000 : 1 |
| ***Lamp*** | 200 W, 5,000 h durability, 6,000 h durability (economy mode) |
| ***Keystone Correction*** | Auto vertical: ± 30 °, Manual horizontal ± 30 ° |
| ***Colour Processing*** | 10 Bits |
| ***2D Vertical Refresh Rate*** | 50 Hz - 85 Hz |
| ***Colour Reproduction*** | Up to 1.07 billion colours |
| ***Optical Projection Ratio*** | 1.45 - 1.96:1 |
| ***Zoom*** | Digital, Factor: 1.35 |
| ***Lens*** | Optical |
| ***Projection Size*** | 30 inches - 350 inches |

| | |
|---|---|
| ***Projection Distance Wide/Tele*** | 1.77 m - 2.4 m (60 inch screen) |
| ***Projection Lens F Number*** | 1.44 |
| ***Focal Distance*** | 16.7 mm |
| ***Focus*** | Manual |
| ***Offset*** | 8:01 |
| ***USB Display Function*** | 3 in 1: Image / Mouse / Sound |
| ***Interfaces*** | Cinch audio in, VGA in, RGB in, S-Video in, Component in,<br>Composite in, HDMI in, Wireless LAN IEEE 802.11b/g/n (optional), USB 2.0 Type B, USB 2.0 Type A<br>Epson iProjection App<br>Ad-Hoc / Infrastructure |
| ***Security*** | Kensington lock, Security cable hole, Wireless LAN security |
| ***3D*** | No |
| ***Features*** | AV Mute Slide, Built-in speaker, Digital zoom, Direct Power on/off, Document Camera Compatible, Horizontal and vertical keystone correction, Network projection, Wireless LAN capable |
| ***Video Colour Modes*** | Blackboard, Dynamic, Presentation, Sports, sRGB, Theatre, Whiteboard |
| ***Energy Use*** | 270 Watt, 201 Watt (economy), 0.28 Watt (standby) |
| ***Supply Voltage*** | AC 100 V - 240 V,50 Hz - 60 Hz |
| ***Product dimensions*** | 297 x 234 x 77 mm (Width x Depth x Height) |
| ***Product weight*** | 2.4 kg |
| ***Noise Level*** | Normal: 37 dB (A) - Economy: 29 dB (A) |
| ***Temperature*** | Operation 5° C - 35° C, Storage -10° C - 60° C |
| ***Humidity*** | Operation 20% - 80%, Storage 10% - 90% |
| ***Options*** | Document camera, Quick wireless USB key, Wireless LAN unit |
| ***Loudspeaker*** | 2 Watt |

## 8.8 Appendix 8: Informed consent letter drafts for respondents

***Informed Consent Letter Draft for Parents***

**Dear Parent,**

We, together with the school administration, teachers and students, are conducting a research study called "Factors impacting the integration of one-to-one computing initiative into learning and teaching". The aim of the research is to closely monitor learning-teaching processes and explore issues affected by this new programme in the participant schools. The Bureau on ICT for Education under the Ministry of Education and the administration of your school kindly ask you to participate in the research.

If parents agree, they will participate in 1-1.30 hour-long discussions. The research does not hold any physical or emotional harm for parents. Participation is absolutely on a voluntary basis and focus group discussions will be anonymous. Each participant will be provided with a research code and their names will be kept anonymous. No-one except the researcher and the research assistant will have access to these codes.

In case you wish to acquire further information about the research and participation in the research you can contact us at XXXXX.

If you would like to participate in the above-mentioned research, please fill in the consent form below.

**Sincerely,**
**Research Assistant**
**Sabina Savadova**

# Informed Consent Form

Circle the answer with which you agree:

I agree to participate in the interview: Yes / No

---

Audio recording of the interview: Yes / No

---

I thoroughly read the information attached to this form and based on the above-mentioned clauses I agree to participate in the research.

_____

Parent's Name and Surname

_____

Parent's Signature

Date

## *Informed Consent Letter Draft for Students*

**Dear Student,**

Your school is participating in the pilot "One-to-one computing" project. Currently we are conducting a research study called "Factors impacting the integration of one-to-one computing initiative into learning and teaching". The aim of the research is to closely monitor learning-teaching processes and explore issues affected by this new programme in the participant schools. The Bureau on ICT for Education under the Ministry of Education and the administration of your school kindly ask you to participate in the research.

Participants will be interviewed for 40-60 minutes. The interviews will be absolutely anonymous and there will not be any name registration. Each participant will be provided with a research code and their names will be kept anonymous. No-one except the researcher and the research assistant will have access to these codes. The school administration will not have any access to the gathered information. Participation in the research is absolutely voluntary. In the case of your withdrawal there will not be any kind of punishment. Even if the parent agrees, a student is still free to choose whether to participate in the interviews, reject or withdraw from it any time they want.

In case you wish to acquire further information about the research and participation in the research you can contact us at XXXX.

If you would like to participate in the above-mentioned research, please, you and one of your parents fill in the consent form below.

**Sincerely,**
**Research Assistant**
**Sabina Savadova**

# Informed Consent Form

Circle the answer with which you agree:

Agree to participate in the interview: Yes / No

Audio recording of the interview: Yes / No

I thoroughly read the information attached to this form and based on the above-mentioned clauses I agree to participate in the research.

_____

Student's Name and Surname

_____

Student's Signature

Date

I _____agree for my child's_____ participation in the above-mentioned research.

_____

Parent's Name and Surname

_____

Parent's Signature

Date

## *Informed Consent Letter Drafts for Teachers*

**Dear Teacher,**

Your school is participating in the pilot "One-to-one computing" project. Currently we are conducting a research study called "Factors impacting the integration of one-to-one computing initiative into learning and teaching". The aim of the research is to closely monitor learning-teaching processes and explore issues affected by this new programme in the participant schools. The Bureau on ICT for Education under the Ministry of Education and the administration of your school kindly ask you to participate in the research.

Within the framework of this research, 40-45 minute-long classroom observations and follow-up interviews with teachers, as well as 40-60 minute-long individual interviews with students will be conducted. We will seek permission in order to conduct classroom observations. Following the classroom observations together with the researcher or the research assistant, teachers will have an opportunity to watch the video recordings of the observations and discuss the classroom processes that unfolded. Participant teachers will be invited to focus group discussions, where they will discuss teaching methods with their peers.

Your participation in the research will assist us to reveal the impact of the initiative upon students' learning and comprehension. By participating in this research you will be able to share your opinions and provide feedback about the initiative, as well as learn about the opinions of your peers working in different schools.

The research is designed for the EdD study. The video and audio recordings of the classes, interviews and focus group discussions will be kept confidential.. Each respondent will be provided with a research code and there will be no registration. The results of the research will not affect teachers in any way. The gathered information will be completely confidential, no-one except for the researcher and the

research assistant will have accesses to them. The school administration will not have any access to the gathered information.

In case you wish to obtain further information regarding the research and your participation in it, you can contact us at the following number: XXXX.

**Sincerely,**
**Research Assistant**
**Sabina Savadova**

# Informed Consent Form

Circle the answer with which you agree:

| | |
|---|---|
| Agree to participate in the interview: | Yes / No |
| Audio recording of the interview: | Yes / No |
| Conduct of classroom observations: | Yes / No |
| Video recording of classroom observations: | Yes / No |
| Participation in focus group discussions: | Yes / No |
| Audio recording of focus group discussions: | Yes / No |

I thoroughly read the information attached to this form and based on the above-mentioned clauses I agree to participate in the research.

_____

Teacher's Name and Surname

_____

Teacher's Signature

Date

## 8.9 Appendix 9: Questions for follow-up teacher interviews

| | **Questions for Follow-up Teacher Interviews** |
|---|---|
| ***Introduction*** | 1. What subject do you teach?<br>2. How long have you been teaching?<br>3. How long have you been teaching with one-to-one computing?<br>4. Have you had any relevant training to implement this program?<br>If yes, did you develop a lesson plan for a 1:1 learning environment during the training?<br>If yes, did you find the training useful?<br>5. Do you think there should be similar training for parents and school administrators? |
| ***Classroom description*** | 1. How do you organize the classroom environment? In a traditional or modern way?<br>2. Is your classroom environment different now compared to before?<br>3. What do you think, are your classes student or teacher-directed?<br>4. How do you set up the classrooms? Have you made any changes in the physical-setting of the classroom?<br>5. Do you use netbooks in classroom? If yes, how often?<br>6. In case of technical problems or other problems in 1:1 what do you do? Do you have any plan B? |

| | |
|---|---|
| | 7. How do your students usually work on netbooks during the lesson? Individually, or in pairs or in groups?<br>8. How much of a class hour do students work at netbooks?<br>9. For what purposes do you use netbooks in the classroom?<br>10. Please describe the work process<br>11. In which steps of teaching do you make use of netbooks the most?<br>12. For which step is netbook use more useful/ helpful? |
| ***Student attitude*** | 1. Have there been any positive/ negative changes in student attitude since the launch of the program?<br>2. How interested are your students in using the netbooks?<br>3. Do netbooks motivate your students during their study? If yes, how?<br>4. Are there any distracting factors to the learning process due to netbook usage in your class period?<br>5. Have you been applying any specific new punishment/reward strategy since the start of using one-to-one computing in your class?<br>6. How independent are your students in using the netbooks?<br>7. How do you estimate overall classroom performance of your students after applying1:1?<br>8. How does 1:1 influence student achievement level?<br>9. Do you think your students have gained new learning abilities/ skills after applying 1:1?<br>10. How do you estimate the level of student engagement in the learning process now?<br>11. What is the level of student collaboration during classes |

| | |
|---|---|
| | after 1:1 implementation? How about student-teacher collaboration? |
| ***Teacher aspect*** | 1. Are there sufficient resources in your subject for using netbooks in the classroom?<br>2. Do you develop your own resources for the class?<br>3. Do you coordinate/collaborate with other teachers that teach with 1:1? |
| ***Impact on learning*** | 1. How do you think the program has impacted your students' learning?<br>2. In which steps of learning are your students interested in using notebooks the most? Have you noticed any changes? What kind?<br>3. Are there any challenges they face?<br>4. Do you have any success stories to share with us?<br>5. Which skills were improved in students? Time management/research skills?<br>6. On what level are your students interested in learning now? Any difference? |

| | |
|---|---|
| ***Challenges*** | 1. What challenges have you faced in "1:1" classrooms?<br>2. How do you solve challenges you face during classroom hours?<br>3. Are you satisfied with the program?<br>4. What do you think can be done to better it?<br>5. What changes would you like to bring to the program?<br>6. What is the biggest problem you have ever faced in this project?<br>7. What kind of suggestion do you have to improve the integration of 1:1 into classroom activities?<br>8. What is the advantage of this program? |
| ***Impact on teaching*** | 1. Has the quality of lessons changed in 1:1 classrooms? If yes, how?<br>2. Is there any change in your teaching methods and lesson plan after applying 1:1? Any differences?<br>3. Can you balance your teaching according to learning types of your students after applying 1:1?<br>4. Are there any restrictions arising from 1:1 in your teaching? |

## 8.10 Appendix 10: Questions for individual student interviews

| | **Questions for Individual Student Interviews** |
|---|---|
| ***Welcome*** | 1. Who we are and what we're trying to do<br>2. What will be done with this information<br>3. Why we asked you to participate |
| ***Student Attitude*** | 1. In which classes do you use netbooks? In which class do you use netbooks most? Why?<br>2. What is your favorite subject? Why do you like it so much? Do you use netbooks in that class?<br>3. Do you like your classes better than before?<br>4. What do you like about using netbooks in class?<br>5. For which activity in class do you like using netbook the most?<br>*6.* What kind of materials do you like to create for lessons on your netbook?<br>7. Do you prefer working at netbook alone or in groups?<br>• If alone, why? If in groups, why?<br>• If your classmates had some problems with netbook and you knew how to solve, would you help them?<br>• Do you help each other with netbook usage?<br>• Do you think you learn better while working at netbook alone or in groups? Why?<br>*8.* Why do you think people at the Ministry of Education gave netbooks to your school and class?<br>9. Do you think netbook usage has made school more interesting? In what ways?<br>10. Is netbook usage interesting in class? How do you like it?<br>11. What is most interesting about netbook usage? |

| | |
|---|---|
| ***Student' s learning*** | 1. How does the 1:1 program impact your learning in class and at home?<br>2. Do you think you are learning more now?<br>3. What is the difference between your studies without a netbook and now?<br>4. Do you do your home assignments on netbooks at home?<br>5. How different is doing home assignments after the 1:1 program?<br>6. Can you work independently at you netbook?<br>• Do you need help with netbook usage in class and at home?<br>• If yes, to whom do you turn for help?<br>7. How do you like typing on your netbooks? Do you think you are fast?<br>• Do you have any problems related to typing?<br>• Would you like to have typing classes at school?<br>8. How do you like the quality of lessons after the 1:1 program? What do you like about lessons the most now? Anything you don't like?<br>• Is there anything related to 1:1 initiative that you would like to change in your class?<br>9. Do you have enough time to prepare homework?<br>• Does it take more time or less time now?<br>• Does netbook usage take additional time in your learning process?<br>10. What did you make on your netbook last?<br>• What were you doing on your netbook last?<br>11. Let's say I don't know how to use netbooks, could you teach me?<br>• How long do you think it would take you?<br>• How does the program impact your ICT skills? |
| ***Student's self-development*** | 1. Do you think you gain new and additional knowledge with netbook usage?<br>2. Can you say that you have gained new skills and abilities after 1:1 program? If yes, what are they?<br>3. How do you compare yourself with a student who does not have a netbook in parallel classes?<br>4. What do you think, if you were to compete with other classes that do not use netbooks, who would win?<br>• Do you think that they should have netbooks in classes as well?<br>• Do you think that could be beneficial for their studies? |

| | |
|---|---|
| | • How do you think netbooks can best help students to learn?<br>• What would you advise students and teachers in other schools to do?<br>5. Do you encounter any challenges while working with netbooks? How do you tackle them? |
| ***Final Remarks*** | 1. Do you have any suggestions for the program?<br>• What do you think could be improved?<br>• Would you like to have classes with netbooks in the future too? |

## 8.11 Appendix 11: Questions for focus group discussions

| | **Questions for Teacher Focus Group Discussions** |
|---|---|
| ***Welcome*** | (Introduce yourself and send the Sign-In Sheet with a few quick questions about demographics (age, gender, cadre, and years at this facility) around the group while you are introducing the focus group).<br><br>● Who we are and what we are trying to do<br>● What will be done with this information<br>● Why we asked you to participate |
| ***Teacher Aspect*** | 1. How do you evaluate your success since the program started till now?<br>2. How do you think your lessons are student or teacher-directed now? How was it before?<br>3. How much do your students work at netbooks during one hour in class?<br>4. In which steps of teaching do you use netbooks the most?<br>5. Is the teaching process different now? If yes, in what ways?<br>6. What can you say about preparation for teaching? Has anything changed? How much time approximately did you need to prepare for the class without netbooks? What about now?<br>7. How does the 1:1 program impact your ICT skills?<br>8. How does the program impact ICT skills of your students? |
| ***Student Learning*** | 1. What has changed in your students' learning since the beginning of the project?<br>2. How independent are your students in using netbooks?<br>3. What skills does this program develop in your students?<br>4. How would you evaluate the typing skills of your students?<br>5. Do you think they need typing lessons at school?<br>6. How does the program impact your students' learning? |

| | |
|---|---|
| | 7. What kind of changes have you noticed in your students' learning?<br>8. How independent are they in the learning process now?<br>9. When do the students use netbooks most frequently?<br><br>10. Does the 1:1 program motivate your students to try harder in their studies?<br>a. If yes, in what ways?<br>b. If no, what causes the problems?<br>11. \|How does the program impact the development of your students' learning skills and abilities?<br>12. How would you evaluate your cooperation with students now? How would you evaluate the cooperation among your students? Have you noticed any changes?<br>13. What are the biggest challenges for your students in 1:1 classrooms?<br>14. What can be done to eliminate these issues? |
| ***Subject Aspect*** | 1. Do you have sufficient e-resources to teach your subject?<br>2. Do you develop your own e-resources to use in classes?<br>3. Do you share your e-resources with other teachers at school?<br>4. How do you develop e-resources for your subject?<br>5. What kind of e-resources have been most useful in teaching so far?<br>6. Does your school assist you in finding e-resources?<br>7. Has anything changed in your teaching methods after 1:1 initiative? If yes, please elaborate on it.<br>8. Has the 1:1 program helped you to take ahead your established methods of teaching more effectively?<br>9. Do you apply new methods to your teaching because of the 1:1 program? If yes, what are they? |
| ***Parental attitude*** | 1. To what extent does parental support affect the integration of the program into learning and teaching?<br>2. Have you had any incidents with parents?<br>3. How interested are parents in the successful implementation of the 1:1 program?<br>4. Do parents support netbook usage in classes? |

| | |
|---|---|
| ***Challenges*** | 1. What are the most common challenges that you face while teaching in 1:1 classrooms?<br>2. What can be done to eliminate these issues?<br>3. Do you think this program should be extended to higher grade classes?<br>4. Do you think 1:1 programme should be expanded at your school?<br>5. What could be improved for more successful implementation of the program?<br>6. Do you think teachers of all subjects should be teaching with 1:1 program?<br>7. What motivates you to participate in the implementation of this program?<br>8. How successful do you find this program for the time being?<br>9. Do you believe that the program will be successful in the future? |

| | Questions for Parent Focus Group Discussions |
|---|---|
| ***Welcome*** | (Introduce yourself and send the Sign-In Sheet with a few quick questions about demographics (age, gender, class, number of children) around the group while you are introducing the focus group).<br>• Who we are and what we're trying to do<br>• What will be done with this information<br>• Why we asked you to participate |
| ***Introduction*** | 1.Have your children been given netbooks by the school?<br>▪ For how long have they had netbooks?<br>• Do your children bring their netbooks home?<br>▪ If yes, for what purposes do they use them?<br>▪ Do you help them use netbook at home? |
| ***Students' learning*** | 1. Have you observed any changes in your children's attitude to studies since their class joined the 1:1 program? If yes, what were the changes?<br>2. How would you evaluate the impact of netbook usage on your children's studies?<br>3. How does the 1:1 program impact your children's learning process?<br>4. Do you think the program has any noticeable impact on your children's education? If yes, what kind of impact is it?<br>5. Would you want your children to use netbooks at school in the future too? Please, state briefly your reasons.<br>6. How do you evaluate the ICT skills of your children after joining the 1:1 program?<br>7. What can you say about your children's typing skills? Do you think they need typing classes at school? |

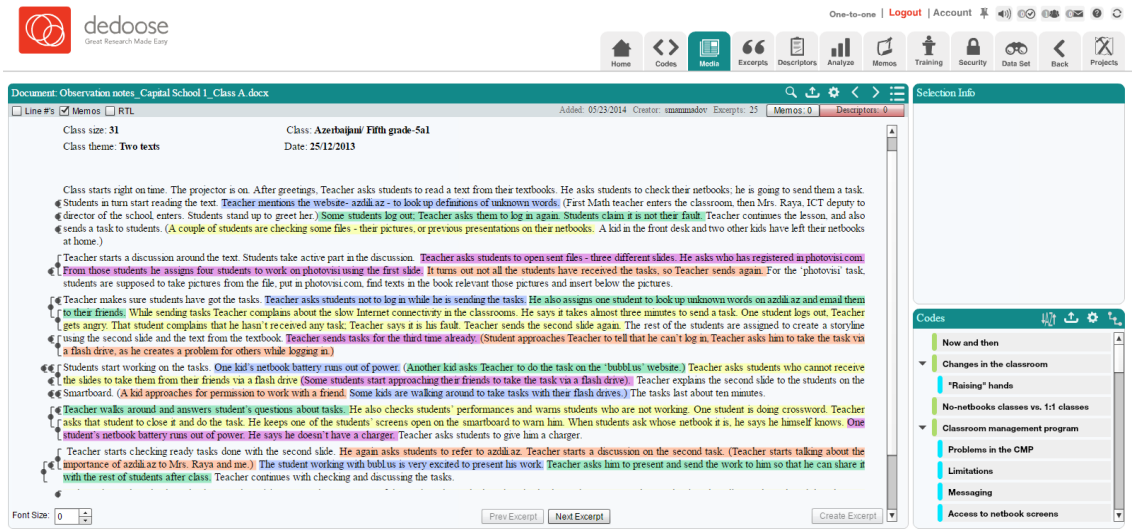
| | |
|---|---|
| ***Students' self development*** | 1. How does 1:1 program impact the achievement level of your children in their studies?<br><br>2. Have you noticed any increase in your children's interests in their studies?<br><br>3. What is the level of your children's involvement in studies now? How can you describe their preparation process for classes?<br><br>4. How independent are they in using netbooks?<br><br>5. How often do they ask for help? Both technical and homework related. |
| ***Final Remarks*** | 1. Would you want your children to use e-books in the future?<br>2. Do you have any concerns about your children's use of netbooks at schools?<br>3. Do you believe in the future of the program?<br>4. Do you have anything to add to today's discussion? Are there any other issues that were not covered in our discussion? |

## 8.12 Appendix 12: Several memos

| | |
|---|---|
| ***ICT and curriculum*** | As I observe the classes I see teachers are trying to meet the curriculum standards and use the one-to-one programme at the same time. I know that the existing curriculum does not require teachers to use computers for instruction or integrate technology into their teaching methods. So the computer usage for instruction seems to be going by inertia, i.e. teachers use computers because they have been provided with them. In this context, it seems that integrating one-to-one programme and meeting curriculum standards has become two diverse pursuits for teachers. I realize how important it is to incorporate ICT into curriculum that would facilitate the process of using technology for instruction and help teachers conduct more fruitful classes. |
| ***After the first analysis of the data*** | Using 'helicopter view' approach to acquire a thorough general understanding of the data was certainly a good decision. At this stage, it appears that there will be quite a lot of themes and categories, and making sense of it all requires first getting the whole picture. Each emerging |

| | |
|---|---|
| | category takes my train of thought in a different direction, which complicates the analysis process. In order to sift through this large amount of gathered data, I should first conceptualize it in full and only then start identifying themes and categories. |
| ***Finding a theory*** | I did not design this study with any particular hypothesis and indeed I did not aim at testing any hypothesis. Instead I wanted to gather data and understand the factors influencing the one-to-one programme integration into teaching and learning. As initially anticipated, the gathered data turned out to be quite diverse in nature. Therefore, with this in mind, constructivist grounded theory seems to be the most suitable conceptual framework within which to fit this research. |

# 8.13 Appendix 13: Dedoose screenshot



## 8.14 Appendix 14: Most commonly and less frequently emerging codes

Code sets and their sub-codes have been highlighted.

| # | *Selected Codes* | *Frequency of Appearance* |
|---|---|---|
| *1* | Student Presentations | 83 |
| *2* | Student ICT skills | 77 |
| *3* | Classroom management program (Access to netbook screens, Limitations, Messaging, Problems in the CMP, Sending files, Time loss) | 71 |
| *4* | Internet | 63 |
| *5* | Student Interest | 69 |
| *6* | Problems (Connectivity, Netbook-related; Charging, Old, Software problems) | 67 |
| *7* | Test (Computer-based tests vs. Paper-based tests, Displaying test results, Immediate result, Practical, Songs, Test in groups, Timed tests) | 62 |
| *8* | Student Confidence | 61 |
| *9* | Homework on netbooks | 60 |
| *10* | Student Assistance | 59 |
| *11* | Research | 56 |
| *12* | Website use (Azdili.az, Wikipedia, YouTube, Web2tools, Ministry websites, Skype, Search engines | 56 |
| *13* | Netbooks vs. Textbooks/Books | 53 |

| | | |
|---|---|---|
| 14 | Student Motivation | 52 |
| 15 | Teacher motivation | 51 |
| 16 | Group work in Regional school (Competition) | 47 |
| 17 | Teacher confidence | 44 |
| 18 | Interesting | 44 |
| 19 | More Learning | 42 |
| 20 | Easy | 41 |
| 21 | No-netbooks classes vs. 1:1 classes | 40 |
| 22 | Netbooks vs. Papers/Copybooks | 40 |
| 23 | Teacher creativity | 33 |
| 24 | Teacher interest | 31 |
| 25 | Group work (Group Presentations, Assessment, Self-assessment, Group work in Regional school; Competition) | 31 |
| 26 | Now and then | 30 |
| 27 | Independent | 29 |
| 28 | Homework Preparations | 29 |
| 29 | Fast | 29 |
| 30 | Parent complaints | 27 |
| 32 | Group Presentation | 26 |
| 33 | Parents vs Teachers | 24 |
| 34 | Teacher reputation | 24 |
| 35 | Parent Concerns | 24 |
| 36 | Teacher 1:1 experience | 23 |
| 37 | PowerPoint | 21 |
| 38 | Collaboration | 20 |
| 39 | Student Comparisons | 20 |

| | | |
|---|---|---|
| 40 | Personal Device vs. School Netbooks | 19 |
| 41 | Student Suggestions | 19 |
| 42 | Teacher Presentation | 19 |
| 43 | Pair work (Pair work because of netbook problems, Assessment) | 18 |
| 44 | Student recommendations | 18 |
| 45 | Teacher e-resources | 18 |
| 46 | Teacher Frustration | 18 |
| 47 | Teacher ICT experience | 18 |
| 48 | Teacher Suggestions | 17 |
| 49 | Tablets | 16 |
| 50 | Teacher workload | 16 |
| 51 | Classroom activities (Changes, Group work, Pair work, New classroom activities, Interesting) | 16 |
| 52 | Teacher creativity | 16 |
| 53 | New classroom activities (Crossword, -vocabularies, Social Network use) | 16 |
| 54 | Parent restrictions | 16 |
| 55 | Regional School now and the previous year (Better with netbooks) | 15 |
| 56 | Typing vs. handwriting | 15 |
| 57 | Student Development | 15 |
| 58 | Problems in Classroom observations (Connectivity, Charging) | 15 |
| 59 | Presentations | 14 |
| 60 | Advantages | 14 |
| 61 | Teacher 1:1 Training | 13 |
| 62 | Assistance in Classroom Observations (Assistance among | 13 |

| | | |
|---|---|---|
| | students, Student Assistance, Teacher Assistance) | |
| 63 | Parent Interest | 13 |
| 64 | Teacher assistance | 12 |
| 65 | Distraction | 12 |
| 66 | School _Interesting | 11 |
| 67 | Student health concerns | 11 |
| 68 | More learning in Groups | 10 |
| 69 | Group work in Classroom Observations (Group work Assessment, Group work due to netbook problems) | 9 |
| 70 | 1:1 classes with curriculum | 9 |
| 71 | Challenges | 8 |
| 72 | Sharing work | 8 |
| 73 | Changes in the classroom (Raising hands) | 7 |
| 74 | Competition | 7 |
| 75 | Archiving | 7 |
| 76 | Teacher complaints | 6 |
| 77 | Parent Support | 6 |
| 78 | Parent comparisons | 6 |
| 79 | Anytime anywhere | 5 |
| 80 | Teacher Initiative | 5 |
| 81 | Teaching Method | 5 |
| 82 | Parent Suggestions | 5 |

## 8.15 Appendix 15: Selected most co-occurring codes

| # | *Selected co-occurring codes* | *Frequency of co-occurrence* |
|---|---|---|
| *1* | Student Motivation - Student Interest | 38 |
| *2* | Student Confidence - Student ICT skills | 37 |
| *3* | Research - Internet | 30 |
| *4* | Teacher Motivation - Teacher Interest | 28 |
| *5* | Teacher reputation - Teacher confidence | 24 |
| *6* | Improvement - Student ICT skills | 16 |
| *7* | Teacher Motivation - Teacher Confidence | 16 |
| *8* | Group presentation - group work | 16 |
| *9* | Limitations- Classroom Management Program | 15 |
| *10* | Fast - Easy | 15 |
| *11* | Teacher Motivation - Teacher Creativity | 14 |
| *12* | Parents vs Teachers - Parent concerns | 14 |
| *13* | Teacher Interest - Teacher Confidence | 13 |
| *14* | Teacher reputation - Teacher Interest | 13 |
| *15* | Student Comparisons- No netbook classes vs 1:1 classes | 12 |
| *16* | Student ICT skills- Student Assistance | 11 |
| *17* | More learning – the Internet | 11 |
| *18* | Group work-Collaboration | 10 |
| *19* | Student Presentations - Research | 10 |
| *20* | Student Confidence - Student comparisons | 9 |
| *21* | Netbooks vs Papers/copybooks - Easy | 9 |
| *22* | Student Confidence - No netbook classes vs 1:1 | 8 |

| | | |
|---|---|---|
| | classes | |
| *23* | Student Presentations - Independent | 8 |
| *24* | Netbooks vs textbooks/books - Easy | 8 |
| *25* | Parent restrictions - Parent concerns | 8 |
| *26* | Netbooks vs textbooks/books - e-books | 8 |
| *27* | Better with netbooks- now and the previous year | 7 |
| *28* | Group work due to lack of netbooks - Making Presentations | 7 |
| *29* | Student Assistance- Collaboration | 7 |
| *30* | Student Assistance- ICT masters | 7 |
| *31* | Student Confidence - Website use | 7 |
| *32* | Student Interest - Research | 7 |
| *33* | Student Motivation - Website use | 7 |
| *34* | Teacher 1:1 experience - Teacher ICT experience | 7 |
| *35* | Teacher Confidence - Teacher suggestion | 7 |
| *36* | Teacher e-resources - Teacher Confidence | 7 |
| *37* | Teacher Motivation - Teacher e-resources | 7 |
| *38* | Teacher Preparedness - Teacher confidence | 7 |
| *39* | Teacher Interest - Teacher Suggestions | 7 |
| *40* | Teacher Suggestions - Teacher Reputation | 7 |
| *41* | New classroom Activities - Teacher creativity | 7 |
| *42* | Group work in the Regional school - Research | 7 |
| *43* | Netbooks vs textbooks/books - Fast | 7 |
| *44* | Better than teachers - Student ICT skills | 6 |
| *45* | Teacher Frustration - Implementation | 6 |
| *46* | Teacher 1:1 experience - Teacher frustration | 6 |
| *47* | Teacher Motivation - Teacher ICT experience | 6 |
| *48* | Teacher Workload - Teacher Confidence | 6 |

| | | |
|---|---|---|
| *49* | Netbooks vs Papers/copybooks - Fast | 6 |
| *50* | More learning - student comparisons | 6 |
| *51* | Netbooks vs textbooks/books - More learning | 6 |
| *52* | Parent complaints - Parent comparisons | 6 |
| *53* | Interesting - More learning | 6 |
| *54* | Netbooks vs Papers/copybooks - Homework on netbooks | 6 |
| *55* | anytime anywhere - No netbook classes vs. 1:1 classes | 5 |
| *56* | Student Confidence - Anytime Anywhere | 5 |
| *57* | Student Motivation - Research | 5 |
| *58* | Student Interest - Teacher Creativity | 5 |
| *59* | Teacher Workload - Teacher Reputation | 5 |
| *60* | Teacher Workload - Teacher Motivation | 5 |
| *61* | Competition - Group work in the Regional school | 5 |
| *62* | Netbooks vs. textbooks/books - Interesting | 5 |
| *63* | New classroom Activities - Teacher Motivation | 5 |
| *64* | Group work - Research | 5 |
| *65* | Easy - Research | 5 |
| *66* | Easy - \|Student Interest | 5 |
| *67* | Fast - Typing vs. Handwriting | 5 |
| *68* | Easy - Homework preparations | 5 |
| *69* | Student Interest - Web2tools | 4 |
| *70* | Student ICT skills-Research | 4 |
| *71* | Teacher Creativity - Research | 4 |
| *72* | Teacher Creativity - Teacher ICT experience | 4 |
| *73* | Teacher e-resources - Teacher ICT experience | 4 |
| *74* | Student interest - Classroom Activities | 4 |
| *75* | Group work in the Regional school - Better with | 4 |

| | | |
|---|---|---|
| | netbooks | |
| *76* | Fast - Research | 4 |
| *77* | More learning in groups - group work | 4 |
| *78* | Easy - Homework on netbooks | 4 |
| *79* | Fast - homework on netbooks | 4 |

## 8.16 Appendix 16: Categories and their codes

| Categories | | |
|---|---|---|
| **Teacher-related category (Factors describing teacher -related issues and teachers' views on the programme)** | **Student-related Category (Factors exploring students' perspectives on the programme and programme-related matters)** | **Classroom dynamics-related category (Factors explaining classroom processes and one-to-one setting)** |
| Teacher Motivation | Student Motivation | Emergence of Complementary Teaching Tools |
| Teacher Frustration | Student Assistance | Emergence of new learning tools |
| Teacher Training | Student Confidence with Technology | New type of interaction |
| Teachers being supported | Research | New classroom activities |
| Incentive vs. workload | Homework (homework on netbooks) | Group work |
| Teacher experience (teaching + 1-1) | Parent concerns | Limitations of the programme |
| New curriculum and one-to-one | Access to information anytime anywhere | Determination despite parental concern |
| Teacher ICT skills | Student Happiness | Inefficiency |