Introduction

This case study documents the results of a study which examined the impact on the quality of education of programmes which sought to train teachers in rural Mongolia to utilize information and communication technologies (ICT) effectively in the classroom. The case study also identifies key issues and makes recommendations for future research and for future ICT in Education initiatives in Mongolia.

Background

With the aim of providing Developing Member Countries with better guidance for using ICT effectively in education, the Asian Development Bank (ADB) funded a 21-month regional technical assistance (RETA) study in four countries: Bangladesh, Nepal, Mongolia, and Samoa. The RETA study researched approaches to using ICT in education, for improvements in teaching and learning that are not only successful but also feasible and sustainable given the region’s development challenges.

Titled the “Innovative Information and Communication Technology in Education and its Potential for Reducing Poverty in Asia and the Pacific Region” project, the study commenced in April 2006 and was implemented in the four countries by RTI International in partnership with iEARN-USA.

The RETA study built on existing projects in each of the four participating countries. In Mongolia the study built on two ADB-funded “e-Resource initiatives”: the ICT for Innovating Rural Education in Mongolia (IIREM) project and the Second Education Development Project (SEDP). In this context, the study as such was not an extension or follow-on for either IIREM or SEDP, but focused on strengthening and complementing investments already made, while studying the approaches and lessons learned under the existing initiatives.

Under SEDP, more than 100 schools in rural areas of the country were provided with up to six computers, some also with a printer and related accessories. Basic training in computer set-up, trouble shooting and training in informatics instruction was provided to some of the informatics teachers in those schools.

Under IIREM, 45 schools in rural areas of the country were provided with an equipment package containing at least one laptop, one LCD projector and one digital camera, and were provided with training for subject matter teachers (not informatics) in the use of the equipment, development of electronic teaching materials and basic introduction to integrating ICT into classroom teaching. IIREM also provided a set of Mongolian education software titles for subject matter teaching, professional development and teacher productivity. In cases where no electricity was available, IIREM also provided diesel generators to selected schools.

This summary case study was adapted by UNESCO, with permission, from the full research report: C. Strigel, L. Ariunaa, and S. Enkhjargal 2007. Where Desert meets Technology: Findings from ICT in Education Initiatives in Rural Schools in Mongolia – Summary of Findings. RTI International.

ADB TA6278-REG. Research Triangle Park.

RTI International is a trade name of Research Triangle Institute.

Initiatives which provide equipment and resources such as computers, digital cameras and other ICT tools, along with electronic teaching materials and training for teachers in how to utilize these tools and materials in the classroom.
Study Implementation

While there have been efforts and studies in the Asia-Pacific region to identify lessons learned regarding the use of ICT in education, no systematic approach to cataloguing drivers of effective ICT integration in classroom teaching had been done. The Mongolia study addressed this by aiming to provide an account of lessons learned, good practices and successful approaches with regard to integrating ICT into education, with specific reference to the IIREM and SEDP teacher education initiatives.

In order to define, however, what a “good” or “successful” approach constituted it was necessary to clarify if there had been any tangible, positive outcomes in terms of education quality. “The teacher” was selected as the unit of assessment, and “teaching quality” was selected as a key aspect of education quality.

The study addressed the following two main research questions:

- Are there differences on indicators of teaching quality in schools that featured an e-Resource initiative compared to schools that did not?
- Do e-Resources address specific needs or challenges of rural and remote schools?

Specifically, the study intended to identify whether the e-Resource initiatives, as they took place, triggered any differences in teaching quality or not. If yes, it would be possible to classify the e-Resource initiatives under investigation, including at least a number of their defining approaches, as having been “successful”.

Twelve schools participated in the study, including four schools that had participated in the IIREM project, four schools that had received computer equipment under SEDP and four control schools.

The aim was to compare teacher data from both IIREM and SEDP schools with data from teachers in control schools, and compare the data of participants from IIREM and SEDP schools for differences that may have been caused by the former having been exposed to ICT for a longer period of time and having received substantially more training due to their earlier participation in IIREM.

The study is unique in that it couples indicators of teaching quality with ICT-related indicators in addition to contextual aspects. This was to highlight the myriad of factors that can have an impact on the effectiveness of ICT in Education initiatives. In this sense, the study provides a more comprehensive contextual perspective to ICT integration and its relation to education quality than was formerly available.

Various activities were undertaken as part of the study. These were guided by a site assessment and need analysis, to strengthen and complement IIREM and SEDP inputs. The activities included:

- A one-week intensive training programme for teachers, training managers, and representatives from the Education and Culture Department (ECD) in August 2006.
- Moderate procurement of equipment and software for SEDP schools.
- Two-day, follow-on training interventions at each IIREM and SEDP school in the study, in October 2006.
- A four-day training course for trainers with three-day follow-on regional trainings in April 2007.

57 Ministry of Education, Culture and Science on regional level.
58 SEDP schools in the study were provided with the same equipment package that IIREM schools had: one laptop, one LCD projector, one digital camera and some self-study software on desktop applications, such as Internet browser software, word processing software and spreadsheet and presentation software.
The training courses for teachers focused on providing teachers with methodological skills on ICT integration into their classrooms and with their curricula. For training managers and ECD counterparts, the courses focused on issues of pedagogical leadership and organizational integration. SEDP and IIREM school representatives took part in the same study activities.

Following the activities, data collection was conducted in each of the twelve participating schools. The study surveyed and interviewed 57 teachers, 13 training managers, 11 principals and 125 students. In addition, focus groups were conducted with 71 parents, 70 students and 70 teachers.

To answer Research Question 1, the study investigated a number of indicator dimensions of teaching quality, including (a) teacher pedagogical support, (b) teaching practice and evaluation or assessment, (c) teacher efficacy, (d) teacher lesson planning and material production, (e) teacher collaboration, (f) teacher job satisfaction and attendance, and (g) access and use of equipment and materials.

To be able to answer Research Question 2, the study complemented outcomes for Research Question 1 with detailed ICT case studies from the participating schools.

**Study Findings**

**Findings on Research Question 1**

**Findings by Indicator Dimension**

- **Teacher Pedagogical Support.**
  Classroom observations and review of lesson plans and documentation are necessary mechanisms for providing teachers with feedback and pedagogical support. Data analysis shows that the classrooms of teachers in control schools are significantly less likely to be observed by their training managers or principals than classrooms of IIREM and SEDP teachers and, for most of them, observation does not take place more than once a year. Furthermore, control school teachers’ lesson plans and other documentation are reviewed considerably less frequently than those of the participating IIREM and SEDP teachers, and for the majority of them less than once a month. The study also found that teachers from all three groups mostly turn to their colleagues for support and guidance on specific challenges or questions they face. Data from this dimension suggests that control school teachers receive considerably less pedagogical support than their peers in schools that participated in e-Resource initiatives.

- **Teaching Practice**
  In order to gain more insight into teaching methodology and instructional practices, teachers were presented with a set of statements, some of which exemplify conventional, teacher-centred teaching methods, others that indicate a more student-centred and constructivist approach. Reviewing responses of teachers across statements indicates that there are no significant differences between teachers who participated in e-Resource initiatives and teachers who did not. These results were confirmed by responses of training managers. There are certain teaching methods in which frequency of usage considerably varies, however. For example, teachers in schools that participated in e-Resource initiatives are much more likely than their peers from control schools to let their students explain how they have gone about solving a problem. Furthermore, control school teachers require the whole class to repeat sentences that they say first more frequently than their colleagues from other schools.

---

59 Deputy principals responsible for pedagogic leadership, teacher performance evaluation and school-based in-service professional development.
• **Student Assessment**

Participating teachers report several ways of using results from student assessments. Least likely among them is using results to prepare the next lesson or to decide about student retention. A great many teachers use results to group students by ability. While differences are not significant between the three groups of teachers, control school teachers use results to a lesser extent for improving their teaching practice. More significantly, however, control school teachers feel less confident about their capacity to utilize a variety of assessment strategies, compared to their counterparts in IIREM and SEDP schools.

• **Teacher Evaluation**

Qualitative definitions of a “good teacher” by school principals do not differ very much between groups, and neither do training managers’ accounts of criteria of teacher performance evaluations. Training managers mainly state “student grades”, “getting along well with everyone” and “experience” as the three main criteria playing a role in such evaluations. Teachers in control schools, however, are more likely to state that “seniority” plays a role in teacher performance evaluations than their peers from IIREM and SEDP schools. In addition, teachers from control schools are significantly less satisfied with the procedures of teacher performance evaluation at their school than IIREM or SEDP teachers.

• **Teacher Efficacy**

As part of the study, teachers rated their efficacy on a validated set of 12 statements. The instrument captured teachers’ feedback on three subscales: efficacy in student engagement, efficacy in instructional practices, and efficacy in classroom management. Data analysis shows, that while answers to individual statements may vary between groups, participating teachers have a similar sense, overall, of how well they are able to control certain situations and difficulties in their classrooms and with their students. Therefore, there were no significant differences observed on teacher efficacy between teachers in schools which participated in e-Resource initiatives and teachers who did not.

• **Lesson Planning and Material Development.**

There are some differences to be observed in the time dedicated to lesson planning between the different groups, with IIREM teachers investing most, and SEDP teachers least of their time per week on this task. Training managers across the three groups estimate a lower level of time investment compared to teachers’ estimates. The three groups do not differ significantly on this item. They do differ significantly, however, in the amount of money they spend on the raw materials necessary to develop teaching and learning aids. IIREM and SEDP teachers spend about 30% less per month than control school teachers on items such as cardboard, paper, colours, etc. For selected control school teachers, the amount they spend may be up to a seventh of their monthly salaries. As was expected, given their participation in the project, there are also significant differences in the time teachers spend on developing electronic teaching and learning materials. Teachers who participated in e-Resource initiatives are much more likely to spend time in developing electronic teaching and learning resources than those that did not. Comparing IIREM to SEDP teachers in this regard did not yield any considerable differences.

• **Teacher Collaboration.**

Control school teachers on average spend less time working with other teachers compared to teachers who participated in e-Resource initiatives. When they do, they prefer to work on issues of lesson planning
and school events, and comparatively little on issues of teaching and learning material development. Most notably, it is significantly less common for teachers from control groups to exchange materials with each other, than teachers who participated in e-Resource initiatives. In addition, teachers who participated in these initiatives have more exchange with other schools. More than a third of control school teachers have this chance only once a year or less.

- **Teacher Job Satisfaction and Attendance.**
  Data analysis shows that there is a significant difference between teachers who participated in e-Resource initiatives and those who did not in terms of their satisfaction with their jobs. Teachers who were part of the e-Resource initiatives are more likely to agree to statements that exemplify satisfaction with their jobs than teachers in schools that were not part of e-Resource initiatives. While SEDP teachers show the highest mean score on this dimension, there were no significant differences between the IIREM and the SEDP group to be observed. Although there were hardly any differences in teachers’ self-assessment of the quality of their attendance, there was some difference in their training managers’ evaluation. Most training managers from control schools rated their teacher’s attendance worse than training managers from IIREM and SEDP schools assessed that of their teachers.

- **Teacher access and use of equipment and materials.**
  Teachers in all three school groups are able to draw on resources such as teachers’ guides and student textbooks or books in their libraries. The general availability of student textbooks and teachers’ guides seems to be appropriate across all three groups of teachers. Many of the participating teachers report problems, however, in that their students do not have their textbooks in time for the start of the school year. Principals confirmed this challenge, outlining a number of reasons and highlighting their schools’ remote locations and textbook affordability for parents as key among them. In addition, a big part of the books and science models available in all schools are not usable for teachers because they are damaged, too old, or not relevant to the curriculum.

IIREM teachers make most use of the library books, cassette recorders, televisions, computers, and education software for lesson planning, professional development, or teaching. Control schools, according to their teachers, are less well equipped, not only in terms of new media, such as computers, but also in terms of older technology, such as radio, cassette recorders, and television, as well as science models. For several of these items, however, their training managers’ replies did not confirm the lack or shortage reported by their teachers.

Furthermore, teachers in control schools tend to make less use of these tools (when known to be available) for educational purposes than their counterparts from schools that participated in e-Resource Initiatives. Triangulating results from teachers with that of their training managers and students confirms this pattern. Comparing usage between IIREM and SEDP teachers, data suggest that the latter make considerably less use of most of the items under discussion, except for the use of the digital camera to develop teaching and learning materials.

**Conclusion – Research Question 1**

In regard to Research Question 1, study outcomes indicate that there are indeed differences to be noted on dimensions of teaching quality between schools that participated in the e-Resource initiatives and schools that did not. On some dimensions, teachers from schools that participated in the e-Resource initiatives show more positive results than their peers. This is the case specifically for teacher
collaboration, teacher job satisfaction and teacher use of equipment and material. On other dimensions no significant differences could be found. These dimensions include teaching practice, teacher efficacy and teacher attendance. On none of the dimensions, however, did teachers from control schools show significantly more positive results. Our research suggests, therefore, that the e-Resource initiatives under investigation have had a positive effect on teaching quality, as assessed by this study.

Findings from ICT case studies

Outcomes for Research Question 1 suggest that the e-Resource initiatives under investigation have been successful in advancing critical aspects of teaching quality. To better understand the context in which these changes have taken place, it is important to have a clear understanding of ICT-related aspects on school level in these schools. The study therefore conducted detailed case studies in each of the participating schools to gain insight into the contextual factors that may play a role for the effective integration of ICT. In this section, summary data from the case studies in the participating schools is presented along with key dimensions of ICT integration at the school level, such as ICT infrastructure, access to ICT, purpose of use of computers, ICT-related policies and strategies on school level, access to resources and guidance on ICT and attitude to ICT.

Findings along ICT-related aspects:

- Infrastructure and ICT equipment

Electricity is a key challenge among all of the schools that are not located in the aimag\(^61\) centre. Soum\(^62\) schools have electricity only on an hourly basis, mostly from diesel generators, but also use wind and solar power. Electricity in most soum schools is available only outside school hours, in the evening.

Principals in soum control schools\(^63\) report a larger number of functioning computers, on average, than IIREM or SEDP principals. At the same time, computers in those schools are more likely to run under older operating systems. None of the schools mentioned utilizing any open source applications and the operating system and desktop applications in use are all in English and Arabic script, not in Cyrillic script.\(^64\)

The majority of schools have most of their computers situated in a computer lab, and also have at least one printer. There are more control schools in the sample that have a more “traditional” computer room set up, organizing computers in rows, facing the front. All IIREM schools have their computers organized along the wall, with the screens facing the room.

Except for one SEDP school, none of the soum schools has Internet access. In addition to the number of functioning computers, control schools are also better equipped when it comes to overhead projectors. Otherwise, however, it is clearly participation in e-Resource initiatives that allows IIREM and SEDP schools to report laptops, LCD projectors, and digital cameras in their inventory. IIREM schools are in general better equipped and feature more fax, scanner, and copy machines than participating SEDP and control schools.

---

\(^{61}\) Aimag – second biggest administrative unit of Mongolia after capital city Ulaanbaatar, similar to a “province”.

\(^{62}\) Soum – third biggest administrative unit of Mongolia, similar to a “district”.

\(^{63}\) Excluding the generally larger and better equipped aimag centre schools.

\(^{64}\) Mongolian (Khalkha Mongolian) is the dominant national language of Mongolia and its dominant script is Cyrillic orthography.
• Access to ICT tools by teachers, trainers administrators and students
  IIREM teachers mainly report using the school laptop,\textsuperscript{65} whereas SEDP teachers also make use of the computers in the computer lab (much more than their IIREM counterparts). Most responding control school teachers indicated that they don’t make use of computers at all. Those that do, tend to use a computer from the school administration. Some teachers also have a computer at home.

Training managers in IIREM schools mostly use the school laptop, whereas training managers in SEDP schools also use the computer lab and the computers that are available to the school administration. Training managers in control schools share a computer with other school administrators. Most principals have a computer in their office.

A clear majority of students from control schools have never used a computer, whereas the majority of IIREM and SEDP students clearly make use of computers, and do so mostly in the computer lab. It is apparent that more students in schools that participated in e-Resource initiatives report access to computers than students in schools that did not.

• Purpose of ICT use
  In general, there are no significant differences between the schools in the purpose for which teachers are using computers. Mainly, computer use is for student and class administration or lesson planning. IIREM teachers are more likely to make use of computers for information research than their peers. Training managers mostly use computers for school administration. Notably, training managers from IIREM and SEDP schools make use of computers for a larger variety of purposes than their control school counterparts. There are no major differences between groups in terms of how principals are using computers: mostly for school administration. Students who report using a computer, mainly tend to do so for their informatics subject.

• ICT-related policies and strategies
  There is a significant difference between schools that participated in e-Resource initiatives compared to those that did not in the existence of policies guiding teacher ICT competence. Nearly all of the IIREM and SEDP schools feature such a tool. There are also different approaches to providing incentives for teachers to utilize ICT in their teaching. Control schools tend to provide access to electricity and computers, whereas SEDP and IIREM schools offer more personalized and targeted schemes, such as salary increases and scholarship nominations. Furthermore, a large number of participating teachers think there are teacher performance evaluation criteria related to the use of ICT in the classroom in their schools. They did not mention specific criteria; rather, general guidelines that exist at their schools. Training managers interviewed pointed out that some teachers have achievements regarding ICT integration in their performance contracts\textsuperscript{66} with the school.

• Resources and guidance on ICT
  Most IIREM and SEDP teachers report receiving and utilizing resources and guidance on ICT integration. They also find support from the ECD on this issue. Control school teachers do not report many sources of guidance on this topic, or support from ECD. In fact, most control school teachers did not know where to find such guidance. Notably, nearly all IIREM and SEDP training managers feel confident about providing methodological feedback to their teachers in this area. This is significantly different to their peers from control schools, who don’t share that same confidence.

\textsuperscript{65} Laptops were provided under IIREM for IIREM schools and under this study for SEDP schools.

\textsuperscript{66} At the beginning of the school year, a contract is drawn up between every teachers and her/his school, that specifies aims and targets (both for their students, their professional development, but sometimes also for “innovative” elements or professional achievements in other form) for the year and the incentives or “bonus”, to be received upon their achievement.
Attitudes to ICT

While there are some differences to be seen on selected statements capturing teachers’ attitudes toward ICT, summative results did not yield any significant differences in this dimension. In fact, the group with the lowest mean score on this dimension is that of the SEDP teachers. Overall, however, the data did not indicate a significant difference in attitudes toward ICT by teachers who participated in e-Resource initiatives compared to teachers who did not.

Applying the same scale to training managers and principals, however, yields more differentiated results. Due to the very small sample size of these groups of respondents, these have to be considered with care. Training managers in IIREM and SEDP schools share the same results on this assessment; however, training managers from control schools show a significantly more positive attitude toward ICT than their IIREM and SEDP counterparts. Principals from control schools are the most positive in their attitude toward ICT compared to their IIREM or SEDP counterparts or any other group in the study.

On an adapted scale, a slightly more positive attitude to ICT was recorded for students whose teachers participated in e-Resource initiatives, compared to those who did not. While differences are not significant, students in IIREM and SEDP schools tend to have a more positive attitude toward ICT than their control school peers.

System-level support on ICT integration

Principals from participating schools tend to receive non-financial support regarding ICT from the soum, aimag, or state, mostly in form of training for themselves or their staff. There are no significant differences between groups of schools on this item. In addition, most participating principals stated that they have an opportunity to express their views on ICT (e.g. on access issues and integration issues) at least on a regional level, e.g. during general principals’ and teachers’ meetings.

ICT financing, servicing and procurement

Data does not indicate a clear relationship between expenditures for equipment maintenance and servicing and group membership. Except for two IIREM schools, all participating schools make explicit budget allocations for this item. The IIREM aimag centre school, being the largest, most affluent and best equipped in the region, shows the largest expenditures on this item. In terms of percent of the annual school budget, the control school in the aimag centre spends the least, even less than any of the soum schools that make budget allocations. Among soum schools, SEDP schools spend the most money on this item in absolute terms. At the same time, it is the control schools that allocate the highest percentage of their annual school budget. With information from only one IIREM soum school, however, results of the data analysis are not fully conclusive.

In terms of decision-making on procurement of new equipment, there are considerable differences between schools that took part in e-Resource initiatives and schools that did not. In both, IIREM and SEDP schools, the decisions regarding ICT procurement is made jointly by school management and teachers, and often on the teachers’ initiative. In all control schools, procurement decisions rest with the school principal.

Findings on Research Question 2

Complementing findings and data from Research Question 1 and the ICT Case Studies, targeted questions were integrated into the interviews with principals, training managers, and teachers to answer Research Question 2: “Do e-Resources address specific needs or challenges of rural and remote schools?”
The study aimed to identify what challenges schools face due to their geographic location in the country, in delivering high quality education. Conclusions for this research question were then made on the basis of outcomes from Research Question 1 and what was found in terms of the ICT-related context of each of the participating schools.

Outcomes of data analysis indicate that there are common challenges participating schools and teachers are facing. These include the following:

- Lack of information and communication
- Lack of electricity and appropriate infrastructure
- Lack of teaching and learning materials
- Inadequate learning environment
- Insufficient professional staff and teacher capacity
- Lack of community and parent engagement

In the following sections, the potential of ICT to address specific challenges in rural schools is discussed in the context of the schools under investigation, drawing on data from Research Question 1 and the ICT Case Studies.

- Lack of information and communication and lack of electricity and infrastructure. Some of the communication and information access challenges are a result of the fact that it is very difficult for teachers and school managers from some soums to attend any in-service training programmes, conferences, or other events. These challenges also limit the opportunity for regular professional exchange with peers. In most soum schools, there is only one teacher per subject. While this teacher may be able to draw on other teachers’ support for some areas, such as general methodological issues, possibilities of subject-specific didactical and pedagogic deliberations, or peer-to-peer capacity building, are extremely limited. This does not help to alleviate issues of teacher capacity, especially in areas of didactical skills.

Internet access, repeatedly requested by teachers and school managers in the study, would alleviate some of these issues. It is not yet available in most of the soums, however. Practices established under IIREM, where teachers would develop emails offline, and then connect the laptop to the Internet in the aimag centre every two to three weeks, have, as study outcomes show, made a difference to teachers already. While not regular or on a daily basis, the IIREM teacher email network alleviated some of the isolation soum teachers are experiencing, and increased opportunities for professional exchange and peer-to-peer capacity building.

- Lack of teaching and learning materials
The lack of materials and resources for teaching was a key challenge raised by school principals, training managers, and teachers. For teachers, the cost of the raw materials to develop teaching and learning aids is a barrier and contributes to a limited use of visual aids and teaching and learning materials other than teacher guides and textbooks in classrooms.

In this environment, the CD ROMs provided to teachers, including graphics, pictures, texts, and a myriad of other resources, have shown to be of significant value. Teachers have capitalized on the ability to take pictures and video-clips with the digital camera and engaged in preparing their own electronic teaching and learning materials and have shared those materials. This did not require any financial investment, other than time, but greatly diversified their information sources and enhanced their classroom teaching practice.
Inadequate learning environment

It is questionable if e-Resource initiatives can have much impact on the overall learning environment, unless accompanied by structural changes. Classrooms are not secured and electricity outlets are faulty, leading, together with the challenges of generator performance, to equipment damage. In many schools, sand and dust are an additional problem, especially in soums located in the south of Bayankhongor, at the northern Gobi Desert. Under IIREM, one room in each school was rehabilitated and equipped with tables, chairs, bookshelves, and other items in order to provide an adequate environment. In some IIREM schools these rooms now function as the teachers’ room, a classroom, or the computer lab. Calibrated to the specific equipment package provided, such small structural improvements may be required to protect equipment and ensure its operation. The many broken computers in nearly all of the participating schools are a clear indicator for the gravity of this issue. While e-Resource initiatives don’t address some of the challenges that schools are facing in regard to their larger environment, appropriately designed e-Resource initiatives need to include some basic rehabilitation, if only for the sake of equipment and project sustainability, and in this will make a small, but noticeable difference for these schools.

Insufficient professional staff and teacher capacity

Our data suggest that the opportunity for professional exchange with peers, facilitated through email networking, and augmented through the opportunity to share teaching and learning resources, has already had a positive effect on teachers’ collaboration and, according to participants, on their methodological skills. In focus groups, teachers also report that they feel their subject matter knowledge has increased. Appropriately designed e-Resource initiatives, therefore, following the example the study has set, that focus on teachers’ didactic and pedagogical capacity in regard to ICT integration, rather than their computer skills, can have a positive effect on general teacher capacity.

Lack of community and parent engagement.

As in other whole school reform approaches, and ICT integration certainly counts as a similar change, community and parent engagement are critical for success. Such engagement, as current knowledge about education indicates, is also a key dimension in education quality. E-Resource initiatives, if properly designed, should therefore take this into account and explore ways to engage parents and communities in support of schools’ development objectives. Specific efforts were not made under IIREM or under this study to include the community (beyond holding informational meetings at the outset of the IIREM project).

Focus group discussions with parents indicate that across all three groups, parents are concerned about their children’s schools’ capacity to appropriately equip their students with informatics skills. According to those parents, such skills are critical in the “21st century” and in “modern society”, and they don’t want their children to lag behind. It is obvious that parents have a rather limited perspective regarding the use of ICT in education. Their perspective is mainly limited to the informatics subject that provides computer skills to their children. At the same time, their demand and interest do drive ICT development at the schools, with principals reporting receiving frequent enquiries and significant demand.

Student Motivation

According to participating principals, student motivation and engagement seem to be a challenge for schools, especially in the absence of appropriate and stimulating learning environments.

---

67 The study equipment to SEDP schools was all provided with protective bags for this purpose.
68 See full country report for reference.
The dire situation not only in the schools, but also in the dorms, seems to contribute to students’ disengagement in their own learning. Focus groups with students clearly showed that students are very excited about their teachers’ use of ICT in classrooms and about having the chance to access the technology themselves. For many, computers and especially computer games open a new door into a world hitherto unknown. Teachers, in focus groups and discussion, were unanimous in their affirmation that using technology in the classroom increases student motivation.

**Conclusion - Research Question 2**

Study outcomes indicate that e-Resources can address challenges such as lack of teaching and learning materials and lack of information. The value of e-Resources, in the form of providing schools with electronic teaching and learning aids and educational software, is limited, however.

Data clearly indicate that while all the schools have such resources, they need to be accompanied by:
- familiarization with the resources (among teachers)
- training of teachers in the use of a computer
- access to appropriate equipment for their use
- models of their integration with instructional practices

Without these associated requirements, the resources are not utilized as tools for teaching and learning in the classroom, or as tools for self-study and professional development.

Our data suggest that e-Resource initiatives, if designed appropriately, have the potential to address some of the challenges that schools in remote areas of Mongolia face. These include aspects of teacher capacity, the learning environment, and student motivation.

**Drivers and Barriers to effective use of ICT in education**

Study outcomes indicate that there are a number of drivers and barriers to effective use of ICT in education, specifically the use of ICT by teachers to enhance learning. Drivers and barriers exist at the teacher-level, school-level, and system-level. Table 1, below, outlines the drivers and barriers to effective ICT integration into classroom teaching, as identified in the study.
Table 1. Drivers and Barriers to Effective ICT Integration into Classroom Teaching

<table>
<thead>
<tr>
<th>Teacher-level</th>
<th>Drivers</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Motivation to change and learn</td>
<td>Aversion to change</td>
</tr>
<tr>
<td></td>
<td>Advanced methodological skills</td>
<td>Lack of encouragement for innovation</td>
</tr>
<tr>
<td></td>
<td>Ability to translate theoretical instructional models into active student-centred teaching practices</td>
<td>Lack of methodological skills</td>
</tr>
<tr>
<td></td>
<td>Basic computer skills</td>
<td>Lack of basic computer skills</td>
</tr>
<tr>
<td></td>
<td>Positive attitude to ICT</td>
<td>Lack of clarity and information on potential of ICT for personal productivity and to enhance teaching and learning</td>
</tr>
<tr>
<td></td>
<td>Encouragement and support for innovation by school management</td>
<td>Lack of appropriate professional development programmes that take teachers’ existing skills and experiences into account</td>
</tr>
<tr>
<td></td>
<td>Confidence to use technology in didactically appropriate ways</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ongoing access to resources, guidance and models for appropriate instructional ICT integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capacity to develop locally-appropriate content</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexibility in the allocation of some curriculum hours and topics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ongoing pedagogical support from colleagues and school management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alignment between student assessment, instructional practice and teacher evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incentives for professional development and innovation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integrated, ongoing professional development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pedagogical leadership and follow up on ICT integration by school management (e.g. via classroom observations and in-school professional development)</td>
<td></td>
</tr>
</tbody>
</table>
### School-level

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity during school hours</td>
<td>Lack of electricity</td>
</tr>
<tr>
<td>Access to functioning equipment appropriate for educational objectives</td>
<td>Absence and poor quality of ICT infrastructure</td>
</tr>
<tr>
<td>Availability of locally appropriate content, suitable and easy to integrate with curriculum and instructional practice</td>
<td>Limited access to ICT equipment</td>
</tr>
<tr>
<td>School management with experience in whole school reform. Policies on teacher ICT competencies and strategies/planning for professional development and their follow-up</td>
<td>ICT infrastructure not aligned with educational objectives (e.g. only computer labs and no computers in classrooms or mobile units)</td>
</tr>
<tr>
<td>Incentive structures for teacher innovation and engagement, that align with policies and teacher evaluation practices</td>
<td>Lack of Internet</td>
</tr>
<tr>
<td>School management with ability for strategic planning and financial management</td>
<td>Lack of change management capacity</td>
</tr>
<tr>
<td>Participatory planning and decision making regarding ICT</td>
<td>Lack of integration of ICT with school development strategies</td>
</tr>
<tr>
<td>Explicit use of ICT to achieve school development goals (organizational and financial integration)</td>
<td>Lack of appropriate solutions for equipment maintenance and servicing</td>
</tr>
<tr>
<td>Opportunities for regular collaboration among teachers</td>
<td>High teacher-student ratios</td>
</tr>
<tr>
<td>Opportunities for exchange with other schools</td>
<td>Lack of information and communication to parents and the community about role of ICT in achieving educational objectives</td>
</tr>
<tr>
<td>A critical mass of champion teachers that promote ICT integration and lead exploration of innovative practices</td>
<td>No specific ICT champion(s) and resource persons at school to promote ICT integration and innovation</td>
</tr>
</tbody>
</table>

### System-level

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible elements in formal education system (e.g. in regard to some portion of the curriculum hours)</td>
<td>Rigid curriculum structures</td>
</tr>
<tr>
<td>Alignment of ICT in education policies with national education development strategies (on all levels)</td>
<td>Rigid student assessment structures</td>
</tr>
<tr>
<td>Ownership and awareness by regional/national government agencies (e.g. ECD)</td>
<td>Rigid teacher evaluation approaches</td>
</tr>
<tr>
<td>Consultations and forums for teachers and school managers on regional level</td>
<td>Rigid school budget structures</td>
</tr>
<tr>
<td>Certain flexibilities in regard to utilization of school budgets and funds</td>
<td>Uniform, per-capita funding structures for schools, without adjustments for distinct challenges of schools in rural locations</td>
</tr>
<tr>
<td>System level support, starting on school level, via regional government and to national level</td>
<td>Lack of clarity on role of ICT to achieve educational objectives</td>
</tr>
<tr>
<td>Well-documented pilot experiences that provide the anchor for future initiatives</td>
<td></td>
</tr>
<tr>
<td>Information based decision making regarding role of ICT in education</td>
<td></td>
</tr>
</tbody>
</table>
Recommendations for Future Research

Given the small sample size and that some of the issues under investigation were explored for the first time in such a framework, it is recommended that future research focus on the following:

- Longitudinal research that would shed insight into the impact of the ICT initiatives under investigation on student achievement.
- Complement indicative findings on teaching quality of this study with data from standardized regional and state-level teacher assessments and school-level performance evaluations.
- Conduct in-depth classroom observations to identify and document advanced models of ICT integration. Findings should then be integrated into the design of locally appropriate professional development programmes.
- Complement the dimensions in this study with further aspects hitherto not considered, such as:
  - Specific personnel dynamics in schools that may influence teacher’s attitudes and practices.
  - Informal encouragement mechanisms and support practices of school management to encourage innovation.
  - Role of actors such as the community and local government to foster innovation at the school level.
  - Aspects of ECD capacity to support school’s reform process.

Investigate in more detail a possible correlation between ICT maturity of a school and its teachers with increased access to ICT by students, without any activities, such as training, having directly targeted this group.

Recommendations for Future Initiatives

The study raised a number of recommendations for future activities, either directly derived from responses study participants, or deduced from study findings and outcomes. A few are highlighted below.

It is recommended to build on the momentum which pilot initiatives such as IIREM have generated, in framing ICT integration as a discussion about educational development objectives, with specific pedagogic goals, rather than as a discussion about technology.

Basic computer skills are critical to build the necessary familiarization and rapport between teachers and technology, a pre-condition for ICT use in classroom teaching and other purposes. Integrating computer skills training from the outset with explicit models for ICT use in teaching seems to be more appropriate however, than isolating computer skills training from teachers’ daily needs and practices. Professional development, in formal pre-service and in-service training programmes, needs to focus more deeply on the relationship between pedagogy, curriculum and technology. Existing policies for teacher pre- and in-service training should be reviewed to better meet the growing needs and demands in this field.

For integration of ICT and instructional practices, appropriate models and samples to learn from are necessary. Thus, it is recommended to conduct classroom observations and teaching simulations and document teaching practice with ICT. This can help teachers translate innovative ideas into (instructional) practice and speed up effective technology adoption.

Student assessment and teacher evaluation approaches need to be reviewed to capture issues of ICT integration. Broader definitions of student achievement, beyond grades and results on standardized student assessments, are needed to fully capture the impact ICT may have on areas such as life skills, student creativity and higher-order thinking skills.
Future initiatives need to acknowledge and strengthen the role of training managers as pedagogical leaders at their schools. Training managers need to have the capacity to function as role model for their teachers, as trainers on ICT integration, but also have the capacity to link elements of student assessment, instructional practice and teacher evaluation.

Future initiatives also need to acknowledge and strengthen the role of the ECDs as support and reference units in the education system. As with training managers, ECD staff, especially methodologists, should receive more support and professional development to support training managers and teachers in linking pedagogy, curriculum and technology.

Future initiatives may build on the positive experiences with the mentor school model made under IIREM. Such an approach can alleviate some of the challenges rural schools face, such as not having access to the Internet and an overall lack of information and teaching and learning materials. Mentor schools in urban areas, in which some of the environmental factors and school-level barriers (such as lack of electricity and Internet) are not as apparent as in the rural soum schools, should therefore better positioned to explore innovative and new instructional practices, integrate ICT, and provide their peers in the more remote schools with ideas, examples, and lessons learned. This way, collaborative capacity building can take place.

Furthermore, future initiatives should learn from and promote equipment packages such as the one provided under IIREM (a package consisting of one laptop, one LCD projector, and one digital camera), that have been proven to affect teaching quality.

It is recommended to provide schools with regular networking opportunities around ICT in Education issues, so that teachers in remote schools have opportunities to share knowledge and skills with other schools – another means to raise teacher capacity. At the same time, such exchanges between school managers are equally critical to promote exchange of ideas and strategies for organizational integration.

More appropriate solutions for hardware maintenance and servicing need to be found, especially in soum schools. Given an increased focus on Technical and Vocational Education and Training in upcoming education reform approaches, such as under the Third Education Development Project and the proposed activities under the Millennium Challenge Corporation, may provide a possible opportunity for public-public partnership in this regard.

A specific recommendation is to strengthen investments already made and to maximize existing capacity in IIREM schools and the SEDP schools that participated in this study. It would be critical to provide these schools with one or two more laptop computers each to increase access to technologies for teachers, so that use of ICT in teaching can take place more frequently. This would allow these schools to continue being frontrunners in innovating teaching practice with ICT.

Finally, a national-level ICT in Education portal in Mongolia, where teachers can upload their own e-materials for exchanging with others and download necessary e-Resources and tools for their own use, could further promote information and material exchange and sharing of best practices on effective ICT integration into classroom teaching.


70 Data indicate that the frequency of use of computer in the classroom is restricted mostly by the availability of the laptops (with one laptop per school being shared by at least some 9-10 teachers), rather than by teacher motivation. International studies indicate that, “...pupils and teachers who use ICT the most are also the ones who experience the greatest impact.” (Ramboll Management. 2006. E-Learning Nordic. Impact of ICT on education. Copenhagen. 9)