Contributions of Technology and Teacher Training to Education Reform: Evaluation of the World Links Arab Region Program in Jordan

A Report to World Links Arab Region
Amman, Jordan

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Executive Summary

In 2003, World Links Arab Region (WLAR) launched a program in Jordan to train teachers in support of education reform in the country. The goals of the program were to integrate technology into the curriculum, introduce student-centered teaching and learning strategies into classrooms, provide students with new knowledge and skills needed to participate in the information age, and contribute to the Ministry of Education's Education Reform for the Knowledge Economy. Since its launch, World Links in Jordan has trained more than 1,500 teachers in more than 400 schools.

This evaluation of the World Links program consists of two components: 1) a quantitative component based on the surveys of self-reported practices and opinions of 256 principals, 381 teachers, and 375 students from 125 schools that participated in the World Links program and 131 schools that did not; 2) a qualitative component based on field site visits of 6 World Links schools, that included classroom observations and interviews with principals, teachers, and students. The goals of the evaluation are to examine the extent to which components of the WLAR program were implemented in classrooms; determine the impact that these components had on teachers, students, and schools; and provide WLAR staff and policymakers with recommendations about the program's future.

Overall assessment. Results from the surveys of World Links and Non-World Links teachers, principals, and students, and those from the case studies of six World Links schools make it clear that the World Links Arab Region program in Jordan has been successful in meeting its goals. World Links teachers, principals, and students all agree that the program was effective and they recommend it to others. In addition, teachers and principals agree that the program contributes to the Ministry's Education Reform for the Knowledge Economy. They also rate the various components of the program as effective. In particular, World Links teachers rate the training overall and each of its components as effective.

Implementation. As a result of World Links training, a number of innovative teaching and learning practices were integrated into the classrooms of World Links teachers. According to self-reports of teachers, principals, and students, World Links teachers integrated a variety of software applications, search engines, and the Internet into their teaching, far more so than Non-World Links teachers. Furthermore, World Links teachers had their students work with other students in their class on collaborative projects that were important to them, in which they searched for information on a topic, wrote project reports, and used graphics. They did this much more so than did Non-World Links teachers. Also, World Links teachers more often

collaborated with other teachers than did Non-World Links teachers and they were far more likely to use ICT to communicate with other teachers.

Impact on teachers. Consequently, World Links teachers and principals felt that the program improved teachers' ability to integrate technology into the curriculum and use a variety of ICT solutions, such as applications software, the Internet, and email. They were much more able to use student groups, use collaborative projects, and design project work. They also reported that the program increased their motivation to continuously learn and improved their attitudes and excitement about teaching and technology. Principals and teachers in the case studies also reported increased teacher skills and motivation as a result of participation in the program.

Impact on students. In addition to impacting teacher classroom practices, the ratings of teachers, students, and principals indicate that World Links teachers had a significant impact on a range of student outcomes, although the impacts were less pronounced than those on teachers. Many of the ratings of teachers and principals were higher than those of Non-World Links teachers. These outcomes included increased technology skills and the ability to write reports, as well as students' ability to give oral presentations in front of class, and their leadership and teamwork skills. These outcomes were confirmed and qualified by classroom observations and interviews related to the case studies of World Links schools.

Impact on schools. Survey respondents agreed that the program increased the principal's knowledge and understanding of the role of ICT in teaching and learning and increased collaboration within the school. But the impact on other teachers was modest. The case studies, too, confirm that it was rare that the program impacted the technological and pedagogical practices of non-participating teachers in World Links schools.

Recommendations to WLAR. While all indications are that the World Links program has been successful in meeting its goals, World Links teachers and Principals made recommendations that would improve the program. Additional effort is needed by WLAR to provide follow up mentorship and support of World Links teachers. Specific strategies are needed to leverage teacher participation in the program to increase their impact on non-participating teachers in their schools—this outcome does not flow automatically. And both teachers and principals cite the need for released time that would aid World Links teachers.

Recommendations to policymakers. The success of the World Links program indicate that policymakers would be justified in continuing their support of the program and that additional investments would allow the program to implement strategies that likely would result in increased implementation and impact. The positive impact of the program on student learning, according to self reports of principals, teachers, and students, justify additional research that would directly measure the impact on learning. Results also make it clear that teachers, students, and schools in Jordan would benefit from increased investment in ICT infrastructure, particularly high-speed networking.

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Introduction

In the late 1990's, considerable international attention was focused on reducing the "digital divide" between developed and developing countries. Multinational organizations (UNDP, 1999; World Bank, 1997; OECD, 2000) and Heads of State (G8 Heads of State, 2000) recognized the importance of information and communications technologies (ICT) to the economic and social advancement of developing countries.

More recently, this international concern has shifted from a focus on merely bridging the digital divide to the specific ways that ICT can be used to support development within a global economy that has become increasingly dependent on the international flow of goods and services and on the invention, dissemination, and use of new knowledge. This concern has become particularly focused on role that ICT can play in modernizing the education systems of developing countries (UNDP, 2001; UNIDO, 2003; World Bank, 2003). More specifically, the application of ICT has come to be seen as an important component of education reform that aligns changes in teacher training, curriculum, pedagogical practices, and assessment to provide students with the skills and knowledge that they need to live within the global community and prosper within the global economy (Kozma, 2005).

The term "21st century skills" is sometimes used to refer to the abilities to think critically, to collaborate, to communicate, to solve problems, to create, to manage information, to apply technology, and to continue to learn. Education reform efforts are seeking to incorporate these new skills into the curricula (Resnick & Wirt, 1996; ISTE, 2000; Partnership for the 21st Century, 2003, 2005). Reform efforts are also incorporating "student-centered" pedagogical practices that actively engage students in their own learning, practices such as the use of collaborative projects in which students work together to solve complex problems that are personally meaningful and relevant to the real world (Bransford, Brown, & Cocking, 2000; Blumenfeld, Kempler, & Krajcik, 2006; Krajcik & Blumenfeld, 2006). Assessment is also an important part of this change. Assessments are moving from examinations that measure the recall of facts to portfolios of performance tasks that measure complex cognitive skills and that are embedded into the every day activities of the classroom (Pellegrino, Chudowsky, & Glaser, 2001; Mislevy, et al., 2003). Teacher training is a key element to education reform, particularly ongoing teacher activities that engage teachers in a community of professional practice and development (McLaughlin & Talbert 2001; Bransford, Darling-Hammond, & Page, 2005; Fishman & Davis, 2006). Finally, ICT can be used to support these changes by providing students and teachers with a variety of multimedia, email, web design tools, simulations, and

course management tools that they can use to support deep understanding, collaboration, project planning, and knowledge creation (Means, B. Penuel, W., & Padilla, C., 2001; Schofield & Davidson, 2002; Kozma, 2003; Scardamalia & Bereiter, 2006; Schofield, 2006).

World Links Arab Region (WLAR) has instituted a program of teacher training and ICT-based pedagogical practices that draws on these principals to contribute to education reform in Jordan. While there is clearly much promise and hope that technology can improve education systems, there is currently a lack of information that policymakers can use on the consequences or impact of such programs on educational goals (Wagner, 2005). This study responds to that need. It examines the implementation of the WLAR program and its impact on teachers, students, and schools. The study is conducted in the context of national education reform in Jordan and is intended to provide program staff and policymakers in Jordan with information that they can use to improve the program and assess its merits.

Education Reform in Jordan

Jordan has a population of 5.4 million and an economy that generated $11.5 billion in 2004 (World Bank, 2006). Between 1975 and 2003 the average annual growth in per capita GDP in Jordan was only .3%, according to the UNDP (2006).

In 2001, the Government of Jordan under the leadership of His Majesty King Abdullah II created a program of economic and social transformation to develop high value-added sectors and to establish a knowledge economy. This policy goal has been incorporated into the Nation's economic and social development plans. The Jordanian National Economic and Social Development Plan (NESDP) for 2003-2006 set an annual economic growth target of 6% for the country. The plan envisions the creation of a knowledge economy as the basis for sustained economic growth and an improved standard of living for the people of the country. The development of Jordan's human resources is central to achieving its goals. The NESDP articulates a vision of the future of Jordan in which a higher quality of education arms students with specialized skills and expertise in various fields of knowledge to fulfill the needs of society and contribute to sustainable economic and social development.

A program of Education Reform for the Knowledge Economy (ERfKE) was established in 2003 in support of Jordan's economic and social goals. ERfKE is designed to help modernize the Nation's economy and society through the application of information and communication technology in all areas of learning and work. The plan lists four components: governance and administrative reform, the transformation of educational practices, the development of quality physical environments, and the promotion of early childhood education. The transformation of educational practices is intended to achieve learning outcomes that are relevant to the knowledge economy by changing the curriculum and learning assessment, by providing resources to support effective learning, and through professional development and training of teachers. Changes in curriculum and assessment involve the development of materials and electronic content that emphasize collaboration, critical thinking, creative expression, and decision making skills used in real world contexts. The development of resources includes the improvement of physical

learning environments, the deployment of computers, and the distribution of new learning materials. Teacher training includes the development of teachers' abilities to integrate into the curriculum ICT and pedagogical methodologies that support, facilitate, and encourage student learning. In support of different components of this plan a number of education reform programs have been launched in Jordan, including ERfKE Training, the International Computer Drivers License (ICDL), Intel Teach, and the World Links Arab Region program in Jordan.

World Links Arab Region in Jordan

World Links Arab Region (WLAR; http://www.wlar.org/), headquartered in Amman, Jordan, is the Arab holding of World Links (http://www.world-links.org/), an organization originally constituted by the World Bank as the World Links for Development program and now an independent, international NGO, headquartered in Washington, D.C. WLAR was established to harness global knowledge and ensure its adaptation to local culture and needs in the Arab region. More specifically, the organization provides specifically-tailored programs to improve educational outcomes, economic opportunities and global understanding for youth in the Arab region through the use of technology and the Internet. WLAR trains teachers on how to integrate technology and participatory learning techniques into the classroom for improved educational results. A high-level advisory council was constituted to guide and facilitate the work of WLAR. The Advisory Council is composed of HM Queen Rania of Jordan, the First Lady of Syria, HE Asma Assad, HH Princess Zahra Aga Khan, HE Bahia Hariri, Mrs. Lubna Olayan and Mrs. Elaine Wolfensohn. The Council also serves as an additional contact point for interested government agencies and prominent private sector individuals who might wish to support World Links. Support for World Links Arab Region has come from prominent organizations, such as PepsiCo International, Hewlett Packard, Consolidated Contractors Company (CCC) and the Al-Oun Foundation /SEDCO.

In January 2003, World Links, InfoDev, and the World Economic Forum approved a grant to World Links who in turn designated it to its counterpart, World Links Arab Region, to undertake an extensive teacher training program. Subsequently WLAR launched its first pilot program in Jordan late in 2003 which sought to train 400 teachers in 100 schools throughout the country. During its first year and a half, the program actually trained 540 teachers in over 150 schools, according to WLAR sources. This success led to the first expansion of the program to double its scale. The Jordan Expansion program was launched in February 2005 to train 1,000 teachers in 300 schools throughout the Kingdom during the 2005-2006 school year. The expansion program is co-funded by World Links Arab Region and the Ministry of Education. Upon the request of H.E the Minister of Education, WLAR led in the development of training materials aimed at integrating EduWave, the Ministry of Education's first intranet portal, into classroom activities. World Links' teacher professional development, including EduWave training, has been accredited by the Ministry to the "First Teacher" rank.

WLAR training consists of 160 hours of instruction. In addition to training, WLAR provides participating teachers with ongoing mentoring services and online community resources and

support. The training is conducted in four phases, each 30 hours long, plus training in EduWave. Phase I is an introduction to the Internet for teaching and. Phase II focuses on tele-collaborative learning. Phase III is training on the integration of technology into the curriculum. And the topic of Phase IV is innovative pedagogy, technology, and professional. In addition, 40 hours of training in EduWave, required by the Ministry of Education, were added to the WLAR training. EduWave training was given as a separate 40 hours training for the first group of trainees (2003–2005) and was distributed across phases I & IV for the 2005-2006 group.

EduWave is a comprehensive e-learning platform developed by Integrated Technologies Group and customized for the education system in Jordan under contract with the Ministry. The platform is an intranet-based system that consists of three components: a management system, EduWave Administrator; a set of tools for authoring e-learning materials, EduWave Author; and a personalized portal to distribute, share, and use e-learning content, EduWave Portal.

WLAR commissioned an independent evaluation of the World Links program in Jordan to determine the extent to which the goals of the program have been accomplished. This is the report of that evaluation. Interviews with WLAR staff and a review of WLAR documents identified three principal goals of the program. They are to:

- cultivate innovative teaching and learning practices that integrate ICT and student-centered approaches to teaching.
- promote the acquisition and development of new knowledge and skills to prepare Jordanian students and teachers to participate in the information age.
- contribute to the Ministry of Education's Education Reform for the Knowledge Economy.

Given these goals, the evaluation focuses on the extent to which innovative classroom practices were implemented in World Links classrooms, particularly as they compare to classrooms of teachers who did not participate in the program; the extent to which World Links teachers and students acquired new skills, particularly those skills needed to succeed in the global knowledge economy; and the extent to which the program contributed to Jordan's Education Reform for the Knowledge Economy. In addition, a goal of the evaluation is to provide WLAR staff and policymakers with information that can improve the program, its impact, and its contribution to Jordan's development.

Study Design

The design of the WLAR evaluation has two components, a quantitative one and a qualitative one. The quantitative component consists of surveys administered to principals, teachers, and students at randomly selected schools that have teachers who have participated in World Links ('World Links schools') and a randomly selected set of schools that did not have participating teachers ('Non-World Links schools'). The qualitative component included field visits to six World Links schools that consisted of one-session classroom observations and

interviews with the principal, a World Links teacher, a non-participating teacher, and students in the observed class.

The combined quantitative-qualitative design provides complementary advantages of both methodologies. The purpose of the quantitative component is to provide responses on selected questions from a representative set of schools in Jordan. The purpose of the case studies is to provide examples that illustrate findings from the more-representative quantitative analyses.

The structure of the quantitative design allows for the comparison of World Links and non-World Links schools for comparable respondents (principals, teachers, and students) on comparable self-report measures related to classroom activities, teacher practices, and student learning. Responses by principals provide information on the impact of the program on schools. In addition, principals in World Links schools were asked to comment on the teaching practices and student impact of both a participating and a non-participating teacher in the school. Many of the questions asked of principals, teachers, and students were parallel in construction. The use of parallel questions asked of multiple respondents provides a degree of confidence that can compensate for the inherently subjective nature of self-report data. That is, if the responses of World Links principals, teachers, and students all agree, there is a high level of confidence that these responses correspond to actual phenomena in the school and classroom. This confidence extends to statistically significant differences between the responses of principals, teachers, and students in World Links schools and those of principals, teachers, and students in Non-World Links schools.

Sample

For the quantitative component, participating and non-participating schools were selected as the sampling units. It was determined that 100 sets of respondents from each sample would be sufficient to drive the desired statistical analyses. Given latitude for non-respondents, 140 schools were selected from the 443 schools in Jordan that taught at grades 6 and above and had teachers who participated in the World Links program and 140 schools were randomly selected from the set of 1984 remaining schools in Jordan that that taught grades 6 and above and did not have teachers who participated in the program.

Survey data were collected early in the 2006-2007 school year. As collection of the responses progressed, the returns of participating schools lagged behind those of non-participant schools; consequently an additional 20 World Links schools were randomly selected. This resulted in the collection of responses from 125 World Links schools and 131 Non-World Links schools.

At each school, the principal received the set of surveys. He or she was asked to fill out the principal's survey and select one (in the case of a Non-World Links school) or two (in the case of a World Links school) teachers to fill out the teacher's surveys. Several of the selection criteria were identical for the two groups of teachers. For both groups, the principal was asked to select teachers who are currently teaching in the school and had taught grade six level or above during the pervious school year (2005-2006). They were also asked to pick teachers who did not teach

only students last year who were in the final grade that their school offered. Among the teachers that met these criteria, the principal was to pick one with the third longest service in the school, so that the teacher would not be the youngest, least-experienced or oldest, most-experienced teachers in the school. If more than one World Links teacher met the criterion, the principal was directed to select the third most experienced teacher among World Links teachers. Each teacher was, in turn, asked to select one student from a class that he or she had taught during the 2005-2006 school year who was still enrolled in the school. The World Links teachers were asked to select a student from a course in which they had implemented lesson plans from their World Links participation. Teachers in both groups were asked to select a student who received a grade between 80 and 85, so comparable students would be selected across samples.

Of the 256 responding schools (125 World Links schools and 131 Non-World Links schools), all 256 principals returned their surveys. Of the 381 possible teacher respondents (125 each of World Links and Non-World Links teachers at World Links schools and 131 Non-World Links teachers at Non-World Links schools), 380 turned in their surveys (one Non-World Links teachers at a World Links school did not respond). Of the same number of possible students respondents, 375 returned their surveys (missing were surveys from three World Links students and one Non-World Links student from World Links schools and one student from a Non-World Links school).

As for the qualitative component, case study schools were selected based on their availability during a particular three-week period at the end of the target school year (2005-2006). Although the schools were selected to represent a range of geographical locations and school types and although the schools were neither the 'best' of World Links schools nor the 'worst,' the schools were not considered to be typical or representative of the entire set of World Links schools. However, it was not the purpose of the qualitative component to draw inferences to the larger set of schools. Rather, the purpose was to provide details that could illustrate the statistically reliable inferences drawn from the representative schools in the quantitative component.

Instruments and Data Collection

The selection of indicators is key to determining the impact of technology on education. To understand the impact of a program, not only must a study measure the outcomes but the input and implement factors, as well (Kozma & Wagner, 2005). Measures of all of these factors were designed into the surveys of the quantitative component and the protocols of the qualitative component of this study.

The surveys for principals, teachers, and students all had a parallel structure, which consisted of two sections for Non-World participants and three sections for World participants. The survey started with questions about relevant "input" characteristics of the respondent (e.g., number of years at the school, gender, educational background, etc., for principals and teachers; grade level, gender, etc. for students). The second session asked a series of questions about the implementation of classroom activities by teachers and students that principals, teachers, and

students had observed in the target course. Questions were also designed to determine the impact that this course had on student learning. Since data were collected during the fall of the 2006-2007 school year, responses referred to activities that occurred in the classroom during the previous year. Principals in World Links schools were asked these questions in two sets: one set with reference to the selected World Links teacher in the school and the other with reference to the selected Non-World Links teacher. Questions were also asked of teachers and students about the use of ICT resources and barriers to their use. World Links principals, teachers, and students were asked a third set of questions specifically referencing the World Links program. These questions asked the respondents the extent to which certain outcomes were specifically due to participation in the World Links program. They were also asked to rate the program on different effectiveness measures and to identify ways that it could be improved.

Arabic versions of the surveys were distributed to selected schools at the beginning of the 2006-2007 school year and were collected over a three week period. Data were entered by native Arabic speaking research assistants. Recoding was conducted on a 5% random selection of each set of respondents.

For the case studies, there was a formal protocol that specified what to look for during class observations and what to ask in the interviews of students, teachers, and principals. The case study visits were conducted by three researchers: the author of this report (the classes were English language classes), and two Jordanian researchers. The field protocols also served to structure the case study reports that were written for each visit.

Results

An examination of the results of the evaluation begins with a look at the input characteristics of the teachers, schools, and students in the samples. Subsequent sections examine the classroom implementation of various key elements of the program. They proceed to an examination of the impact of the program on teachers, students, and schools. The analyses conclude by examining strengths and weaknesses of the program and technological barriers to educational change in Jordan.

Teachers, Schools, and Students

Before examining the impacts of the program, it is important to examine the input characteristics of World Links teachers, schools and students and the similarities and differences between these and a more representative sample of teachers, schools, and students in Jordan. Otherwise, systematic differences between these groups may compete with program participation as a causal explanation for any differences in program impact.

Teachers. In several ways, teachers in the World Links and Non-World Links samples were similar to each other in background. A slight majority (54% v 52%) of both World Links and Non-World Links teachers were female (Table 1 in Appendix A). They were similar in education background; 64% of both groups had BA degrees, while 19% of the World Links Teachers and 18% of the Non-World Links teachers had taken graduate courses, although not yet

achieved a Masters Degree (Table 2). Nor were there significant differences between the groups in the number of years they had taught at their current school; 38% of World Links teachers had taught there between 3 and 5 years and 26% between 5 and 10 years, while 29% of the Non-World Links teachers had taught at their current school between 5 and 10 years and 26% between 3 and 5 years (Table 3).

On the other hand, 32% of World Links teachers taught in total between 10 and 15 years and 25% had taught between 5 and 10 years, while Non-World Links teachers were more likely to have either taught longer or shorter (Table 4): 25% of the Non-World Links teachers had taught in total for more than 15 years (only 14% of the World Links teachers had) and 11% of the Non-World Links teachers had taught for less than 5 years (only 5% of the World Links teachers had taught so few years). There were significant differences between the groups in rank; 69% of the World Links sample held the rank of Teacher and 23% were Assistant Teachers, while among Non-World Links teachers, 66% were Teachers and 31% were Assistant Teachers (Table 5). Table 6 shows that World Links teachers were more likely to have taught science (34% v 17%) while Non-World Links teachers were more likely to have taught Arabic (18% v 10%). Table 7 shows that World Links teachers were more likely to have computers in their home (93% v 80%), although they were no more likely to have them connected to the Internet. There were also differences between World Links and Non-World Links teachers in their professional development experiences beyond participation in the World Links program (Table 8). Non-World Links teachers were more likely to have been involved in the Intel Teach to the Future program (34% v 5%), while World Links teachers were more likely to have taken ERfKE training (60% v 40%). This is a particularly important and potentially confounding input difference, given that the goal of this evaluation is to examine the impact of World Links professional development effort. Finally, World Links teachers are more likely than Non-World Links teachers (38% v 21%) to spend 5 or more hours a week preparing for their classroom activities (Table 9).

The differences were more pronounced on some variables between World Links teachers and Non-World Links teachers in World Links and Non-World Links schools. World Links teachers were more similar to Non-World Links teachers in World Links schools and different from those in Non-World Links schools. Specifically, there are no significant differences in education background between World Links teachers and Non-World Links teachers in World Links schools (Table 10). But there were differences between World Links teachers and Non-World Links teachers in Non-World Links schools; 19% of World Links teachers studied beyond a BA, short of an MA and 10% have MA degrees, while 15% of Non-World Links teachers in Non-World Links schools have graduate study short of an MA and only 5% have an MA. On the other hand, 15% of these Non-World Links teachers have less than a BA and only 5% of World Links teachers have study for this short a time.

There are no significant differences in rank between World Links and Non-World Links teachers in World Links schools. But only 23% of World Links teachers are Assistant Teachers and 34% of the Non-World Links teachers at Non-World Links schools are of this rank (Table

11). As to total years taught, 32% of World Links teachers had taught between 10 and 15 years and 30% of Non-World Links teachers in World Links schools had taught that long (Table 12). But in Non-World Links schools, only 25% of the Non-World Links taught that long and 28% had taught for longer than 15 years. This was the case for only 14% of the World Links teachers. Finally, World Links teachers are not only more likely than Non-World Links teachers in Non-World Links schools to have home computers but more likely to have home Internet access, as well (Table 13).

As a group, the World Links teachers were similar in background. There were no significant differences between the first group of teachers who participated in World Links between 2003 and 2005, and the second group, who participated between 2005 and 2006, in gender, years taught, years taught at their current school, education background, rank, subjects taught, access to home computing, professional development experience, or hours per week in preparation for classroom activities.

Schools. According to the responses from principals, here are significant differences on a number of variables between the random sample of World Links schools in the study and a random sample of Non-World Links schools in Jordan. First, World Links schools are larger than Non-World Links schools. The World Links schools in the sample had an average of 595 (sd=361) students and 37 teachers (sd=14) while Non-World Links schools had 347 (sd=304) students and 23 (sd=14) teachers, on average ($F=35.5$, $df=1$, $p>.001$; $F=54.6$, $df=1$, $p>.001$, respectively). Table 14 shows that World Links schools were more likely to be secondary schools (63% v 35%), while Non-World Links schools were more likely to be basic education schools (40% v 25%). Table 15 shows that World Links schools were more likely to be all-girls schools (39% v 28%), while Non-World Links schools were more likely to be mixed-gender schools (32% v 18%). World Links schools were also more likely to be Jordan Education Initiative Discovery Schools. This is a special program of teacher training and technical support; 20% of World Links schools were involved in this program, while only 6% of Non-World Links schools participated (Chi Square=11.6, $df=1$, $p>.001$).

World Links schools had significantly more computers (m=24, sd=15) than Non-World Links schools (m=16, sd=12; $F=24.2$, $df=1$, $p>.001$). However when students-per-computer is examined, World Links schools averaged 41 (sd=52) students per computer while Non-World Links schools averaged 34 (sd=65) students per computer, although these differences were not statistically significant. There were significant differences between the two types of schools in the number of computers connected to the Internet (m=8, sd=18; m=2, sd=5; $F=30.5$, $df=1$, $p>.001$) and to the EduWave intranet (m=15, sd=13; m=6, sd=9; $F=37.2$, $df=1$, $p>.001$).

Students. Students in the World Links and Non-World Links samples were similar in gender distribution; 57% of the World Links students were girls, while 53% of the Non-World Links students in the sample were girls. Otherwise, these two groups differed in several respects. World Links students were more likely to be in higher grades (Table 16) and more likely to be taking science (Table 17). And World Links students were more likely to have access to home computers and these computers were more likely to be connected to the Internet (Table 18).

However, it seems that these differences between students are actually due to differences between schools. When these World Links and Non-World Links students in World Links schools are compared on these variables, there are no significant differences. But when comparing World Links students to Non-World Links students in Non-World Links schools, World Links students are significantly more likely to be in 11th (20% v 5%) or 12th grade (26% v 11%; Table 19) and more like to be taking science (40% v 17%; Table 20), while Non-World Links students in Non-World Links schools are more likely to be in lower grades (6th grade: 11% v 1%; 7th grade: 13% v 3%) or taking Arabic (28% v 13%). While there are no significant differences in home access to computers or to the Internet between World Links and Non-World Links students in World Links schools, World Links students are more likely than Non-World Links students in Non-World Link schools to have access to computers at home (86% v 61%; Table 21) and these computers are more likely to be connected to the Internet (45% v 30%).

Conclusions. World Links teachers, students, and schools are different than Non-World Links teachers, schools, and students on many input characteristics. World Links teachers are more likely to be at a higher rank, more likely to teach science, more likely to own a home computer, and more likely to have taken ERfKE training, while Non-World Links teachers are more likely to have taught either longer or shorter than World Links teacher and more likely to have taken Intel Teach training. World Links students are more likely to be at a higher grade level, more likely to have taken science, and more likely to have access to home computers than Non-World Links students. And World Links schools are more likely to be all-girls schools and more likely to be schools of a higher grade. Given these differences, Non-World Link teachers, students, and schools cannot be treated as a homogeneous group in analyses of the program's implementation and impact. Any differences in implementation or impact between World Links and Non-World Links samples could be due to these input differences rather than to participation or non-participation in the World Links program. Such differences need to be addressed in subsequent analyses.

Given differences in input variables, Non-World Link teachers, students, and schools cannot be treated as a homogeneous group in analyses of the program's implementation and impact. Any differences in implementation or impact between World Links and Non-World Links samples could be due to these input differences rather than to participation or non-participation in the World Links program. Such differences need to be addressed in the analyses of implementation and impact.

However, it seems that many of these input differences are due primarily to differences between schools. That is, when World Links teachers and students are compared on input variables to Non-World Links teachers and students in World Links schools, the significant differences disappear. But the differences between them and teachers and students in Non-World Links schools persist. Consequently, in subsequent analyses, comparisons of implementation and impact variables between World Links and Non-World Links participants must be supplemented by comparisons between the more-similar groups of participants and non-

participants in World Links schools. These results must also be checked while holding other variables constant, such as participation in other professional development programs and subjects taught. If differences hold even when comparing highly similar teachers and students, then there is a high degree of confidence that the differences are due to program participation rather than input differences.

Program Implementation

The first set of analyses pertains to the extent to which teachers participated in the World Links program and the degree to which World Links teachers implemented the broad range of classroom and professional activities that were the goals of World Links training.

Program Participation

Of the group of 125 World Links teachers in the sample, 35 (or 28%) were in the program's first cohort that participated in the program between 2003 and 2005. The remaining 90 (or 72%) were in the second cohort that went through between 2005 and 2006. Each of the phases of the training program, as well as the EduWave training, was completed by well over 90% of the teachers (Table 22). Of the 125 World Links teachers, 114 reported having completed all four phases of the training, as well as training on EduWave software. The remaining 11 either did not complete all of the components for one reason or another, or the data for one or more items were missing. In either case, these World Links teachers were not included in the subsequent analyses regarding implementation and impact. These analyses include only the 114 teachers who positively indicated that they had completed all of the components of the training.

Only 13% of the 124 World Links teachers were also World Links trainers. There was more variation in the number of teachers who took advantage of the other components of the program (Table 23). During the 2005-2006 school year, 79% of the World Links teachers used EduWave tools and 78% communicated with World Links staff via email, while 71% emailed other World Links teachers, 66% received technical support through World Links, and 55% took advantage of teaching support and mentoring from World Links staff.

Kinds of Comparisons

The immediate objective of the World Links program was to bring about significant change in teachers' professional practices. As mentioned earlier, these were of three sorts: to have teachers integrate ICT into classroom activities and professional practices, to have them use a variety of student-centered pedagogical strategies, and to have them engage in an extended community of professional exchange, communication, and collaboration. Consequently, the first series of analyses of program outcomes examine differences between World Links and Non-World Links teachers in these practices. Both World Links and Non-World Links teachers were asked to pick a course that they had taught during the 2005-2006 school year and respond to questions based on their practices in that course. Similarly, World Links and Non-World Links students responded to questions with reference to these same courses. Questions about classroom practices were asked in a way that both World Links and Non-World Links teachers

and students could respond; that is, the questions were not specifically related to the World Links program. Consequently, comparisons of the practices of these two groups could justifiably be compared.

Two types of questions were asked: "to what extent" (not at all, some what, very much) some of these practices were used and "how often" they were used (not at all, 1-5 times during the year, more than 5 times but less than once a month, 1-3 times a month, once a week or more). The analyses compare the practices of World Links teachers with the group of all Non-World Links teachers, as well as a sub-group of Non-World Links teachers from World Links schools. As discussed in the previous section, the comparison with the more-similar Non-World Links teachers is a way of ruling out causation due to key input variables that differed between World Links teachers and teachers in Non-World Links schools. In these analyses, the results are compared for the full range of responses and the statistics reported in the text and tables are based on these full-range comparisons. However, to make the analyses easier to understand, the reporting of results in the text and tables is simplified. Figures reported for "extent of use" are only the "very much" figures and those reported for "how often used" combine the "1-3 times a month" and "once a week or more" responses.

Self-reports are an inherently weak data source due to desirability bias in the attribution of one's own behavior. To corroborate the teachers' self reports, students and principals were also asked about their teachers' use of a sample of activities of which they were likely to be knowledgeable. Being more likely than principals to be knowledgeable of a larger number of classroom activities, the questions asked of students' were more comprehensive than those of principals. For students, comparisons are made between those having taken courses from World Links and students having taken courses from Non-World Links teachers (referred to World Links and Non-World Links students, respectively). On the other hand, principals were more likely to be aware of the professional practices of teachers outside the classroom and they were asked more of these questions than were students.

In World Link schools, principals were asked two sets of identical questions related to teacher professional activities, one set referred to the World Links teacher and one referred to the Non-World Links teacher. Because each principal in World Links schools responded about the World Links and Non-World Links teachers in his or her school, Wilcoxon Signed Rank tests were used to compare the ordinal data from these related samples. On the other hand, Mann-Whitney U tests were used on the comparisons of responses of the independent samples of teachers and students.

Finally, some of the questions asked of teachers, students, and principals in Jordan were the same as those asked of teachers, students, and/or principals in an earlier study of the World Links program, as it was implemented in other countries in South America and Africa (Kozma, et al., 2004). For lack of access to the international data set, results from the respondents in Jordan could not be statistically compared with those in other countries. Also, differences in culture, education policies, and national curricula can be powerful intervening variables that can account for differences between countries. These factors require that any comparisons be made with

caution. However having taken these factors into consideration, the responses from the earlier international study can still serve as a useful benchmark.

ICT Integration

Increasing the use of ICT in the classroom is an important goal of the World Links program, as it is for Jordan's Education Reform for the Knowledge Economy, more generally. A series of questions were asked of teachers, students, and principals about the teachers' use of a variety of technology tools and applications.

Teacher ratings. It is clear from the analyses in this evaluation that World Links teachers integrated a variety of technology applications into their classroom teaching during the 2005-2006 school year and did so more often than did Non-World Links teachers. The first column in Table 24A lists the "frequency of use" of a number of ICT-based activities by students, as reported by the 114 World Links teachers who responded that they had completed all of the training components. The frequent use of applications software, search engines, and the Internet was reported by 60% or more of the World Links teachers. Far fewer World Links teachers reported the frequent use of simulations and the production of Webpages.

Table 24A also compares World Links teachers to the group of teachers from both Non-World Links teachers in World Links and Non-World Links schools in the use of these activities. World Links teachers more often reported that their students regularly engaged in the following ICT-based activities:

- Used applications software, such as word processors, databases, etc.
- Used software that taught a specific subject, such as science, math, Arabic, etc.
- Used e-mail.
- Used the Internet or the World Wide Web.
- Used a search engine to find information on the Web.
- Used discussion forums.
- Produced a Website or Web page.
- Used drill and practice software.

When World Links teachers were compared to the more similar Non-World Links teachers in World Links schools, the significance of these differences held for every variable but one (Table 24A, first and third columns). According to self ratings, World Links teachers used simulations no more often than their Non-World Links colleagues in World Links schools, indicating that the difference between World Links teachers and the more general group of Non-World Links teachers may be due more to differences between World Links and Non-World Links schools.

Table 24B includes the analyses of questions about "the extent of use" of some ICT practices. Three-fourths of the World Links teachers used computers "very much" to plan their work and half of them used computers regularly to communicate or collaborate with other

teachers. Far fewer World Links teachers reported the regular use of computers to communicate with outside advisors or with parents.

World Links teachers were more likely than Non-World Links teachers to have reported the regular use these ICT-based activities:

- Used computers to plan their work.
- Used computers to communicate or collaborate with other teachers.
- Used computers to communicate with advisors or experts outside the school.
- Used computers to communicate with parents or other members of the community.

For only one activity ("Used computers for administrative purposes") were World Links and Non-World Links teachers similar in their extent of use. When comparing World Links teachers with the smaller, more-similar sample of Non-World Links teachers in the World Links schools, the significance of the differences holds for all variables.

Student ratings. Findings from an examination of World Links students' responses on frequency of use questions (Table 25A and 25B) parallel the reports of World Links teachers, although a smaller percentage of students reported the frequent use of these activities. (Students were not asked about teachers' extent of use of ICT or their communication). In addition, comparisons of World Links and Non-World Links students confirmed comparisons of World Links and Non-World Links teachers for the following variables, where students:

- Used applications software, such as word processors, databases, etc.
- Used e-mail.
- Used the Internet or the World Wide Web.
- Used a search engine to find information on the Web.
- Produced a Website or Web page.

However, unlike World Links teachers, World Links students were more similar to their Non-World Links counterparts in their ratings of their use of three types of software: software that taught a specific subject, discussion forums, and drill and practice software.

Principal ratings. Principals in World Links schools also rated their World Links and Non-World Links teachers on a parallel subset of items. Comparisons of principals' responses were even more confirmatory of teachers' self-ratings than were the comparison of students' responses (Table 26A and 26B). Principals reported differences between implementation in Word Links and Non-World Links classrooms on all items where differences were found in teacher self-reports, on the subset of questions which they were asked. They agreed with teachers even on those variables where differences were not found in student ratings.

Given the agreement on a number of comparisons in the ratings of teachers, principals, and students, it can be concluded with great confidence that World Links teachers integrated a number of ICT-based activities into their classroom and professional practices and did so significantly more often than did teachers not participating in the program.

Given the agreement on a number of comparisons in the ratings by teachers, principals, and (for the most part) students, it can be concluded with great confidence that World Links teachers integrated a number of ICT-based activities into their classroom and professional practices and did so significantly more often than did teachers not participating in the program.

International comparisons. Table 27 lists the responses on a subset of questions related to ICT-based activities that were answered by World Links teachers in Jordan and by World Links teachers in other countries, as reported in the earlier international evaluation of the World Links program (Kozma, et al. 2004). There were similarities and differences in the responses of these teachers. As mentioned earlier, tests of significance could not be used in these comparisons and there are differences between countries in their educational policies and curricula that can mediate the conclusions that can be drawn from international comparisons. But these similarities and differences can still serve as a source of reflection by WLAR staff.

World Links teachers in Jordan were similar to teachers in other countries in their use of applications software and the Internet with their students. They seemed to more frequently have their students use search engines and produce Websites or Web pages. But their students used email and drill and practice software less often than World Links teachers in South America and Africa.

Implementation of Student-Centered Pedagogy

Another major goal of the World Links program, and of the Education Reform for the Knowledge Economy, is to bring about significant change in classroom teaching and learning. Particularly important are classroom practices that promote student-centered learning activities and tasks that develop students' collaboration and complex information management skills—what are sometimes referred to as 21st century skills.

Teacher ratings. Findings from this evaluation indicate that World Links teachers more often used a variety of 21st century pedagogical practices, such as engaging students in collaborative projects and in a range of complex information management tasks. Returning to Table 24A, the first column of figures reports the number of these student-centered pedagogical activities that were used "1-3 times a week or more" by their students, as reported World Links teachers. More than 40% of these teachers indicated that their students frequently used graphics in a report, wrote project reports, searched for information on a topic, and collaborated with other students in their class on a project. Few teachers reported that their students frequently collaborated with students in other countries, communicated with outside experts, collected information on another country, or collaborated with students in other schools in Jordan.

Table 24A also compares the use of these pedagogical activities for all Non-World Links teachers and for the World Links teachers who reported that they had completed all of the training components. The table shows that World Links teachers more often reported that their students regularly engaged in the following activities:

- Collaborated on a project with other students in the same class.
- Collaborated on a project with students from another school in Jordan.
- Gathered and analyze resource materials on a problem or topic.
- Wrote project reports, PowerPoint presentations, or newsletters.
- Used graphics, such as pictures, charts, or graphs, in a report, presentation, newsletter, or website.
- Searched for and organized information on a topic or issue.
- Drew conclusions or made predictions using data you gathered or information obtained from resource materials, such as books, newspapers, the Web.
- Gave formal presentations to parents or other members of the community about what you did in class.
- Communicated with outside educators or experts.

When World Links teachers were compared to their more similar Non-World Links colleagues in World Links schools, the significance of these comparisons held for every variable. This indicates that differences between the groups are more likely due to participation in the World Links program than to difference between schools.

Table 24B compares "very much" responses to questions about the "extent of use" of some student-centered activities. More than 60% of the World Links teachers reported that they provided guidelines that help students learn on their own, had their students work on collaborative projects, and participated in activities that were important to students. In addition, World Links teachers are more likely than Non-World Links teachers to have responded that their students regularly worked on collaborative projects and participated in activities that they liked and were important to them.

With these activities, too, the significance of the comparisons holds when comparing World Links teachers with only their more-similar, Non-World Links colleagues in World Links schools.

Student ratings. World Links students' responses on a subset of these questions parallel those of their teachers (returning Table 25A and 25B), although the percentage of World Links students who report a frequent use of these activities tends to be smaller than those of their teachers. Also as with teachers, World Links students reported higher use of student-center activities on comparisons with Non-World Links students, where students:

- Collaborated on a project with other students in the same class.
- Collaborated on a project with students from another school in Jordan.
- Gathered and analyze resource materials on a problem or topic.

Based on student ratings, World Links teachers were far more likely than Non-World Links teachers to use a wide range of innovative teaching practices, such as collaborative projects.

- Wrote project reports, PowerPoint presentations, or newsletters.
- Used graphics, such as pictures, charts, or graphs, in a report, presentation, newsletter, or website.
- Worked on collaborative projects.
- Participated in activities that they liked and were important to them.

For only four activities were World Links and Non-World Links students more similar in their responses than their corresponding teachers: searching for information on a topic, drawing conclusions, giving formal presentations to parents, and communicating with outside experts.

Principal ratings. Responses of principal's in World Links schools on questions related to ICT-activities confirmed those of their teachers (Table 26A and 26B). As with technology integration activities, comparisons of principals' responses were more confirmatory of teachers' self reports than were the comparison of students' responses. In every case where there were statistically significant differences between the self ratings of World Links and Non-World Links teachers, the principals' ratings of the two groups were also statistically different in favor of the World Links teachers. In addition, principals rated World Links teachers as more likely to collaborate with others outside Jordan, more likely to provide students with guidelines that helped them learn on their own, and more likely to provide individual attention to each student than did their Non-World Links teachers. These findings are particularly significant, since principals rated the activities of two specific teachers in their schools, one a World Links teacher and the other a Non-World Links teacher. Consequently, comparisons of these ratings have more face validity than the statistical comparisons of the self ratings of the two groups of teachers. Yet, at the same time, they confirm the differences in these self ratings.

International comparisons. However, while Jordanian World Links teachers more often use these innovative, student-centered pedagogical practices than a randomly selected group of other teachers in Jordan, they compare somewhat less favorably with other World Links teachers in South America and Africa. Table 27 compares World Links teachers in Jordan and World Links teachers in these other countries, as reported in an earlier international evaluation of the program (Kozma, et al. 2004). Again, international comparisons should be made with caution. But in these comparisons, Jordanian World Links teachers less often had students collaborate with other students in the same class, had students collaborate with students in other schools in the country, and had students collaborate with students in other countries. Also according to these reports, Jordanian World Links students less often engaged in gathering and analyzing resource materials or collecting information on another country. On the other hand, Jordanian World Links teacher reported more often having their students write reports and use graphics than did World Links teachers in other countries.

Participation in a Community of Practice

A third implementation goal of the World Links program was also to extend the professional development of teachers beyond their direct participation in the program. World Links staff wanted to develop the practice of World Links teachers of engaging with other teachers in an ongoing way. Several questions were asked about teachers' participation in such activities.

It was mentioned above that half of the World Links teachers regularly used computers to communicate or collaborate with other teachers. And World Links teachers more often used computers to communicate with other teachers, outside advisors or experts, and parents than did Non-World Links teachers. The significance of these comparisons held for both the larger group of Non-World Links teachers and the smaller, more similar group of teachers in World Links schools that had access to more computers than did teachers in Non-World Links schools. Comparisons of principals' responses also confirmed these findings.

World Links teachers far more likely than Non-World Links teachers to collaborate extensively with their colleagues, as well as use technology to communicate with other teachers, outside experts, and parents.

An additional question was asked about the extent to which teachers collaborated or teamed with other teachers on projects or lessons, apart from computer-based communication (Table 24B). World Links teachers more often responded "very much" (52%) than either the general group of Non-World Links teachers (22%) or the more similar group of Non-World Links teachers in World Links schools (23%). Principals agree with this assessment (Table 26B). Of the principals in World Link schools, 60% said that their World Links teachers collaborated "very much", while only 33% said their Non-World Links teachers collaborated as often.

Both World Links teachers and their principals agree that World Links teachers collaborated with other teachers more than did Non-World Links teachers. This finding, along with the significant differences on the use of ICT to professionally communicate and collaborate with various groups, indicates that the program was successful in accomplishing this goal. Appendix C contains some examples, provided by WLAR staff, that illustrate the kinds of interactions in which World Links teachers engaged as part of their extended professional development community.

Comparisons of Other Sub-Samples

As reported the "Teachers, Schools, and Students" section, there were no significant differences between World Links teachers in the first and second cohorts of the program on a number of characteristics. Similarly, a comparison of World Links teachers in these two groups found no significant differences on any of the measures of implementation reported above. Thus, in subsequent analyses of impact, these two groups were not be analyzed separately.

On the other hand, there were several differences of note between World Links teachers and Non-World Links teachers beyond the differences associated with the differences between World Links and Non-World Links schools. The teacher differences that are, perhaps, most likely to

confound results are the fact that World Links teachers were more likely to have taught science and to have taken ERfKE training, while Non-World Links teachers were more likely to have taught Arabic and have taken Intel training. Consequently, a series of comparisons between World Links and Non-World Links teachers were rerun pulling out the potential confounding factors: comparisons of World Links and Non-World Links teachers looking only at those teachers from the two groups that did not teach science; only those that did not teach Arabic; only those that had not taken Intel training; and only those that had not taken ERfKE training. For each set of comparisons, almost all differences occurred in the full sample set held as significant. Accordingly, it can be concluded that the differences in ICT, pedagogical, and teacher collaboration practices favoring World Links teachers are very robust and not due to other confounding variables, such as systematic differences between schools, the courses taught, or the participation in other professional development programs.

It can be concluded that the differences in ICT, pedagogical, and teacher collaboration practices favoring World Links teachers are very robust and not due to other confounding variables, such as systematic differences between schools, the courses taught, or the participation in other professional development programs.

Examples from Case Studies

An examination of the six case studies (Appendix D) conducted by the evaluation research team provides examples of many of the findings about program implementation that resulted from the survey analysis. In all six of the cases, technology was integrated into classroom activities. This integration cut across a range of subject areas that included English, chemistry, math, biology, and physics. In each of the classes, teachers asked the students to use the computer and search engines to find information about key topics and concepts in their course. For example in biology, students looked for information on cell structure and function. In physics, students searched for information on step-up and step-down electric transformers. In math, students looked for information on simple and compound profit. And in chemistry, students searched for information on chemical elements. In the two English courses, the teacher gave the students a task that was not a language topic, per se, ('preserving food', in one case, and 'the human eye and its function' in the other). Rather, the teachers wanted students to use and develop their English language skills of reading, speaking, and writing in the context of "real" academic tasks.

In all six cases, teachers had students work together in teams on collaborative projects. Students were typically grouped in teams of 3-5 students working together on one computer. Typically, these "projects" were quite brief—taking as little as 5 or as long as 20 minutes—and not complex. Often the students were directed to find facts, define terms, or perform simple procedures. For example:

- Look up information on preserving food.

- What are the parts of the human eye?
- Using one of the search engines provided, research the topic of 'electric transformer' as an application of electromagnetic induction concept and assembly.
- Which of these particles is anion and what is its charge?
- Use EduWave to search for the concept of simple profit and its rules.

The teachers in these courses invariably said that their role had changed from that of provider of information to that of guide and that their students had become more-active learners. This teachers' role included constructing and introducing the assignments, circulating during the activity to ask students questions and see if they were having difficulty, and prompting and commenting on student responses.

However, the kind of guidance provided by several of the teachers was very structured and allowed students little of latitude needed to develop their ability to learn on their own. For example, the English teacher in commenting on his lesson on food preservation said, "If you want to analyze, you have to create categories. To make it easier for the students, I gave them the categories. You have to tell the student what to do: 'you have to do 1, 2, 3, 4, and 5'." Several of the instructors (English, physics, and math) gave the students the specific search terms rather than having students provide them. Often, these search terms were very simple, such as "electric transformer" in physics, "sulfur" in chemistry, or "simple profit" in mathematics. Rarely were students required to come up with their own terms and never were they asked to create complex search strings using Boolean terms.

The teacher typically gave a brief introduction to the topic, often using a PowerPoint presentation. The introduction would provide some background information on the topic as well as describe the task and the student roles. Several of the groups had student leaders who were appointed by the teacher or by the students at the direction of the teacher. The students in the English class working on the function of the human eye assigned each other roles of leader, editor, and time keeper, at the teacher's direction.

In several classes, the different groups were given slightly different assignments. For example, in the English class looking for information on food preservation, one group collected facts, another wrote a paragraph on the topic, a third group wrote a critique, a fourth put together a photo gallery, and a fifth put together an e-library of URLs. In the biology class on cell structure and function, one group looked for general information on the structure of the cell, a second focused on the structure and function of the membrane plasma, another on the structure and function of the cytoplasm, a fourth group on the structure and function of the endoplasm web, a fifth on the Golgi apparatus, and a sixth on the nucleus. Students would then share the results of their different assignments with the rest of the class.

As suggested by the assignments, the primary activity of the student groups was to search for information. Students would use search engines (typically Google or Yahoo) and productivity tools, such as Microsoft Word or PowerPoint to create a short product. In the mathematics class, students used email to exchange information. Often, students cut and pasted

portions of texts that answered their assigned question. Sometimes, the report would include diagrams. In the case of the physics course, it was diagrams of transformers or in biology, pictures of cells. For some of the reports on the human eye, diagrams of optical illusions were included. In the case of food preservation, some groups put together photo galleries of food preservation methods.

While students were working, the teachers typically circulated, asked questions, assisted them in narrowing the search, and offered help if students encountered problems. As one teacher described it, "During the lesson I would walk around the classroom and talk to students, strengthening their understanding of the concept of Electromagnetic Induction, and the types of the electric transformers, step-up and step-down." But often the questions that teachers asked were quite simple: "Did you find the answer?" "What search engines did you use?" "What were the results you found?"

In all of the classes, one of the students would make a report to the rest of the class. Often student reports were very brief, consisting of a sentence or two, such as: "Smoking is a way to preserve food. We got information on smoking from the Internet." The teacher would sometimes ask follow-up questions. But these were often "fact-based" questions that did not require a lot of analysis. For example, in the session on food preservation, a student responded to a question about how to dry food by saying "by putting them in the sun . . ." The teacher prompted, "By exposing them to the sun and air." And the student repeated, "By exposing them in the sun and air." On occasion, but rarely, the teacher asked students for additional explanations or elaborations that deepened their thinking. In chemistry, the teacher asked, "How do you know that this particle is a neutral ion?" Another example is in the physic course when after a student gave his initial answer, the teacher asked him to talk an alternative perspective:

Teacher	Can we reverse the situation?
Student:	Using the figure?
Teacher:	Yes, yes how many cycles now?
Student:	451 volts for the secondary and 129 volts for the primary one.
Teacher:	What is the name or type of the transformer now?
Students:	Setup transformer
Teacher:	Very good !

In several courses, the session ended with a brief assessment. But again, these were fact-based, often multiple choice tests. For example, in the English session on food preservation:

- How often must the lid of a can be tested? (Multiple choice)
- How high must the water be when heating the jars for canning? (Multiple choice)
- Mold under the lid might be a sign of . . .? (Multiple choice)

In the physics course:

- Define the electric transformer.
- Draw a Step-up transformer.
- List the components of an electric transformer.

In biology:

- Eucharistic cell consists of main parts … (Multiple choice)
- An organelle that has a role in recognizing types of blood in human body… (Multiple choice)
- The store of the genetic substance is … (Multiple choice)

On occasion, the teacher would review the answers with the students. Again, the teachers' focus was often more on the correctness of the answers than on the quality of the students' thinking. For example, a student in the food preservation lesson selected 'true' that it is okay to taste preserved food if it smells okay. The teacher said: "The answer is 'false'. Why? Because sometimes bad food smells okay."

Summary of Program Implementation Findings

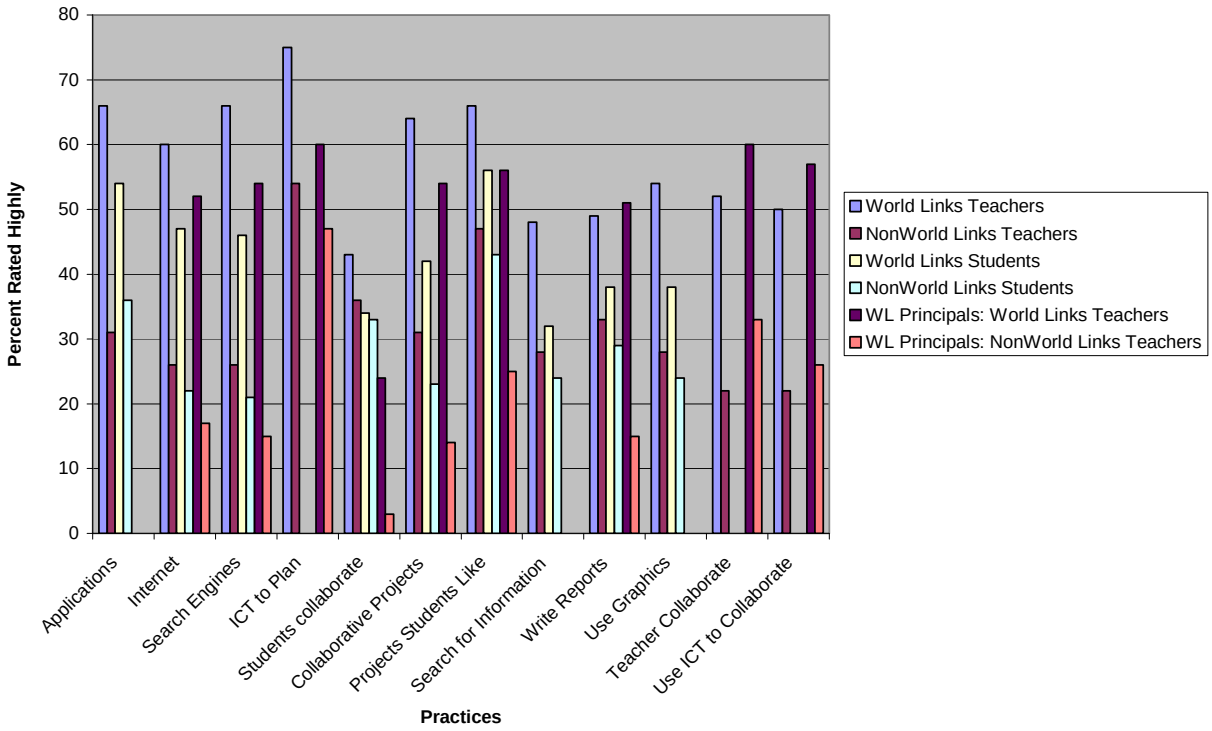
There was a high degree of agreement in the ratings of teachers, students, and principals in the use of certain practices by World Links teachers, particularly in relationship to the use of these practices by Non-World Links teachers. Based on this agreement on a number of comparisons by teachers, principals, and students, as well as case study observations, it can be concluded with great confidence that World Links teachers more often used a variety of classroom activities that support student-centered learning.

The results of the surveys make it clear that the World Links Arab Region program in Jordan resulted in significant changes in the classroom practices of participating teachers that involved the integration of ICT into the classroom in support of student-centered learning and teacher collaboration. Figure 1 summarizes these results and the case studies illustrate and clarify these findings.

First, the surveys of teachers, principals, and students showed that World Links teachers integrated a variety of software applications, search engines, and the Internet into their teaching, far more so than Non-World Links teachers. The case studies of World Links teachers showed that the use of various technologies—including PowerPoint presentations, word processors, search engines, and email—was a central part of the observed lessons. These technologies were used in a variety of courses—English, chemistry, physics, biology, and math.

The surveys also showed that World Links teachers had their students work with other students in their class on collaborative projects that they enjoyed and felt were important. In these projects, students searched for information on a topic, wrote project reports, and used graphics, much more so than in Non-World Links classrooms. Appendix B is a list of examples, provided by WLAR staff, that illustrate the kinds of collaborative projects in which World Links teachers and their students engaged.

Figure 1. World Links Implementation



The case studies also illustrate how these collaborative projects were implemented. Observations indicated that the role of the teacher in these courses changed from that of information provider to that of guide. As a result, students became much more active and participated in their own learning. Students worked together searching for information, writing reports, using graphics, and giving presentations. Observations in six World Links classrooms confirmed and illustrated these survey findings. However, the case studies also show that these student-centered activities are often still tied to the curriculum of facts and memorization. The teachers' guidance was highly structured and rarely did students engage in deep analysis and in drawing conclusions from the information they collected. The cases show that assessments in World Links classrooms also focus on the recall of facts, rather than higher-order thinking.

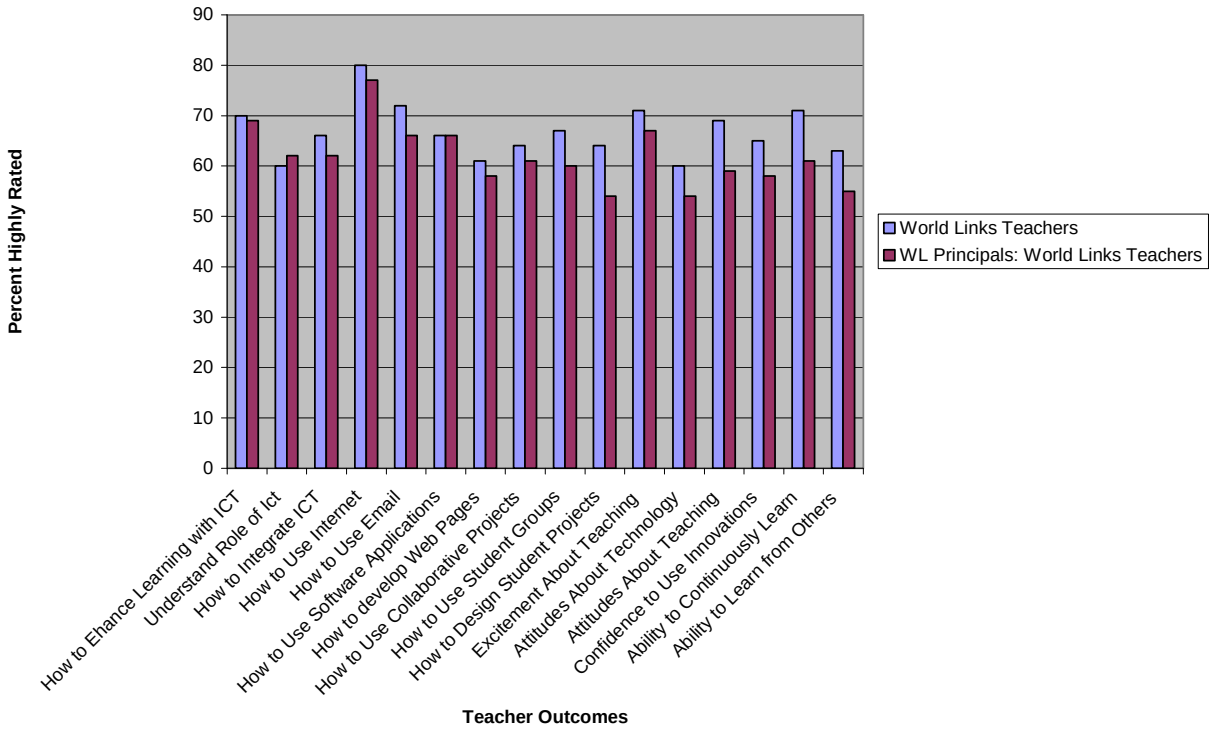
Based on the agreement among comparisons by teachers, principals, and students and on case study observations, it can be concluded with great confidence that World Links teachers more often used a variety of classroom activities that support student-centered learning.

Finally, the surveys of teachers and principals showed that World Links teachers engaged in ongoing community of professional development. World Links teachers collaborated with other teachers far more than Non-World Links teachers. And they were far more likely to use of ICT to communicate with other teachers than were Non-World Links teachers.

Impact on Teachers

The analyses above indicate that a primary impact of the World Links program on participating teachers was to increase their engagement in a variety of ICT activities and innovative classroom and professional practices. A series of questions were asked of World Links teachers and their principals about the extent to which teachers improved on a wide range of skills, knowledge, and attitudes as a result of their participation in the World Links program. Table 28 shows on all but one measure ("How to use simulations"), 50% or more of the World Links teachers said that the program had very much improved their pedagogical skills, ICT abilities, and range of professional attitudes. And on 17 measures, 60% of the teachers or more responded so. Specifically, a large majority of World Links teachers felt that the program improved their understanding of the role of ICT in the classroom and their ability to use computers to enhance teaching, to integrate computers into the curriculum, to use software applications, to use the Internet and email, to develop Web pages. It improved their pedagogical ability to use collaborative projects, use students groups, and design student projects. And it improved their excitement and attitudes about teaching, technology, and their use of innovative techniques, and their ability to continuously learn, to learn from other teachers, and to communicate with others. World Links principals agreed with these assessments and Figure 2 summarizes the results.

Figure 2. World Links Teacher Impact



A large majority of World Links teachers felt that they very much improved on a range of abilities, skills, and attitudes related to pedagogical skill, technological capability, and professional attitudes as a result of their participation in the program. Their principals agreed.

Table 28 also shows comparable responses on a subset of questions asked of teachers and administrators in the earlier, international evaluation of the World Links program. Responses of teachers and principals in Jordan are comparable to those in other countries. Again, for lack of access to the original data set, statistical tests can not be run for these comparisons. However, there were a few differences worth noting. A much higher percent of Jordanian World Links teachers than international World Links teachers gave their program the highest rating when assessing its impact on their ability to integrate computing into the curriculum and their skill in developing Webpages. On the other hand, a much higher percent of the World Links teachers in the international study said that their program very much influenced their ability to use hardware and affected their attitude toward technology.

Interviews with teachers and principals as part of the case studies also illustrate and elaborate on the impact that the World Links program had on participating teachers. For example, the teacher of the English course in School A said, "My role also changed to that of a facilitator rather than a lecturer." His principal agreed by saying: "World Links teachers have moved from being the main source of knowledge to facilitators. The students search for information about their projects and the teachers provides help. Teachers in several other schools also mentioned a change in teacher role. The physics teacher in School C said, "My role was to facilitate and enhance concepts that I want to provide to the students." The biology teacher in School D said she had become a facilitator as a result of the program and it provided her with new strategies for teaching and assessment.

The biology teacher also mentioned that her participation enabled her to exploit modern technology in the classroom. The headmistress in School F also cited this outcome saying, "The teacher was provided with new educational tools and strategies and became capable of using modern technology in education." She added, "The teacher acquired knowledge and skills for communication, higher thinking, problem solving and the use of web-based search engines."

Several interviewees mentioned the more-affective outcomes of program participation. The English teacher in School A said, "My job as a teacher has dramatically changed. My relationship with the students is more of a friend rather than that of an angry teacher." The principal in School C said, "The [World Links] teachers are relaxed with the students because they are offering something new, new styles of learning and tools that make the profession easier." At the same time the principal said that several World Links teacher reported that they had never worked so hard.

Impact on Students

While the immediate goal of the World Links program was on changing the practices of teachers, the ultimate goal was to have an impact on student learning. A series of questions were asked of teachers, students, and principals about students' content knowledge, information

management skills, technological abilities, and attitudes. The questions were asked of both World Links and Non-World Links teachers and students with reference to the impact of their identified course on these student outcomes. Consequently, the responses of World Links teachers and students could be compared with those of Non-World Links teachers and students. In addition, World Links principals were asked to compare the impact of the courses of the World Links and Non-World Links teachers in their schools. Finally, World Links teachers and students and their principals were also asked the extent to which they attributed any impact on student learning to participation in the World Links program.

Teacher Ratings

World Links teachers reported that their courses had a significant impact on a number of target student outcomes; they rated these outcomes significantly higher than did Non-World Links teachers; and they attributed many of these outcomes to their participation in the World Links program. The first column of results in Table 29 shows the percentage of World Teachers who responded "very much" to questions about the impact of their course on students' subject matter knowledge, information management and reasoning skills, technological capabilities, and attitudes. On 12 of the 26 measures, more than 50% of the World Links teachers responded that their course greatly influenced students. More than 60% of the World Links teachers felt their courses significantly impacted students' school attendance and their motivation to learn and be active in class, as well as their ability to give oral presentations in front of class, their leadership and teamwork skills, and their ability to learn collaboratively. Far fewer teachers felt that their course greatly influenced students' knowledge of other cultures, their ability to evaluate positions on an issue, and their ability to manage their own learning.

World Links teachers consistently rated the impact of their courses on student learning more highly than did the general group of Non-World Links teachers. Table 29 also compares World Links and Non-World Links teachers on these student outcomes. World Links teachers' ratings were significantly higher than Non-World Links teachers on the impact of their course on students':

- understanding of school subject matter and concepts.
- ability to reason with information.
- ability to search for, analyze, and organize information.
- ability to write reports or newsletters.
- ability to learn collaboratively.
- leadership and teamwork skills.
- ability to speak and give oral presentations in front of class.
- research skills.
- ability to plan tasks and implement projects.
- ability to manage their own learning and how to learn on their own.
- technology skills.

- ability to use technology to apply school knowledge outside the classroom.
- use of technology in an ethical manner.
- skill and increased their practice of documenting resources used.
- interest in technology.
- ability to learn on their own after they leave school and throughout their lifetime.
- ability to get better jobs upon graduation.
- ability to get jobs in the knowledge economy.

Although World Links teachers rated highly the impact of their course on students' school attendance and motivation to learn, these ratings were statistically no higher than those of Non-World Links teachers. On the other hand, several outcomes received relatively low ratings by World Links teachers but these ratings were significantly higher than those of Non-World Links teachers.

When the ratings of World Links teachers were compared to the Non-World Links teachers in World Links schools, 13 out of 18 of these significant comparisons continued to be significant (also Table 29). This is particularly important because World Links teachers were more similar to Non-World Links teachers in World Links schools than teachers in Non-World Links schools in education level, rank, years at their current school and they shared the same school environment, related to gender and type of school and access to computers. These similarities are likely to moderate the impact of teachers' courses on student outcomes. Yet World Links and Non-World Links teachers in these schools were significantly different in their self-ratings of the impact of their courses on many measures of student learning.

When asked the extent to which various student outcomes were due to their participation in the program, World Links teachers responded "very much" on 16 of the 28 measures (Table 30). Sixty percent or more of World Links teachers reported that the program had a significant impact on students' school attendance, their ability to give oral presentations in front of others, their ability to work collaboratively, their use of technology in an ethical manner, and their motivation to learn and be active in class and their enjoyment of school. Fifty percent or more felt this way about the impact of their course on students' understanding of school subject matter; students' abilities to search for and reason with information; their abilities to write reports and plan tasks; their communication, leadership, and research skills; and their interest in technology. On the other hand, less than 40% of World Links teachers felt that the program had a significant impact on students' knowledge or awareness of other cultures, their abilities to evaluate positions on an issue, to come up with new ideas, and to apply technology and school knowledge outside the classroom, practice of documenting resources, ability to learn on their own, and ability to get a better job or a job in the knowledge economy after graduation.

Student Ratings

World Links and Non-World Links students were also asked about the impact that their teachers' course had on their own learning. The first column in Table 31 shows the percentage

of World Links students that responded "very much" to these questions. As with World Links teachers, these students responded quite favorably, often rating the impact of their course as high or higher than did their teachers. Students rated the impact particularly high on their motivation to learn, their school attendance, the ethical use of technology, their understanding of subject matter, their ability to speak in front of class, and their communication skills. However, when the responses of World Links and Non-World Links students were compared (also Table 31), the impact ratings these two groups were similar. That is, all students seem to rate the impact of their courses quite highly. On only two measures—ability to write reports and ability to come up with new ideas—did World Links students rate outcomes significantly higher than Non-World Links students.

When World Links students were asked about the extent to which their teachers' participation in the program had an impact on various outcomes (Table 32), 70% reported that the participation affected their school attendance, 58% said it improved their communication skills, 52% said that it affected their enjoyment of school, and 51% said that it improved their interest in technology "very much". On only scales—"ability to get a better job" and "knowledge and awareness of other cultures"—did less than a third of the World Links students give the program the top rating.

Principal Ratings

Principals in World Links schools were asked to rate both their World Links and Non-World Links teachers on the impact that their courses had on a subset of these student outcomes (Table 33). Unlike students, principals tended to give few "very much" ratings. However, in each case, principals' ratings of their World Links teachers were significantly higher than the ratings of their Non-World Links teachers.

World Links Principals were also asked the extent to which their teachers' impact on a subset of students' skills, abilities, and attitudes was due to the teachers' participation in World Links program (Table 34). As did World Links students, principals also gave a high rating to the impact program participation had on students' school attendance and their enjoyment of school—63% of the principals gave "very much" responses to these questions. More than half of the principals also felt World Links participation had a significant impact on students' ability to reason with information (53%), on their ability to communicate with others (51%) on their technology skills (50%), and on their interest in technology (50%).

Summary of the Impact on Students

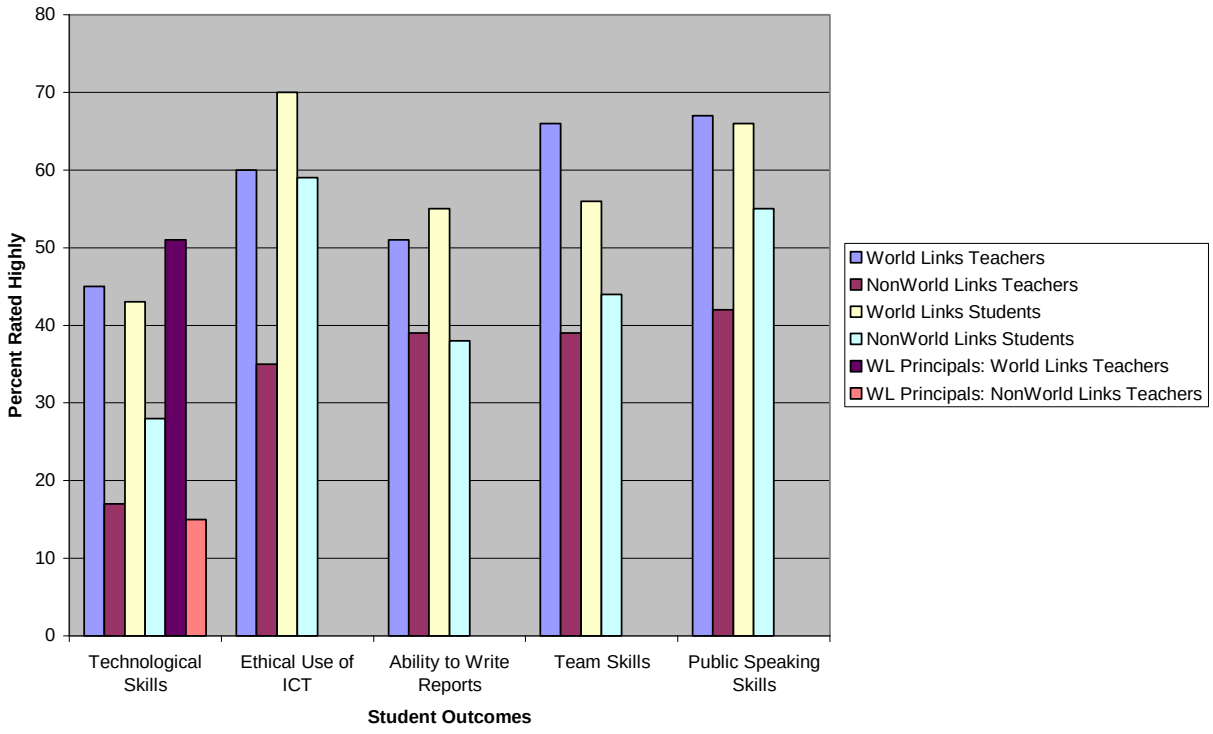
Teachers, students, and principals agree that participation in the World Links program had a significant impact on student outcomes. However, teachers, students, and principals differ in their use of the "very much" response when asked to rate the impact of courses on a range of student outcomes, such as content knowledge, information management skills, technological abilities, and attitudes. Students tend to use this option a lot when responding. Thus, even though World Links students rated their World Links courses highly, their ratings did not differ

statistically from Non-World Links students. On the other hand, principals tend to give few "very much" ratings. But they used them significantly more often with their World Links teachers than their Non-World Links teachers.

While less pronounced than the impact on teachers, the ratings of teachers, students, and principals indicate that World Links teachers had a significant impact on a range of student outcomes. These ratings were higher than those for Non-World Links teachers, and the impact was due to participation in the World Links program. There was considerable agreement among the rating of the respondents that students acquired new technology skills and the abilities to use ICT ethically, to write reports, to work in teams, and to speak in front of others. These outcomes are displayed in Figure 3.

The case studies of six classrooms further illustrate some of the impacts of the World Links program on student outcomes. Invariably, interviewees mentioned the fact that students had become more active and engaged in their own learning. For example, the World Links English teacher in School A said, "The students used the Internet to achieve active learning, to cooperate with each other, and to get more information." One of his students also commented, "We are more involved in the class." The headmistress in School F commented, "The students became the core of the teaching process. The students became active participants in the process of teaching and learning."

Figure 3. World Links Student Impact



Several case study respondents mentioned the motivational effects of the program. The biology teacher in School D mentioned that the program provided students with positive attitudes toward biology. The chemistry teacher in School E said, "Using the computers during the lessons increased the students' motivation to work and interact with their colleagues." The English teacher in School B said, "The students were very excited about the program, particularly the 'weak' students." One of his students said, "We're learning and its fun". Another student agreed and said, "We should learn all subjects this way." The principal said, "Group work was very motivating for students, and there was more active participation."

While less pronounced than the impact on teachers, the ratings of teachers, students, and principals indicate that World Links teachers had a significant impact on a range of student outcomes. These ratings were higher than those for Non-World Links teachers, and the impact was due to participation in the World Links program.

Teachers, principals, and students often commented on the fact that participation in the World Links program had developed students' collaboration skills, communication skills, and technology skills. An English student in School A said, "The teamwork in this class is greater than in any other. It's so useful to be in a team and work together." Another student in the class said, "We learn to work with each other and negotiate with each other." The headmistress of School F said, "The students acquired communication skills, and are now interacting with their peers. They also learnt how to use the web based search engines." The World Links teacher in School F agreed saying, "The students developed web-based search engine skills. They developed communication skills, group and, team work." In describing the impact of the program on students, the biology teacher in School D mentioned that the program developed "their research skills, their communication and cooperation, and their creativity and leadership." Students across the case study schools identified a number of other learning outcomes, as well. Among them are the ability to:

- Use the computer and the Internet to understand lessons.
- Use technology and apply it to learning the language.
- Work with other students in other countries.
- Conduct research.

Some teachers and students mentioned that they were better able to learn school subject matter, as a result of program participation. A physics student in School C said, "I benefited more from the lesson because I learn better from animated images than drawing on the board." Another said, "It is better for students to learn through the computer, as there are figures directly animated before us supported by a complete explanation, and the internet provides direct understanding of the lesson, while we may or may not understand from the teacher's explanation." The chemistry students in School E agreed. One student said, "The computerized lesson is much better than the traditional one, because all the tasks are carried out on the computer which is neither tiring nor boring. Furthermore, I can understand the lesson better."

Another pupil said, "Learning by means of the computer is better than the traditional method, because it involves questions that can test one's information."

Impact on Schools

> ***While the World Links program had a significant impact on participating teachers and students, the impact on other teachers in their school was modest.***

The staff of World Links Arab Region hoped that the training of World Links teachers would, in turn, influence the attitudes and practices of their principals and colleagues and the professional environment in their schools, more broadly. While the program had a significant impact on the teachers that they trained, results from this evaluation indicate that the diffusion of this impact to an entire school is perhaps too much to expect from a program that concentrates on the training of individual teachers.

Some of the school impacts were quite positive. Table 35 shows the responses of World Links teachers and their principals to questions about the impact that the program had on their schools. Half of the World Links teachers and 55% of the principals said that the program had improved the principal's understanding and support of technology's role in teaching and learning "very much". In World Links schools, 46% of the teachers and 55% of the principals said that the program influenced the collaboration among teachers in the school and 46% of the teachers and 48% of the principals said that program participation had enhanced the role of the school in the community.

But the impact on non-participating teachers seemed marginal. There were very few teachers and principals who responded that there was a large impact of the program on the understanding of technology's role by other teachers and on the use of computers by other teachers.

The opinions of principals and teachers in the case study schools were also positive. The Headmistress of School F mentioned the resources that came out of participation, "An electronic library was set up. The library includes the search topics on different subjects." As a result, "A lot of computerized lessons on different topics have been carried out." The World Links math teacher in School F said, "We shared and disseminated the World Links applications among non-World Links teachers. We as World Links teachers have a great impact on our colleagues who did not participate in the program." For example, after observing the World Links approaches, several non-participating teachers developed projects and shared them with their students.

But more often the positive impact on schools referred to the potential that the program had to benefit other teachers, if they were to participate. The principal in School A mentioned that "Other teachers are showing interest in the World Links training and want to get involved." The non-participating teacher in School A said, "There is a common feeling among other teachers that they should get involved in the use of ICT." According to the principal in School B, the non-participating teacher has been very inquisitive about the program. The World Links teacher agreed by saying, "Colleagues are excited and want to know more." The principal in School E said, "Other teachers began to look forward to participating in such programs." While the non-

participating teacher in School E said, "I heard from the World Links teachers that the program is excellent. My students who are learning based on the traditional method are always asking me to incorporate computers in teaching."

Strengths and Weaknesses

World Links teachers, students, and principals were asked to give an overall rating for the effectiveness of the World Links program. Table 36 shows that 44% of the teachers, 52% of the students, and 40% of the principals rated the program as very effective. Only 4 teachers (4%), 3 students (2%), and 6 principals (5%) said it was not at all effective. Likewise, each respondent was asked if they would recommend that (or would like to see, in the case of students) other teachers participate in the program; 52% of the teachers, 63% of the principals and 68% of the students responded with "very much".

World Links teachers and principals were also asked to what extent the program contributed to the Ministry's Education Reform for the Knowledge Economy efforts. Table 37 shows that 46% of teachers and 40% of principals responded that the program contributed very much. Teachers and principals were also asked to further evaluate the program with a series of more-specific questions related to various components. Table 38 shows that the modal response for teachers was "very effective" for online communication among World Links teachers, the use of EduWave, and the assessment and certification of teachers. The support or mentoring of teachers by World Links staff received the fewest "very effective" responses (36%) and the most "not at all effective" responses (15%). Table 38 also shows that for principals, the modal response on all but one component was "some what effective". The item on assessment and certification got the most "very effective" responses from principals (46%).

In addition, World Links teachers were asked to rate various components of the training program. Table 39 shows the ratings of each of the phases of the training, as well as the training on EduWave. The modal response for all of these phases was "very effective," with 70% of the teachers rating EduWave training at this level. When asked to rate various World Links training materials and activities (Table 40), more than half of the teachers indicated a high level of satisfaction with the usefulness of the Internet-based activities (66%) and the alignment between Internet-based training activities and the training objectives (54%). The ease of implementation of Internet materials, the number of Internet activities, and the amount of time available for Internet activities all received "satisfied to a great extent" as their modal rating (48%, 47%, and 43%, respectively). On the other hand, "time available for Internet activities" also received ratings of a weak level of satisfaction from 21% of the teachers, as did the presentation of the training material.

Both World Links teachers and their principals were asked what changes or improvements they would recommend for the program; Table 41 displays the results. In general, there were relatively few recommended changes that were supported by a large number of principals. At the most, 40% mentioned the need for more mentoring and support, while 39% mentioned the need to reduce the load for participating teachers, and 37% mentioned a need for more technical support.

On the other hand, many World Links teachers had recommendations. All but two items out of the list of 13 possibilities were identified by more than 50% of the teachers as ways the program could be improved. For example, 92% affirmed the need for a reduced load, while 86% recommended more mentoring and support for teachers and 85% mentioned the need for better access to computers and the Internet.

Clearly, World Links teachers had a high regard for World Links training and for the Internet-based training materials. They also rated online communication with other World Links teachers as very effective. EduWave training and the program's assessment and certification efforts were also highly rated by both teachers and principals.

Clearly, World Links teachers had a high regard for World Links training and for the Internet-based training materials. They also rated online communication with other World Links teachers as very effective. EduWave training and the program's assessment and certification efforts were also highly rated by both teachers and principals. On the other hand, the program could benefit from a review of its teaching support practices and the way training materials are presented, according to the responses of these teachers. And a very large number of both World Links teachers and their principals mentioned the need for a reduced load for World Links teachers.

Technological Barriers to Change

The availability and use of computers and the Internet are important to all of the goals of the World Links programs, as they are to Education Reform for the Knowledge Economy efforts in Jordan, more generally. Student-centered pedagogical practices and complex information management tasks are supported by the use of various software tools and access to online materials. The participation of teachers in extended, professional communities of practice is supported by online communication and collaboration. And, of course, ICT resources are essential to the goal of integrating technology into the classroom curriculum.

Yet a random sample of Jordanian schools included in this study reported an average of 34 students per computer. Principals in the larger World Links schools reported an average of 41 students per computer. Network access was even lower in these schools. World Links schools had an average of 8 computers connected to the Internet and 15 connected to the Ministry's EduWave network, while a random set of schools had an average of only 2 computers connected to the Internet and 6 connected to EduWave. This is far different from the United States, Korea, and Hungary which have fewer than 5 students per computer in secondary schools (OECD, 2006) or even some developing countries, such as Mexico, which has on average fewer than 15 students competing for each computer, or Turkey which averages 25 secondary students per computer. In the US, 99% of the schools and 92% of the classrooms have access to the Internet (Tabs, 2003). In many European countries (Austria, Denmark, England, Finland, Iceland, Hungary, Norway, Sweden), 50% or more of school-based computers are connected to the Internet (Eurydice, 2004). The lack of these ICT resources can be a major impediment to reform in Jordan's education system.

Unsurprisingly, World Links teachers reported that their students used computers more often than did Non-World Links teachers in either World Links or Non-World Links schools (Table 42). However, the modal response for even the World Links teachers was 1-2 hours a week.

All respondents were asked to identify barriers to their use of computers in their school. Tables 43 and 44 show the percent of all three groups that cited a factor as a major barrier, with figures broken out (for teachers and students) by World Links respondents and Non-World Links respondents in World Links and Non-World Links schools. Principals are divided by those at World Links and Non-World Links schools.

The biggest barrier cited by teachers as a group was the slow speed of Internet access (66% of all teachers). But this was closely followed by the difficultly finding time for computer activities, given other curriculum and testing requirements (65%), difficulty finding time within the school's daily schedule (64%), and lack of Internet access (62%), more generally. On the other hand, relatively few teachers cited lack of support from colleagues (18%) or administrators (18%) or concerns about the value of technology (20%) or that technology does not fit into the official curriculum or syllabus (20%) or the goals of the course (26%). These low ratings are all an indication that the Ministry has been quite effective in promoting the value of technology within Jordan's educational system.

There were several significant differences between different groups of responding teachers. For example, 68% of the World Links teachers said they had difficulty finding time for computer activities within the constraints of the daily schedule but 65% of the Non-World Links teachers in Non-World Links schools cited this as a major barrier and only 58% of the Non-World Links teachers in World Links schools rated it this high. Interestingly, while 64% of the World Links teachers cited lack of Internet access as a major barrier, 48% of the Non-World Links colleagues at their schools and 72% of the Non-World Links teachers at Non-World Links schools responded this way. Other significant differences were the result of fewer World Links teachers reporting a factor as a barrier than one or both Non-World Links groups. For example, Non-World Links teachers at Non-World Links schools were far more likely to cite the lack of computer software, the convenient location of computers, and the lack of alignment between computer activities and instructional goals of their courses as barriers than were either World Links teachers or Non-World Links teachers at World Links schools. Both sets of Non-World Links teachers were more likely to cite concern about the value of technology for their students and the lack of fit between technology and the official curriculum as barriers than were World Links teachers.

Similar analyses were done for students' responses on a subset of items (Table 44). The most often cited as a major barrier by students as a group was the lack of Internet access (62%), followed by the slow speed of the Internet access (60%). The disrepair of hardware and the inconvenience of computer location was cited as a barrier by relatively few students (23% and 24%, respectively). There was only one factor among this subset that varied significantly between the groups of students. World Links students were more often to cite the over use of

Teachers, students, and principals agree that lack of Internet access and slow Internet access are major barriers to the integration of computer activities into the curriculum.

computers as a barrier (45% cited it as a major barrier), than Non-World Links students in Non-World Links schools (36% cited it as a major barrier).

Principals at World Links and Non-World Links schools were given the same list of options (Table 45). As with teachers and students, principals as a group rated lack of Internet access (67%) and slow Internet speed (65%) as major barriers. They also agreed with teachers in rarely reporting that they as administrators were not supportive of computer use (8%) or that teachers in the school were not supportive (13%) and they rarely reported concerns about technology not fitting into the official curriculum (16%) or not having value for students (17%). There were only two significant differences between World Links principals and those in other schools. Principals in Non-World Links schools were even more likely to mention lack of Internet access as a barrier (75% cited it as a major one) than World Links principals (60%) and World Links principals were more likely to mention the over use of computers (49%) than Non-World Links principals (44%).

Finally, teachers and principals were asked what kinds of support would increase there use of computer activities in classes (Table 46). Both teachers and principals mentioned that connection to the Internet (81% and 80%, respectively) and faster Internet connections (76% and 79%, respectively) would help a lot. Training on how to use computers was frequently cited by principals (77%), as was training on integrating computers into teaching (76%), additional software (73%), technical support (72%), and additional hardware (70%). Having more time to prepare for using computers was also frequently mentioned by teachers (69%). There were a number of differences between groups of teachers in their ratings. World Links teachers were more likely than either group of Non-World Links teachers to mention that the following changes would allow them to implement additional computer activities in their classes:

- Additional computers and other equipment.
- Connection to the Internet.
- Faster connection to the Internet.
- Ideas for projects and activities with which to use computers in your teaching.
- More time to prepare for using computers in your classes.

Principals differed on only one item. Principals at World Links schools were more likely to mention that faster Internet connections would increase computer activities in classrooms (86%) than principals from Non-World Links schools (71%).

Overall, it is clear that the lack of ICT resources—especially high-speed access to the Internet—are a significant barrier to change in Jordanian schools. Teachers, students, and principals in both World Links and Non-World Links schools agree on this. And teachers and

principals are also in agreement that an increase in access to the Internet, among other factors, can increase the integration of computer activities into the curriculum.

These findings from the surveys were corroborated by interviewees from the six case studies of World Links schools. Often principals, teachers, and even students mentioned limitations in ICT resources that were holding them back. During the interview of the physics teacher from School C said, "We have overcrowded classrooms compared to the number of computers, which means preparing a lesson takes longer periods of time, and there is a need to reduce the number of lessons to allow teachers to prepare requirements of such lessons." The principle in School C agreed by saying, "The teacher faces a big curricula burden, I recommend reducing the number of lessons to give teachers more time to deliver their work properly."

The headmistress in School D mentioned a number of obstacles that hindered the application of the program, including:

- Shortage in computers and laboratories.
- Problems with internet connections and slow connectivity.
- Few numbers of teachers training for World Links Program.
- Some teachers resist change.
- There is no follow up and assessment by supervisors on the implementation of World Links.
- Teachers overwhelmed with the number of classes, hindering the proper implementation of the program.

Finally, the headmistress in School F said that there were some difficulties facing the implementation process, such as coordinating the timetable of the classes for the teachers participating in the program, the fact that the computer labs are always busy with classes, and problems with the PCs which need maintenance. The World Links math teacher in School F said that there was an insufficient number of computers at the school in order to cover all subjects in addition to computer classes. "The high number of classes taught by the teachers added a burden on our shoulders in terms of meeting and training the students. This forced us to meet with the students after school hours or on Saturdays, which can not always be done." The teacher added, "There were also Internet connection problems and the access was slow."

Conclusions

Results from the surveys of World Links and Non-World Links teachers, principals, and students, and those from the case studies of six World Links schools, make it clear that many of the goals of the World Links Arab Region program in Jordan were accomplished. World Links teachers, principals, and students all agree that the program was effective and they recommend it to others. In addition, teachers and principals agree that the program contributes to the Ministry's Education Reform for the Knowledge Economy. They also rate the various components of the program as effective. In particular, World Links teachers rate the training overall and each of its components as effective.

As a result of World Links training, a number of innovative teaching and learning practices were integrated into the classrooms of World Links teachers. According to the self--reports of teachers, principals, and students, World Links teachers integrated a variety of software applications, search engines, and the Internet into their teaching, far more so than Non-World Links teachers. Furthermore, World Links teachers had their students work with other students in their class on collaborative projects that were important to them, in which they searched for information on a topic, wrote project reports, and used graphics. They did this much more so than did Non-World Links teachers. Also, World Links teachers more often collaborated with other teachers than did Non-World Links teachers and they were far more likely to use ICT to communicate with other teachers.

Consequently, World Links teachers and principals felt that the program improved teachers' ability to integrate technology into the curriculum and use a variety of ICT solutions, such as applications software, the Internet, and email. They were much more able to use student groups, use collaborative projects, and design project work. They also reported that the program increased their motivation to continuously learn and improved their attitudes and excitement about teaching and technology. Principals and teachers in the case studies also reported increased teacher skills and motivation as a result of participation in the program.

In addition to impacting teacher classroom practices, the ratings of teachers, students, and principals indicate that World Links teachers had a significant impact on a range of student outcomes, although the impacts were less pronounced than those on teachers. Many of the ratings of teachers and principals were higher than those of Non-World Links teachers. These outcomes included increased technology skills and the ability to write reports, as well as students' ability to give oral presentations in front of class, and their leadership and teamwork skills. These outcomes were confirmed and qualified by classroom observations and interviews related to the case studies of World Links schools.

Respondents agreed that the program increased the principal's knowledge and understanding of the role of ICT in teaching and learning and increased collaboration within the school. But the impact in the school beyond this was more modest. The case studies, too, confirm that it was rare that the program would impact the technological and pedagogical practices of non-participating teachers.

Much of this may have to do with the limited technological resources of the schools, particularly limited access to the Internet. This was consistently cited as a problem in surveys of both World Links and Non-World Links teachers and principals. And these limitations were often mentioned in the case study interviews.

Implications for the WLAR Program

World Links Arab Region did many things right with the program in Jordan. The results of this study confirm such a conclusion. Participating teachers improved their technological and pedagogical skills and implemented a number of innovative strategies in their classrooms. As a result, their students acquired important new technological and interpersonal skills. Teachers

also engaged in an ongoing community of teacher communication and exchange. WLAR staff can take satisfaction in these results.

Teacher Mentoring and Support

However, there are several areas in which the World Links program could be improved, according to the findings of this study. Teachers gave the mentoring program the lowest ratings of all the program components. And when asked what improvements could be made in the program, both principals and teachers most often mentioned the need for more mentoring and support for teachers—an overwhelming 86% of the World Links teachers and 40% of the principals mentioned this need. The training of teachers is a significant task for WLAR, one that requires a lot of resources and staff time. But this finding would suggest that as important as is the initial training, the follow-up and continuous support is also crucial in the minds of teachers and principals. WLAR has a mentoring component and has gone a long way to establish a vehicle for online teacher exchange that can support the ongoing need for support. However, the feedback from teachers suggests that more work in this area is wanted and needed.

WLAR has a mentoring component and has gone a long way to establish a vehicle for online teacher exchange that can support the ongoing need for support. However, the feedback from teachers suggests that more work in this area is wanted and needed.

Of course, the program could, and maybe should, hire more professional staff that could be assigned to as mentors to specific teachers. These staff could communicate with their mentees on a regular basis, review their lesson plans, and visit their classes. But this approach would require a significantly larger investment of resources in the program, if the mentor-mentee ratio was going to be reasonable enough to allow for regular contact, particularly as the program scales up.

However, to reduce some of the demand on staff resources, WLAR could take a more-formal approach to teacher collaboration and build this into their mentorship model. For example, they could create a "buddy program" in which new World Links teachers are paired up and charged to communicate with each other regularly and help each other out with problems and issues. Or they could create "senior" World Links teachers from among the graduates of the program who are recognized for their experience and accomplishments in the program and designate them as mentors to a specific group of new World Links teachers. In both cases, additional training in mentorship skills would need to be provided by the World Links program. But it is clear from the responses from teachers and principals that the World Links teachers are already overloaded. Any additional "requirements" of regular or "senior" World Links teachers would need to be met with released time from their classes that would allow them to communicate regularly with assigned new teachers.

School Impact

Both the World Links teachers and their principals felt that the program had improved the principal's understanding and support of technology's role in teaching and learning. And many teachers and principals said that the program influenced the collaboration among teachers in the school and had enhanced the role of the school in the community. But there were very few teachers and principals who felt there was a large impact of the program on the use of technology or the understanding of technology's role by non-participating teachers in the school. It was also clear from the responses of principals and teachers and from interviews during case study visits that the impact of the program on other teachers has been modest.

Changing not only the practices of participating teachers but those of their colleagues is an extremely challenging goal. Its accomplishment does not come automatically or for free. If broader school impact is to continue as a high-value goal of the program, there is a need for additional efforts (and investments) to be explicitly directed at this goal. An example of this kind of effort would be an extended workshop series specifically designed for principals of World Links schools. The workshop would help principals build on the efforts of initial participating World Links teachers in their school and integrate them into the broader curricular, pedagogical, and organizational practices in the school. There could also be a mentorship program, similar to the mentorship programs cited above, except one that partnered experience World Links teachers with their non-World Links colleagues in the same school. As mentioned above, World Links teachers would need training in the skills of peer-mentoring and would need to be supplied with released time for these activities.

If broader school impact is to continue as a high-value goal of the program, there is a need for additional efforts and investments to be explicitly directed at this goal.

Implications for Policymakers

In addition to recommendations to the WLAR program, there are also recommendations that can be derived from the results of this study for the funders of the program and for the Ministry of Education in Jordan.

Continued Support for WLAR

The most straight forward recommendation for policymakers coming from this study is that they should continue to support this successful program. All of the findings from the study justify a continuation of funding that would allow the program to continue contributing to the goals of the Education Reform for the Knowledge Economy in Jordan and they warrant additional investments that would enable the program to expand its scope and broaden its impact.

The most straight forward recommendation for policymakers coming from this study is that they should continue to support this successful program.

Responses from World Links teachers and principals indicate their desire for additional resources that would allow WLAR to improve upon and expand its mentoring program and its support for teachers after they leave training. In addition,

an overwhelming number of World Links teachers, 92%, and many principals, 39%, mentioned the need to reduce the load for participating teachers. Such a reduction would also require significant additional investments.

Additional ICT Resources for Jordanian Schools

It is also clear from the results of this study that the lack of ICT resources, particularly the lack of high bandwidth access to the Internet, is a major impediment to the integrating ICT into the curriculum in support of education change. There was universal agreement among World Links and Non-World Links teachers, students, and principals that a major barrier to technology use was the lack of Internet access or the slowness of its speed. In addition, 85% of the World Links teachers mentioned the need for better access to computers and the Internet as a way to improve the World Links program. This point also came up in interviews with principals and teachers in the World Links case studies. If teachers in Jordan are to prepare students for a civic and work life that builds on and takes advantage of technology, the Ministry of Education must continue to invest in buying computers and wiring schools and classrooms with high-speed network access.

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Direct Assessment of Student Learning

World Links teachers, students, and principals agreed that participation in the program had a significant impact on a range of student outcomes. Interviews with teachers, principals, and students at the World Links case study schools also affirmed the opinion that students benefited from participation in the program. Case study students, teachers, and principals commented that students enjoyed the class sessions, understood the course content, learned technology capabilities, and acquired communication skills, leadership skills, and collaboration skills. These opinions were confirmed by the survey results which found that teachers, principals, and students rated the program favorably on its impact on students' increased school attendance and motivation to learn and be active in class, as well as students' ability to give oral presentations in front of class, their leadership and teamwork skills, and their ability to learn collaboratively. The self-ratings of World Links teachers were significantly higher on these measures than the ratings of Non-World Links teachers. Furthermore, Principals at World Links schools rated more highly the impact of their World Links teachers on student learning than they did for their Non-World Links teachers. While the ratings of students ratings of World Links teachers were also high—actually higher than their teachers' or principals' ratings—they were not significantly different than the ratings of Non-World Links teachers by their students.

This last finding conveys some of the problems with the measures that were used in this study to evaluate the impact of the program on student learning—they are overly subjective.

While direct assessment of student learning (i.e. student testing) has more construct validity and is more reliable, reasons of cost and ease of implementation make surveys the method of choice for most large scale evaluations (Kozma & Wagner, 2005), as they did in this study. However, the uniform findings of this study lead to the recommendation that the additional expense of direct student assessment is justified for the World Links program.

The cost of direct measurement of student learning is high. However, the uniform findings of this study lead to the recommendation that the additional expense of direct student assessment is justified for the World Links program.

A deeper understanding of the impact of the program on student learning can be achieved by carefully designing and implementing an experimental evaluation using direct assessment (Carver, 2006). By comparing the scores of students on subject matter tests that are relevant to the courses of participating and non-participating teachers, policymakers would have a much higher level of confidence about the program's benefit to student learning than if they relied solely on survey and classroom observation studies. However, it is important to keep in mind that many of the skills promoted by innovative, technology-based classroom practices are not measured by standard assessments of subject matter learning. Traditional measures of math, science, language, and so on, do not measure key 21st century skills, such as critical thinking, collaboration, drawing conclusions, justifying positions, and the information management skills of searching for, organizing, analyzing, producing, and communicating information. Novel tests need to be designed to specially measure these skills. Fortunately, such tests are now being developed (Quellmalz & Kozma, 2003; Means, 2006).

Some Final Thoughts

Jordan and other countries in the Middle East have committed themselves to moving toward a knowledge economy. This commitment is both important and challenging in a region where the development of new knowledge is key to economic prosperity while the inadequate technological infrastructure is a major impediment (UNDP, 2002; Abuert & Reiffers, 2003). The strength of the effort in Jordan is the comprehensiveness of its approach to addressing the challenge. A national strategy has been initiated at the highest levels of government. This strategy coordinates efforts across ministries and between public and private sectors and addresses the major components of change—economic, technological, and educational.

If WLAR and the Ministry are ultimately going to succeed in bringing about education reform for the knowledge economy, it will be because more students in Jordan are engaged in the kinds of tasks that develop their ability to think critically, to collaborate, to communicate, to solve problems, to create, to manage information, to apply technology, and to continue to learn.

As part of this strategy, both the Ministry of Education in Jordan and World Links Arab Region have committed themselves to providing Jordanian students with the skills they need to be successful in the information age and knowledge economy of the 21st century. This requires that the curriculum,

pedagogy, and assessment move from the recall of information to the generation, dissemination, and use of new knowledge. This kind of coordinated, systemic change is an ambitious goal that calls for nothing less than a major transformation of the education system.

WLAR has gone a long way in introducing student-centered, project-based learning into participating classrooms. The student projects in Appendix B illustrate the kinds of activities that can result from these innovative interventions. But neither WLAR nor the Ministry should be content with initial success or underestimate the work that is yet to be done. Observations of classes in six World Links schools also show that even these innovative World Links teachers can still focus on the recall of facts, definitions, lists, and simple procedures at the expense of tasks that emphasize complex reasoning or at the expense of questions that require students to draw conclusions or defend the thinking behind their answers. Admittedly the case studies involved brief observations in a small number of schools and generalizations can not be drawn from them. But what remains clear is that Jordanian students will need advanced cognitive skills if they are to participate and compete in a knowledge economy. If WLAR and the Ministry are ultimately going to succeed in bringing about education reform for the knowledge economy, it will be because more students in Jordan are engaged in the kinds of tasks that develop their ability to think critically, to collaborate, to communicate, to solve problems, to create, to manage information, to apply technology, and to continue to learn—tasks such as those in Appendix B.

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About the Author

Dr. Robert Kozma is a semi-retired, independent consultant in San Francisco, California. During his thirty-five year career he was at the Center for Technology in Learning at SRI International in Menlo Park, California, for ten years where was a Director of the Center and a Principal Scientist and is now an Emeritus Director and Emeritus Principal Scientist. For 20 years prior to that, he was at the University of Michigan as a professor and a research scientist. He began his career as a primary school teacher. His expertise spans ICT policy that links education reform to economic and social development, international educational technology research, the evaluation of large-scale technology-based education reform, the design of advanced interactive multimedia systems, and the use of technology to improve learning, particularly the learning of science. During his career, he directed or co-directed over 25 research projects and large-scale evaluations of ICT-based projects, including an international evaluation of the World Links program and a national virtual high school in the US. He has authored or co-authored more than 75 articles, chapters, and books. And he has consulted with Ministries of Education in Egypt, Singapore, Thailand, Norway, and Chile, as well as Intel Corporation, the World Bank, OECD, UNESCO, and the Ford Foundation on the use of technology to improve educational systems and connect to development goals. Most recently, he provided pro-bono consulting for the Millennium Villages Project on the role that ICT can play in supporting poverty reduction and development in Africa.

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Appendix A:

Tables

Table 1. Gender by Teacher Participation		
Gender	Teacher Participation	
	World Links	Non-World Links
Male	46% 57	48% 122
Female	54% 68	52% 131

Table 2. Teacher Participation by Education Background		
Education Background	Teacher Participation	
	World Links	Non-World Links
Less than BA	5% 6	13% 33
BA	64% 80	64% 162
More than BA, less than MA	19% 24	18% 45
MA	10% 13	5% 13
More than MA, less than Doctorate	1% 1	0% 1
Doctorate	0% 0	0% 1

Table 3. Years at Current School by Teacher Participation		
Years at Current School	Teacher Participation	
	World Links	Non-World Links
1-2 Years	24% 30	28% 70
3-5 Years	38% 48	26% 67
5-10 Years	26% 33	29% 74
10-15 Years	8% 10	12% 32
More than 15 Years	3% 4	5% 12

Table 4. Years Taught by Teacher Participation		
Years Taught	Teacher Participation	
	World Links[A]	Non-World Links
1-2 Years	5% 6	11% 29
3-5 Years	23% 29	18% 47
5-10 Years	25% 31	18% 45
10-15 Years	32% 40	27% 69
More than 15 Years	14% 18	25% 64

[A] Chi square=12.2, df=4; p>.05

Table 5. Rank by Teacher Participation		
Rank	Teacher Participation	
	World Links[A]	Non-World Links
Assistant Teacher	23% 27	31% 75
Teacher	69% 82	66% 161
First Teacher	8% 9	2% 5
Expert Teacher	1% 1	0% 1

Mann Whitney U=12646; p>.05

Table 6. Subject Taught by Teacher Participation		
Subject Taught	Teacher Participation	
	World Links	Non-World Links
Grades 1, 2, or 3	1% 1	4% 9
Science	34%[A] 43	17% 44
Mathematics	19% 24	18% 47
Arabic Language	10% 12	18%[B] 47
Social Studies	10% 13	14% 35
Religion	5% 6	9% 24
Informatics	5% 6	6% 14
Foreign Language	12% 15	15% 39
Other Subjects	5% 6	7% 18
Special Program	0% 0	1% 3

[A] Chi square=14.1, df=1; p>.001
[B] Chi square=4.9, df=1; p>.05

Table 7. Home Computer and Access by Teacher Participation		
Home Computer and Access	Teacher Participation	
	World Links	Non-World Links
Home Computer	93%[A] 116	80% 204
Home Computer with Internet Access	45% 52	37% 76

[A] Chi square=9.9, df=1; p>.005

Table 8. Professional Development Experience by Teacher Participation		
Professional Development Experience	Teacher Participation	
	World Links	Non-World Links
ICDL	90% 113	84% 214
Intel Teach	5% 6	34%[A] 87
ERfKE	60%[B] 75	40% 103
Education Diploma in ICT	5% 6	3% 7
Other	11% 14	8% 20

[A] Chi square=38.8, df=1; p>.001
[B] Chi square=13.2, df=1; p>.001

Table 9. Hours Preparing by Teacher Participation		
Hours Preparing in a Typical Week	Teacher Participation	
	World Links[A]	Non-World Links
Zero	1% 1	5% 12
1-2 Hours	21% 25	43% 106
3-4 Hours	41% 49	31% 75
5-6 Hours	17% 20	12% 28
7 Hours or More	21% 25	9% 23

Mann Whitney U Test=10077; p>.001

Table 10. Education Background by Teacher Participation			
Education Background	Teacher Participation		
	World Links[A]	Non-World Links World Links School	Non-World Links Non-World Links School
Less than BA	5% 6	10% 13	15% 20
BA	64% 80	64% 79	63% 83
More than BA, less than MA	19% 24	20% 25	15% 20
MA	10% 13	5% 6	5% 7
More than MA, less than Doctorate	1% 1	1% 1	0% 0
Doctorate	0% 0	0% 0	1% 1

[A] Between World Links teachers & Non-World Links teachers in Non-World Links schools
Chi square=11.6, df=5; p>.05

Table 11. Rank by Teacher Participation			
Rank	Teacher Participation		
	World Links[A]	Non-World Links World Links School	Non-World Links Non-World Links School
Assistant Teacher	23% 27	28% 34	34% 41
Teacher	69% 82	69% 84	64% 77
First Teacher	8% 9	2% 2	2% 3
Expert Teacher	1% 1	1% 1	0% 0

[A] Between World Links teachers & Non-World Links teachers in Non-World Links schools
Chi square=11.6, df=5; p>.05

Table 12. Years Taught by Teacher Participation			
Years Taught	Teacher Participation		
	World Links[A]	Non-World Links World Links School	Non-World Links Non-World Links School
1-2 Years	5% 6	10% 13	12% 16
3-5 Years	23% 29	18% 23	18% 24
5-10 Years	25% 31	19% 24	16% 21
10-15 Years	32% 40	30% 37	25% 32
More than 15 Years	14% 18	22% 27	28% 37

[A] Between World Links teachers & Non-World Links teachers in Non-World Links schools
Chi square=14.2, df=4; p>.005

Table 13. Home Computer and Access by Teacher Participation			
Home Computer and Access	Teacher Participation		
	World Links	Non-World Links World Links SchoolB	Non-World Links Non-World Links School
Home Computer	94%[A] 107	85% 104	76% 100
Home Computer with Internet Access	47%[B] 50	42% 44	32% 32

[A] Between World Links teachers & Non-World Links teachers in Non-World Links schools
Chi square=14.2, df=1; p>.001
[B] Between World Links teachers & Non-World Links teachers in Non-World Links schools
Chi square=4.7, df=1; p>.05

Table 14. School Level by School Participation		
School Level	School Participation	
	World Links[A]	Non-World Links
Lower (Grades 1-6)	0% 0	20% 26
Basic (Grades 1-10)	25% 30	40% 52
Secondary Only (Grades 11-12)	13% 16	5% 6
Secondary (Any Grade-12)	62% 76	35% 46

[A] Chi square=43.6, df=3; p>.001

Table 15. School Gender by School Participation		
School Gender	School Participation	
	World Links[A]	Non-World Links
All-Boys	43% 54	40% 53
All-Girls	39% 49	28% 36
Mixed Gender	18% 22	32% 42

[A] Chi square=8.1, df=3; p>.05

Table 16. Student Grade Level by Participation		
Grade Level	Student Participation	
	World Links[A]	Non-World Links
Grade 6	1% 1	6% 15
Grade 7	3% 3	8% 20
Grade 8	12% 13	14% 33
Grade 9	14% 16	18% 42
Grades 10	26% 29	21% 49
Grade 11	20% 22	13% 31
Grade 12	26% 29	20% 47

[A] Chi square=13.9, df=6; p>.05

Table 17. Student Subject Taken by Participation		
Subject Taken	Student Participation	
	World Links	Non-World Links
Science	40%[A] 39	28% 53
Mathematics	14% 14	20% 38
Arabic Language	13% 13	19% 37
Social Studies	6% 6	8% 15
Religion	5% 5	4% 8
Informatics	3% 3	5% 10
Foreign Language	14% 14	10% 20
Other Subjects	3% 3	5% 10

[A] Chi square=6.1, df=1; p>.05

Table 18. Home Computer and Access by Student Participation		
Home Computer and Access	Student Participation	
	World Links	Non-World Links
Home Computer	86%[A] 97	72% 169
Home Computer with Internet Access	45% 44	37% 63

[A] Chi square=8.5, df=1; p>.005

Table 19. Student Grade Level by Participation			
Grade Level	Student Participation		
	World Links[A]	Non-World Links World Links School	Non-World Links Non-World Links School
Grade 6	1% 1	2% 2	11% 13
Grade 7	3% 3	3% 4	13% 16
Grade 8	12% 13	11% 13	17% 20
Grade 9	14% 16	14% 16	22% 26
Grade 19	26% 29	20% 24	21% 25
Grade 11	20% 22	21% 25	5% 6
Grade 12	26% 29	29% 34	11% 13

[A] Between World Links students & Non-World Links students in Non-World Links schools
Chi square=38.4, df=6; p>.001

Table 20. Subject Taken by Student Participation			
Subject Taken	Student Participation		
	World Links[A]	Non-World Links World Links School	Non-World Links Non-World Links School
Science	40% 39	36% 38	17% 15
Mathematics	14% 14	19% 20	21% 18
Arabic Language	13% 13	12% 13	28% 24
Social Studies	6% 6	8% 8	8% 7
Religion	5% 5	5% 5	3% 3
Informatics	3% 3	5% 5	6% 5
Foreign Language	14% 14	11% 11	10% 9
Other Subjects	3% 3	4% 4	7% 6

[A] Between World Links students and Non-World Links students in Non-World Links schools
Chi square=17.1, df=7; p>.05

Table 21. Home Computer and Access by Student Participation			
Home Computer and Access	Student Participation		
	World Links	Non-World Links World Links School	Non-World Links Non-World Links School
Home Computer	86%[A] 97	82% 97	61% 72
Home Computer with Internet Access	45%[B] 44	41% 41	30% 22

[A] Chi square=18.1, df=1; p>.001
[B] Chi square=4.1, df=1; p>.05

Table 22. Training Phases Completed by World Links Teachers	
Phase	Completed
Phase I	95% 119
Phase II	94% 118
Phase III	94% 117
Phase IV	94% 118
EduWave	94% 117

Table 23. Program Components Used by World Links Teachers	
Component	Used
Technical Support	66% 83
Teaching Support & Mentoring	55% 69
EduWave Tools	79% 99
Email with WLAR Staff	78% 98
Email with Other World Links Teachers	71% 89

Certification	71% 89

[A] **Table 24A. Teachers' Self Assessment of Implementation of Classroom Strategies by Teacher Participation**

Frequency of Implementation (1-3 Times a month or more)[A]	Teacher Participation		
	World Links Teachers	All Non-World Links Teachers	Non-World Links in World Links Schools
Integration of ICT			
Used applications software	66%[BC] 75	31% 74	36% 42
Used subject software	40%[BC] 43	20% 44	21% 24
Used email	48%[BC] 53	14% 31	17% 18
Used the Internet	60%[BC] 64	26% 60	33% 37
Used search engine	66%[BC] 73	26% 58	32% 36
Used simulations	27% 28	20% 46	20% 22
Used discussion forums	24%[BC] 25	17% 38	17% 19
Produced web pages	26%[BC] 29	7% 17	8% 9
Used drill and practice software	34%[BC] 36	12% 28	14% 16
Student-Centered Teaching			
Collaborated with other students in class	43%[BC] 48	36% 87	32% 38
Collaborated with other school in Jordan	17%[BC] 19	5% 11	4% 5
Collaborated with school in other country	1% 1	5% 11	5% 6
Gathered and analyzed materials	35%[BC] 35	19% 43	16% 17
Wrote reports, PowerPoint presentations, newsletters	49%[BC] 55	33% 78	33% 40
Used graphics in a report	54%[BC] 61	28% 68	28% 32
Search for and organized information	46%[BC] 50	28% 68	26% 31
Collected information on another country	16% 17	14% 33	12% 13
Drew conclusions or made predictions	38%[BC] 39	26% 55	22% 25
Gave presentations to parents or community	14%[BC] 16	10% 23	8% 9
Communicated with outside experts	8%[BC] 8	8% 19	8% 9
Analyzed and evaluated information	24% 25	21% 48	20% 23

While "1-3 times a month" and "Once a week or more" responses were combined and only these are displayed here, the analyses were done on the full range of responses.

[B] Mann-Whitney U p>.05 for comparisons between World Links teachers and All Non-World Links teachers

[C] Mann-Whitney U p>.05 for comparisons between World Links teachers and Non-World Links teachers in World Links schools.

[A]

Table 24B. Teachers' Self Assessment of Implementation of Classroom Strategies by Teacher Participation

Extent of Implementation (very much)[A]	Teacher Participation		
	World Links Teachers	All Non-World Links Teachers	Non-World Links in World Links Schools
Integration of ICT			
Used computers for administrative purposes	39% 43	32% 76	28% 32
Used computers to plan work	75% [BC] 85	54% 133	57% 69
Student-Centered Teaching			
Collaborative projects	64% [BC] 73	31% 74	34% 40
Activities students liked and felt were important	66% [BC] 75	47% 114	49% 58
Used guidelines to help students learn on their own	61% 70	59% 146	56% 66
Paid attention to each students' progress	52% 57	51% 124	51% 61
Teacher Communication			
Collaborated with other teachers on projects	52% [BC] 58	22% 54	23% 27
Used computers to collaborate with teachers	50% [BC] 56	22% 52	24% 28
Used computers to contact outside experts	18% [BC] 19	9% 22	10% 12
Used computers to communicate with parents	14% [BC] 15	3% 8	2% 3

While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.

[B] Mann-Whitney U p>.05 for comparisons between World Links teachers and All Non-World Links teachers

[C] Mann-Whitney U p>.05 for comparisons between World Links teachers and Non-World Links teachers in World Links schools.

Table 25A. Students' Assessment of Teachers' Implementation of Classroom Strategies by Participation		
Frequency of Implementation (1-3 Times a month or more)[A]	Teacher Participation	
	World Links	Non-World Links
Integration of ICT		
Used applications software	54%[B] 63	36% 89
Used subject software	34% 38	21% 49
Used email	41%[B] 48	15% 38
Used the Internet	47%[B] 55	22% 54
Used search engine	46%[B] 53	21% 51
Used simulations	26% 29	25% 56
Used discussion forums	18% 21	21% 47
Produced web pages	20%[B] 24	9% 21
Used drill and practice software	29% 32	18% 40
Student-Centered Teaching		
Collaborated other students in class	34%[B] 40	33% 80
Collaborated with other school in Jordan	6%[B] 7	3% 7
Collaborated with school in other country	4% 4	2% 4
Gathered and analyzed materials	35%[B] 38	26% 58
Wrote reports, PowerPoint presentations, newsletters	38%[B] 45	29% 68
Used graphics in a report	38%[B] 45	24% 56
Search for and organized information	32% 35	24% 54
Collected information on another country	13% 14	14% 31
Drew conclusions or made predictions	25% 28	24% 54
Gave presentations to parents or community	12% 13	15% 35
Communicated with outside experts	15% 17	6% 13
Analyzed and evaluated information	33% 37	22% 50

[A] While "1-3 times a month" and "Once a week or more" responses were combined and only these are displayed here, the analyses were done on the full range of responses.
[B] Mann-Whitney U p>.05 for comparisons between World Links students and Non-World Links students

Table 25B. Students' Assessment of Teachers' Implementation of Classroom Strategies by Participation		
Extent of Implementation (very much)[A]	Teacher Participation	
	World Links	Non-World Links
Student-Centered Teaching		
Collaborative projects	42%[B] 49	23% 54
Activities students liked and felt were important	56%[B] 66	43% 105
Used guidelines to help students learn on their own	65% 77	53% 127
Paid attention to each students' progress	62% 73	61% 148

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Mann-Whitney U p>.05 for comparisons between World Links students and Non-World Links students.

Table 26A. World Links Principals' Assessment of Teachers' Implementation of Classroom Strategies by Participation		
Extent of Implementation (very much)[A]	Teacher Participation	
	World Links	Non-World Links
Integration of ICT		
Used subject software	46%[B] 51	22% 26
Used email	50%[B] 56	22% 26
Used the Internet	52%[B] 59	26% 31
Used search engine	54%[B] 60	24% 28
Produced web pages	40%[B] 45	16% 19
Student-Centered Teaching		
Collaborated with other school in Jordan	24%[B] 27	3% 4
Collaborated with school in other country	11%[B] 12	1% 1
Wrote reports, PowerPoint presentations, newsletters	51%[B] 60	14% 17
Gave presentations to parents or community	28%[B] 31	9% 10
Communicated with outside experts	36%[B] 40	11% 14

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Wilcoxon p>.05 for comparisons between World Links principals and Non-World Links principals.

Table 26B. World Links Principals' Assessment of Teachers' Implementation of Classroom Strategies by Participation		
Extent of Implementation (very much)[A]	Teacher Participation	
	World Links	Non-World Links
Integration of ICT		
Used computers for administrative purposes	42% 49	34% 41
Used computers to plan work	60%[B] 69	47% 57
Student-Centered Teaching		
Collaborative projects	54%[B] 64	14% 16
Activities students liked and felt were important	56%[B] 65	25% 29
Used guidelines to help students learn on their own	66%[B] 78	35% 40
Paid attention to each students' progress	47%[B] 55	34% 38
Teacher Communication		
Collaborated with other teachers on projects	60%[B] 70	33% 37
Used computers to collaborate with teachers	57%[B] 66	26% 29
Used computers to contact outside experts	32%[B] 37	13% 14
Used computers to communicate with parents	24%[B] 27	4% 5

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Mann-Whitney U p>.05 for comparisons between World Links principals and Non-World Links principals.

Table 27. Comparisons of World Links Teachers' Self-Assessment Classroom Implementation in Jordan and Internationally		
Frequency of Implementation (1-3 Times a month or more)[A]	World Links Teachers	
	Jordanian	International
Integration of ICT		
Used applications software	67%	71%
Used email	49%	62%
Used the Internet	60%	59%
Used search engine	66%	56%
Produced web pages	25%	16%
Used drill and practice software	35%	56%
Student-Centered Teaching		
Collaborated with other students in class	44%	53%
Collaborated with other school in same country	16%	27%
Collaborated with school in other country	1%	23%
Gathered and analyzed materials	35%	44%
Wrote reports, PowerPoint presentations, newsletters	50%	35%
Used graphics in a report	55%	35%
Collected information on another country	16%	26%
Drew conclusions or made predictions	38%	34%

Table 28 Reported Impacts on World Links Teachers				
Report of "very much" impact on:	Teacher Impacts Reported by World Links Teachers and Principals			
	Jordanian Teachers	Jordanian Principals	International Teachers	International Principals
ICT Skills				
How to use computers to enhance learning and teaching	70% 79	69% 82	–	–
Improved understanding of the role of ICT to enhance teaching and learning	60% 67	62% 68	–	–
How to integrate computers into the curriculum	66% 75	60% 69	39%	40%
How to use computer hardware	58% 64	71% 83	70%	82%
How to use software applications	66% 72	66% 77	67%	67%
How to use the Internet	80% 90	77% 86	73%	80%
How to develop Web pages	61% 68	58% 63	47%	53%
How to use simulations	44% 47	44% 50	–	–
How to use email	72% 80	66% 73	–	–
Pedagogical Skills				
How to use student-centered strategies	58% 66	58% 67	–	–
How to use collaborative projects	64% 71	61% 70	–	–
How to use student groups	67% 75	60% 70	63%	60%
How to design student project work	64% 72	54% 63	68%	58%
How to evaluate learning resources	56% 63	50% 56	–	–
Collaboration Skills				
How to collaborate with other teachers	53% 58	44% 49	52%	44%
Attitudes				
Attitudes about technology	60% 66	54% 61	72%	85%
Attitudes about teaching	69% 75	59% 66	75%	90%
Improved confidence in applying innovative techniques	65% 73	58% 64	–	–
Ability to continuously learn and improve	71% 80	61% 68	–	–
Ability to learn from other teachers	63% 67	55% 61	–	–
Excitement about teaching	71% 78	67% 76	–	–
Ability to communicate with others directly and in virtual communities	65% 70	50% 54	–	–

Table 29 Teacher Self-Assessment of Student Impacts by Teacher Participation			
Teachers' report of "very much" impact on students':[A]	Teacher Participation		
	World Links Teachers	All Non-World Links Teachers	Non-World Links in World Links Schools
ICT Skills			
Technology skills	45%[BC] 46	17% 38	22% 25
Apply technology outside school	38%[BC] 40	19% 43	21% 23
Use technology ethically	60%[BC] 64	38% 86	41% 46
Document resources	44%[BC] 47	18% 41	21% 22
Interest in technology	49%[B] 53	36% 81	40% 44
Knowledge			
Understand school subject matter	60%[BC] 67	47% 117	41% 49
Ability to use school subjects to solve problems outside school	44% 47	33% 77	32% 35
Complex Cognitive Skills			
Ability to reason with information	53%[BC] 58	39% 93	41% 48
Ability to search for, analyze information	44%[BC] 48	30% 69	42% 36
Ability to evaluate positions on an issue	27% 19	27% 62	29% 32
Ability to write reports	51%[B] 57	39% 94	41% 48
Ability to come up with new ideas	38% 40	30% 70	33% 37
Research skills	58%[BC] 64	25% 59	27% 32
Plan tasks and implement projects	35%[B] 39	25% 58	31% 36
Ability to manage their own learning	33%[BC] 35	20% 46	22% 25
Interpersonal Skills			
Communication skills	51% 55	47% 113	48% 56
Ability to learn collaboratively	64%[BC] 72[BC]	50% 122	50% 59
Leadership and team skills	66%[BC] 74	39% 93	42% 47
Ability to organize and run meetings	40% 43	33% 75	34% 39
Ability to speak in front of others	67%[BC] 74	42% 101	42% 49
Knowledge of other cultures	22% 23	15% 34	21% 24

Table 29 Teacher Self-Assessment of Student Impacts by Teacher Participation (Continued)			
Teachers' report of "very much" impact on students':[A]	Teacher Participation		
	World Links Teachers	All Non-World Links Teachers	Non-World Links in World Links Schools
Attitudes			
Enjoyment of school	64%[C] 69	53% 128	49% 57
School attendance	73% 80	71% 172	62% 74
Motivation to learn and be active in class	70% 78	59% 144	58% 69
Engagement in out-of-class learning	46% 49	37% 87	35% 40
Ability to learn on own after graduate	49%[BC] 46	34% 70	31% 32
Ability to get a better job	47%[B] 44	31% 59	36% 34
Ability to get job in the knowledge economy	36%[B] 31	24% 44	27% 25

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Mann-Whitney U p>.05 for comparisons between World Links teachers and All Non-World Links teachers
[C] Mann-Whitney U p>.05 for comparison between World Links teachers and Non-World Links teachers in World Links schools.

Table 30 World Links Teachers' Attribution of Student Impacts to their World Links Participation	
Teachers' report that their participation had "very much" impact on students':	World Links Teachers
ICT Skills	
Technology skills	43% 47
Apply technology outside school	35% 37
Use technology ethically	61% 65
Document resources	38% 41
Interest in technology	56% 60
Knowledge	
Understand school subject matter	51% 57
Ability to use school subjects to solve problems outside school	44% 47
Complex Cognitive Skills	
Ability to reason with information	50% 55
Ability to search for, analyze, and organize information	53% 58
Ability to evaluate positions on an issue	30% 32
Ability to write reports	55% 61
Ability to come up with new ideas	37% 38
Research skills	55% 61
Plan tasks and implement projects	41% 45
Ability to manage their own learning	41% 44
Interpersonal Skills	
Communication skills	58% 63
Ability to learn collaboratively	62% 69
Leadership and team skills	59% 64
Ability to organize and run meetings	46% 50
Ability to speak in front of others	63% 71
Knowledge of other cultures	26% 25

Table 30 World Links Teachers' Attribution of Student Impacts to their World Links Participation (Continued)	
Teachers' report that their participation had "very much" impact on students':	World Links Teachers
Attitudes	
Enjoyment of school	60% 63
School attendance	69% 76
Motivation to learn and be active in class	61% 67
Engagement in out-of-class learning	47% 48
Ability to learn on own after graduate	39% 37
Ability to get a better job	39% 34
Ability to get job in the knowledge economy	37% 33

Table 31 Student Self-Assessment of Impacts by Teacher Participation		
Students' report of "very much" impact on their:[A]	Participation	
	World Links	Non-World Links
ICT Skills		
Technology skills	43% 49	28% 63
Apply technology outside school	48% 56	32% 71
Use technology ethically	70% 80	59% 137
Document resources	40% 47	32% 72
Interest in technology	49% 57	42% 98
Knowledge		
Understand school subject matter	68% 82	66% 164
Ability to use school subjects to solve problems outside school	41% 48	43% 103
Complex Cognitive Skills		
Ability to reason with information	50% 60	56% 139
Ability to search for, analyze, and organize information	56% 65	45% 104
Ability to evaluate positions on an issue	29% 35	25% 60
Ability to write reports	55%[B] 65	38% 91
Ability to come up with new ideas	46%[B] 53	35% 83
Research skills	53% 64	41% 96
Plan tasks and implement projects	41% 47	36% 85
Ability to manage their own learning	43% 49	41% 95
Interpersonal Skills		
Communication skills	64% 75	61% 146
Ability to learn collaboratively	56% 66	50% 118
Leadership and team skills	56% 66	44% 101
Ability to organize and run meetings	41% 49	36% 81
Ability to speak in front of others	66% 78	55% 127
Knowledge of other cultures	21% 24	22% 50

Table 31 Student Self-Assessment of Impacts by Teacher Participation (Continued)		
Students' report of "very much" impact on their:[A]	Participation	
	World Links	Non-World Links
Attitudes		
Enjoyment of school	57% 67	60% 144
School attendance	71% 85	78% 193
Motivation to learn and be active in class	75% 90	74% 180
Engagement in out-of-class learning	51% 59	42% 101
Ability to learn on own after graduate	56% 65	61% 140
Ability to get a better job	58% 60	57% 122

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Mann-Whitney U p>.05 for comparisons between World Links students and Non-World Links students

Table 32 World Links Students' Attribution of Student Impacts to their Teachers' World Links Participation	
Students' report that their teachers' participation had "very much" impact on their:	World Links Students
ICT Skills	
Technology skills	48% 58
Interest in technology	51% 62
Complex Cognitive Skills	
Ability to reason with information	48% 58
Interpersonal Skills	
Communication skills	58% 71
Knowledge of other cultures	29% 35
Attitudes	
Enjoyment of school	52% 63
School attendance	70% 85
Ability to get a better job	19% 23

Table 33 World Links Principals' Assessment of Student Impacts by Teacher Participation		
Principals' report of "very much" impact on students': [A]	Participation	
	World Links Teachers	Non-World Links Teachers
ICT Skills		
Technology skills	51%[B] 58	15% 36
Interest in technology	57%[B] 64	18% 43
Complex Cognitive Skills		
Ability to reason with information	55%[B] 63	20% 48
Interpersonal Skills		
Communication skills	53%[B] 62	22% 52
Knowledge of other cultures	34%[B] 38	7% 16
Attitudes		
Enjoyment of school	65%[B] 73	38% 92
School attendance	60%[B] 68	49% 117
Ability to get a better job	36%[B] 37	18% 38

[A] While only the "very much" responses are displayed here, the analyses were conducted on the full range of responses.
[B] Mann-Whitney U p>.05 for principals' comparisons between World Links and Non-World Links teachers

Table 34 World Links Principal's Attribution of Student Impacts to their Teachers' World Links Participation	
Principals' report that their teachers' participation had "very much" impact on students':	World Links Principals
ICT Skills	
Technology skills	50% 58
Interest in technology	50% 57
Complex Cognitive Skills	
Ability to reason with information	53% 61
Interpersonal Skills	
Communication skills	51% 58
Knowledge of other cultures	32% 36
Attitudes	
Enjoyment of school	63% 72
School attendance	63% 71
Ability to get a better job	41% 42

Table 35. World Links Teachers' and Principals' Assessment of School Impacts of Teacher Participation		
Report of "very much" impact on:	World Links Teachers	World Links Principals
Principal's understanding of the role of ICT in teaching	50% 57	55% 63
Other teachers' understanding of the role of ICT in teaching	26% 29	31% 36
Positive environment for innovation	35% 38	47% 55
Collaboration among teachers in the school	46% 52	55% 63
Increased dialog in the school about educational change	42% 46	48% 55
Other teachers' use of computers	38% 42	32% 36
Enhanced role of the school in the community	46% 50	48% 55

Table 36. Teachers' and Principals' Overall Assessment of the WLAR Program			
Overall Assessment of WLAR Effectiveness:	World Links Teachers	World Links Students	World Links Principals
Not at all effective	4% 4	2% 3	5% 6
Somewhat effective	52% 57	36% 43	54% 63
Very effective	44% 48	52% 63	40% 47

Table 37. Teachers' and Principals' Assessment of Extent WLAR Program Contributed to ERfKE		
Assessment of WLAR Effectiveness:	World Links Teachers	World Links Principals
Not contributed at all	5% 5	6% 7
Contributed somewhat	49% 51	54% 61
Contributed very much	46% 48	40% 45

Table 38. World Links Teachers' and Principals' Assessment of Components of the WLAR Program						
Report of effectiveness for:	World Links Teachers			World Links Principals		
	Not at All Effective	Somewhat Effective	Very Effective	Not at All Effective	Somewhat Effective	Very Effective
Technical support from WLAR	10% 11	51% 56	38% 42	12% 13	59% 64	29% 32
Teaching support and mentoring from WLAR	15% 17	49% 54	36% 40	6% 7	60% 67	34% 38
Use of EduWave	5% 5	47% 51	48% 52	8% 9	48% 55	44% 50
Communication through email with WLAR staff	11% 12	46% 52	43% 48	13% 14	54% 59	33% 36
Online communication and collaboration among WLAR teachers	13% 14	38% 42	50% 55	14% 15	51% 55	35% 37
WLAR assessment and certification	10% 11	44% 49	46% 51	11% 12	43% 46	46% 49

Table 39. World Links Teachers' Assessment of WLAR Phases of Training			
Phases	Not at All Effective	Somewhat Effective	Very Effective
Phase I	6% 7	38% 43	56% 64
Phase II	4% 4	38% 43	58% 65
Phase III	4% 4	31% 35	65% 73
Phase IV	6% 7	40% 45	54% 61
EduWave	4% 4	27% 30	70% 78

Table 40. World Links Teachers' Satisfaction with Components of WLAR Training			
Components	To a Weak Extent	To a Moderate Extent	To a Great Extent
Ideas well expressed	12% 13	54% 60	34% 38
Units well structure	12% 14	52% 59	35% 40
Training materials presented in an easy way	21% 24	52% 58	27% 30
Training materials interesting and motivating	19% 21	41% 46	40% 44
Training books and manuals were useful	19% 21	42% 47	39% 43
Internet-based activities were in line with objectives	9% 10	36% 42	54% 60
Internet-based activities were easy to implement	10% 11	42% 47	48% 53
Number of online materials adequate	13% 15	39% 44	47% 53
Time available for Internet-based activities was adequate	21% 24	36% 40	43% 48
Internet-based activities were useful	4% 4	30% 34	66% 74

Table 41. World Links Teachers' and Principals' Recommended Program Changes		
Recommended changes:	World Links Teachers	World Links Principals
Update training materials	76% 87	31% 80
More on theory of teaching	35% 40	18% 46
More online materials	74% 84	32% 81
More mentoring and support	86% 98	40% 102
More technical support	79% 90	37% 95
More collaboration with other teachers	59% 67	27% 68
Reduced academic load	92% 105	39% 99
Training shortened	63% 72	26% 66
Better qualified teachers	60% 69	29% 75
More on pedagogical reform	42% 48	22% 55
Better access to computers & Internet	85% 97	35% 90
Improved translation of materials	62% 71	26% 67
More technical training materials	64% 73	29% 75

Table 42. Teachers' Report of Students' Use of Computers by Teacher Participation			
Hours Students Used Computers in a Typical Week	Teacher Participation		
	World Links[AB]	Non-World Links World Links Schools	Non-World Links Non-World Links Schools
Zero	2% 3	15% 18	20% 25
1-2 Hours	36% 43	37% 43	52% 64
3-4 Hours	31% 38	35% 41	21% 26
5-6 Hours	15% 18	8% 10	16% 2
7 Hours or More	16% 19	4% 5	6% 7

[A] Mann-Whitney U p>.05 for comparisons between World Links teachers and Non-World Links teachers in World Links schools.

[B] Mann-Whitney U p>.05 for comparisons between World Links teachers and Non-World Links teachers in Non-World Links schools.

Table 43. Teacher Identified Barriers to ICT Use by Teacher Participation				
Identified as "Major Barriers" to ICT Use	Teacher Participation			
	All Teachers	World Links Teachers	Non-World Links in World Links Schools	Non-World Links in Non-World Links Schools
Not enough hardware	40% 144	40% 49	37% 46	44% 54
Lack of appropriate software	36% 131	26% 32	34% 42	49% [B] 60
Hardware out of repair	26% 92	24% 29	29% 34	28% 33
Computers not conveniently located	30% 107	30% 37	20% 24	41% [B] 49
Computers overly used	51% 182	57% 71	43% 53	52% 64
Lack of Internet access	62% 222	64% [A] 80	48% 59	72% 89
Slow network speed	66% 227	68% 81	58% 68	69% 83
Lack of technical support	38% 134	34% 42	32% 39	49% 57
Computer activities do not match goals of course	26% 91	21% 26	21% 25	38% [B] 44
Difficulty finding time for activities within the day	64% 228	68% [A] 84	58% 71	65% 80
Difficulty finding time, given curriculum & testing	65% 233	70% [A] 87	58% 71	69% 83
Difficulty finding time to prepare	59% 207	60% 75	54% 67	60% 72
Computers are not valuable for students	20% 69	8% 10	29% [A] 34	22% [B] 26
Computers do not fit into the official curriculum	20% 72	14% 17	23% [A] 28	24% [B] 29
Lack of support from colleagues	18% 64	17% 21	21% 26	16% 20
Lack of administrative support	18% 65	19% 23	20% 24	17% 21

[A] Chi square, p>.05 for comparisons between World Links teachers and Non-World Links teachers in World Links Schools.
[B] Chi square, p>.05 for comparisons between World Links teachers and Non-World Links teachers in Non-World Links Schools.

Table 44. Student Identified Barriers to ICT Use by Participation			
Identified "Major Barriers" to ICT Use	Participation		
	All Students	World Links Students	Non-World Links Students
Not enough hardware	32% 81	33% 40	31% 76
Lack of appropriate software	32% 78	32% 39	30% 74
Hardware out of repair	23% 55	23% 28	24% 59
Computers not conveniently located	24% 58	24% 29	19% 46
Computers overly used	38% 95	45% [A] 54	36% 89
Lack of Internet access	62% 154	59% 72	61% 149
Slow network speed	60% 143	62% 72	58% 137
Lack of technical support	36% 88	32% 39	36% 89

[A] Chi square, p>.05 for comparisons between World Links students and Non-World Links students in World Links Schools.

Table 45. Principal Identified Barriers to ICT Use by Participation			
Identified "Major Barriers" to ICT Use	Participation		
	All Principals	World Links Principals	Non-World Links Principals
Not enough hardware	40% 94	40% 49	40% 45
Lack of appropriate software	32% 73	29% 35	34% 38
Hardware out of repair	20% 47	29% 27	18% 20
Computers not conveniently located	29% 66	28% 33	31% 33
Computers overly used	46% 106	49% [A] 59	44% 47
Lack of Internet access	67% 155	60% 74	75%[A] 81
Slow network speed	65% 147	64% 78	67% 69
Lack of technical support	48% 112	45% 54	53% 58
Computer activities do not match goals of course	20% 47	23% 28	18% 19
Difficulty finding time for activities within the day	42% 96	44% 54	38% 42
Difficulty finding time, given curriculum & testing	46% 106	46% 57	46% 49
Difficulty finding time to prepare	43% 100	40% 49	47% 51
Computers are not valuable for students	17% 40	14% 18	20% 22
Computers do not fit into the official curriculum	16% 37	13% 16	20% 21
Lack of support from colleagues	13% 30	15% 19	10% 11
Lack of administrative support	8% 19	11% 13	6% 6

[A] Chi square, p>.05 for comparisons between World Links and Non-World Links principals.

Table 46. Teacher and Principal Recommended ICT Support by Participation							
Identified would "help a lot" for ICT Use	Participation						
	Teachers				Principals		
	All Teachers	World Links	Non-World Links World Links School	Non-World Links Non-World Links School	All Principals	World Links	Non-World Links World Links School
Additional hardware	63% 234	72%[AB] 89	62% 76	55% 69	70% 163	72% 88	68% 75
Additional Software	62% 232	71% 88	58% 72	58% 72	73% 168	74% 89	72% 79
Connection to the Internet	81% 300	90%[A B] 112	74% 90	78% 98	80% 186	81% 100	79% 86
Faster Internet connection	76% 278	89%[A B] 110	74% 90	64% 78	79% 183	86%[C] 106	71% 77
Technical support	62% 226	62% 82	61% 73	56% 71	72% 166	77% 94	67% 72
Training on how to use computers	66% 244	65% 81	68% 84	63% 79	77% 178	78% 96	76% 82
Training on how to integrate computers into teaching	63% 234	68% 85	65% 80	56% 69	76% 167	76% 93	68% 74
Ideas for project using computers	54% 202	64%[A B] 80	50% 61	49% 61	66% 153	70% 86	62% 67
Contact with other teachers using computers	58% 216	65% 81	55% 67	54% 68	59% 136	62% 76	55% 60
Examples of how other teachers are using computers	56% 207	61% 76	54% 66	52% 5	60% 138	62% 75	58% 63
More time to prepare for using computers	69% 255	84%[A B] 104	67% 82	55% 69	69% 161	70% 86	68% 75

[A] Chi square, p>.05 for comparisons between World Links teachers and Non-World Links teachers at World Links schools.
[B] Chi square, p>.05 for comparisons between World Links teachers and Non-World Links teachers at Non-World Links schools.
[C] Chi square, p>.05 for comparisons between World Links and Non-World Links principals.

Appendix B:

Examples of the WLAR Student Projects

Box 1. Sample of WLAR School Regional and Global Collaborative Projects

Let Us Celebrate Our Differences (English Language)
Participating schools in: Jordan, Dominican Republic, USA
Description: Students from Jordan, from the Dominican Republic and from the USA have collected information from local communities about habits, customs and traditions to present them and answer related questions, such as:

1-Do people in their community abide by this tradition? To what extent?
2-Do they think this tradition/habit is still handed down by generations? And Why?
3-Could life be different without this tradition/habit?
4-Are we responsible for keeping or removing this tradition/habit?

Students were able to communicate their ideas through email communication and an online forum. Students were able to share experiences, learn about other countries, cultures and traditions.
Web site:**http://www.geocities.com/wl_jo_do/**

Jordan & China (English Language)
Participating schools in: Jordan, China
Description: This project is conducted by groups of students from Khaled Ibn Al-Waleed Secondary School in Irbid, JORDAN and groups of students in CHINA. The Project is designed to help students at the age of 16-17 communicate in English, and exchange information about reported speech using e-mail.
Web site: **http://www.moe.gov.jo/worldlinks/Backup%20Hussein/Hussein/index.htm**

Karak and Yabroud (History and Culture)
Participating schools in: Jordan, Syria
Description: Collaborative work between the students from Syria and Jordan. Students collected information about Karak and Yabroud and via online means (e-mail, forums, …etc) were able to share the information amongst each other and learn more about their countries.

Web site: **http://www.geocities.com/karak_yabroud**

My School, Garden & Observatory (Science)
Participating schools in: Jordan, Syria

Description: An interdisciplinary project where students learn about "whether impact on plants" from various approaches including: geography (building school observatory/whether measurement); geology (planting school garden); chemistry (soil and Fertilizers); technology (using various applications and Internet publishing).

Web site: http://www.geocities.com/karak_yabroud

Box 1. Sample of WLAR School national collaborative Projects

Farm Animals Disease (Science)
Participating schools in: Jordan/ 3 Vocational Schools in Irbid
Description: An interactive project where students learn about Farm animal diseases from various sources including: field trips, group discussions, community interviews, libraries, and Internet. By the end of the project students were able to produce a comprehensive website on farm animals various diseases which was used to teach the subject to other classes in the participating schools.

Web site: http://www.geocities.com/r_h_tm/

Religious Tourism in Jordan (Tourism and History)
Participating schools in: Jordan/ Schools from Irbid
Description:

Students from different schools in Irbid collaboratively collected and shared information about the various religious sites in Jordan. By using various means to collect and process information (school visits around the country, Internet, discussion groups, experts) students were able to collect valuable information and photographs and presented it with an interactive guide to the various religion sites in Jordan.

Web sites:http://islamicirbed2.jeeran.com

Story Time (English Language & Art)
Participating schools in: Jordan/ Schools Karak
Description: The project is about the influence of reading and telling stories on kids. Students tried to get an answer to the question (why do we read stories to the kids?). They used the internet and books to find scripts of stories, analyze it and then using their own language wrote a brief on the story they read and its influence on the kid's mind. Students as well pictured their image of the heroes through drawings. The goal of the project is to help students develop positive moralities through telling the story to kids while enhancing their English language skills and vocabulary.

Web site: http://www.geocities.com/karakgroupeng_wl/homepage.htm

Our Beloved Prophit (Religion Study)
Participating schools in: Jordan/ Karak
Description: An online periodic developed and published by students from 3 schools in Jordan with the aim to spread awareness among Muslims and other ethnic groups about the good virtues of prophet Mohammed and how a student can defend prophet Mohammed and share his point of view peacefully and using technological channels. Moreover, students used their technological skills to create interactive tools for students to learn about prophet Mohammed.

Web site: http://www.geocities.com/karakwl_newsletter/MAGALA.HTM

Medical Plants (Biology)
Participating schools in: Jordan/ Aqaba and Irbid
Description: A Collaborative work between the students from various schools in Jordan. Students collected information about medical plants in Jordan from different sources including local community, internet and books and were able build a website with comprehensive information on local plants, their medical applications and use.
Web site: http://www.geocities.com/midplants/

Common Vocabulary (Arabic Language)
Participating schools in: Jordan/ Tafieleh
Description: Students from schools in Tafieleh worked together to create a comprehensive dictionary for common words used in their region and their origin and use.

Web site: http://www.moe.gov.jo/worldlinks/taf/world_links/pages/arabic.htm

Appendix C:

Examples of the WLAR Online Teacher Community

World Links Arab Region Learners Community

WLAR Teacher Virtual Learning Community is a component of WLAR Professional Development program. The WL Collaboration Center with over than 12,000 posts:

http://www.world-links.org/cgi-bin/discus-arabic/discus.cgi?pg=topics

and the WLAR Teacher Listservs have processed over than 7,000 messages from World Links teachers and staff:

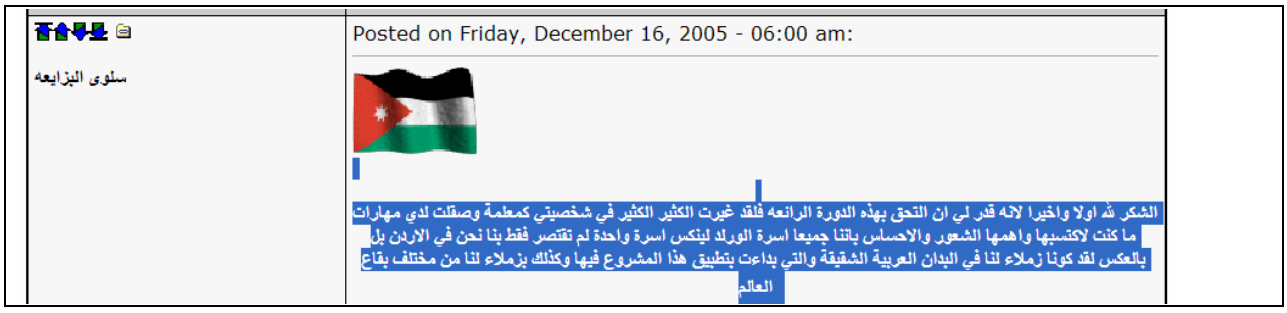
http://groups.yahoo.com/group/worldlinks_jordan2005/
http://groups.yahoo.com/group/worldlinks_jordan2003/
http://groups.yahoo.com/group/worldlinks_jordan/

Through these online channels teachers work together; share their successes, difficulties, hopes, excitement, and experiences; and call for collaboration and seek help from their peers. As a result, teachers can become part of a bigger national, regional and global community. For example, **Hussein Ahmed,** a teacher from Irbid was proud to say that after hundreds of e-mails to WL teachers around the world, he succeeded in setting up a collaborative project with a school in China:

http://www.moe.gov.jo/worldlinks/Backup%20Hussein/Hussein/index.htm

What teacher **Salwa Al Basaega** from Karak wrote in the collaboration center could be the best description to how important this community was for teachers in Jordan:

http://www.world-links.org/discus/arabic/messages/10657/27449.html?1140186912


سلوى البزايعه

Posted on Friday, December 16, 2005 - 06:00 am:

الشكر لله اولا واخيرا لانه قدر لي ان التحق بهذه الدورة الرائعه فلقد غيرت الكثير الكثير في شخصيتي كمعلمة وصقلت لدي مهارات ما كنت لاكتسبها واهمها الشعور والاحساس باننا جميعا اسرة الورلد لينكس اسرة واحدة لم تقتصر فقط بنا نحن في الاردن بل بالعكس لقد كونا زملاء لنا في البدان العربية الشقيقة والتي بداءت بتطبيق هذا المشروع فيها وكذلك بزملاء لنا من مختلف بقاع العالم

The followings are few samples from the Collaboration Center:

Teachers share new ideas and skills;
http://www.world-links.org/discus/arabic/messages/15420/21544.html?1158515431

Teachers share their successes:
http://www.world-links.org/discus/arabic/messages/10657/11973.html?1144663368

Teachers seek help and were happy to find response from their colleagues:
http://www.world-links.org/discus/arabic/messages/15420/18679.html?1136379073

Teachers collaborate in creating e-library and share their ideas about their findings:
http://www.world-links.org/discus/arabic/messages/15420/22606.html?1150035222

Teachers share their exitment about their new teaching experience:
In this example, **Lubna Mahmoud**, a teacher from Karak shares with the group her new teaching experience using ICT to teach a unit in physics and how students were able to understand the topic with less time and have better learning outcomes:

http://www.world-links.org/discus/arabic/messages/10657/7031.html?1112141885

Author	Message
lubna	Posted on Saturday, November 15, 2003 - 02:28 am: بسم الله الرحمن الرحيم الاسم: لبنى محمود مجد معلمة فيزياء في مركز الكرك الريادي متدربة في مركز كرك ٢ لقد قمت بتنفيذ ثلاثة حصص باستخدام الانترنت لتدريس موضوعي: ١- الحركة في بعد واحد للصف الأول الثانوي العلمي للطلبة المتفوقين ٢- المرايا الكروية قانون المرايا العام ومن خلال هذه الخبرة البسيطة التي عشتها مع طلبتي ورغم بعض الصعوبات الصغيرة التي واجهتنايمكن ان ألخص نتائج هذه التجربة على النحو التالي: 1- كانت دافعية الطلبة للتعلم باستخدام الانترنت أكبر من دافعيتهم للتعلم بالطرق العادية: حيث أبدى الطلبة استعدادا أكبر للتعلم ومثابرة اكبر واستمرارية في العمل دون توقف حتى بعد انتهاء الحصة. ٢- استمر التواصل مع الطلبة حتى خارج نطاق الغرفة الصفية وخارج نطاق ايام حضور الطلبة الى المركز وذلك من خلال البريد الالكتروني مما سمح لي وللطلبة من اكمال ما عليهم من مهمات ووظائف بيتية ومكنني من الاطلاع على وظائفهم طيلة ايام الأسبوع وعدم الحاجة للإنتظار لحصة قادة لإكمال الوظائف ومتابعتها. ٣- بالنسبة لتجربة تطبيق درس باستخدام الانترنت حول المرايا الكروية والذي تم تطبيق الحصة عبر الانترنت من خلال مختبر فيزياء افتراضي توصل الطلبة وبطريقة الاكتشاف الى قانون المرايا العام وصفات الأخيلة المتكونة للأجسام الموضوعة على أبعاد مختلفة من مرايا محدبة ومقعرة وبخبرتي العملية شرح هذه المادة بطريقة الاكتشاف من خلال المختبر كانت تتطلب مني على الأقل خمس حصص (٣حصص للتوصل لصفات الأخيلة المتكونة في المرايا الكروية، ٢حصتين لإثبات القانون العام للمرايا الكروية) ولقد تم انجاز هذا كله خلال حصة وكواجب بيتي للطلبة مما وفر وقت كبير. وسأزودكم في هذا الموقع بنماذج أوراق العمل التي قمت بإعدادها وتطبيقها على طلبتي راجية منكم تزويدي بملاحظاتكم واقتراحاتكم لتعديل وتحسين مثل هذه الأوراق وشكرا لكم arabic file _.doc (41 k)

Amjad Al Muheisen, an English teacher from Zarqa, shares a similar experience with the group

http://www.world-links.org/discus/arabic/messages/10657/7029.html?1141692830

Amjad AL-Muhasin	Posted on Saturday, November 29, 2003 - 04:18 am: Dear colleagues, I'LL share my point of view practically,i.e. here is an attachment shows a plan for a lesson which i have recently done in Abdullah the 2nd for Excellence School. No pens,NO textbooks.NO notebooks,EVEN no need for you as a teacher to stand,maybe just a little observation,& no need to worry about checking marks.Just enjoy giving your class. أمجد lesson_plan.doc (24 k)

Jamla Al Azaideh, a biology teacher from Madaba, was not enthusiastic to use ICT in her classes until she tried that and in the quote below she says

"I may not have been very exited to this new method of teaching but I found that this method is excellent and effective if we have time and resources, all students took part in the session and students introduced important information that we teachers may not have been aware of it"

http://www.world-links.org/discus/arabic/messages/10657/7033.html?1072817758

		ولا اكتمكم انني لم اكن من المتحمسين لهذة الطريقة الا انني الان اجد ان هذة الطريقة هي ممتازة وفعالة(اذا توفرت لها الامكانيات الجيدة والوقت الكافي) حيث اشتركت جميع الطالبات في اعطاء الحصة وقد قدمت الطالبات مواضيع ذات اهمية كبيرة وفي بعض الاحيان لم نكن نحن المعلمين على علم بهذة المعلومات من قبل

From group & individual e-mails:

Adnan Hmoud, a WLAR trainer in Ramtha, shares with the group a seminar organized in Ramtha and attended by Ministry educators and local community:

"I would like to tell you that world-links teachers in Ramtha Directorate have started to use what they have learnt recently in their classrooms effectively. Last Thursday one of the teachers in Al Khansa Secondary. School for girls presented something wonderful. The parents of the students attended and it was a great matter to involve parents in the teaching-learning process …."

Mu'sab Abkel a WLAR trainer in Ma'an is exited to see teachers choose voluntarily to come after school to work on their projects despite the bad whether.

"الأخت الفاضلة

أقوم الآن وزملائي بالعمل على الانترنت على الرغم من سوء الأحوال الجوية هنا حيث اعتقدت أنهم سوف لن يحضروا ولكن تفاجئت بحضورهم وان دل ذلك هو اهتمامهم ونشاطهم المتميز لهذه الدوره"

More samples of the teacher collaboration:

Group e-mails are full with various examples of teachers' collaborative learning.

An online session between students from Jordan and Syria:

http://www.world-links.org/cgi-bin/discus-arabic/show.cgi?tpc=15610&post=68778#POST68778

Teachers' discussion on how to enhance training:

http://www.world-links.org/discus/arabic/messages/15420/20995.html?1132599428

Educational and training related issues discussed by teachers:

http://www.world-links.org/discus/arabic/messages/15420/22107.html?1135870989

http://www.world-links.org/discus/arabic/messages/10657/14296.html?1108903989

Appendix D:

Case Studies of the WLAR Schools

School Visit Report A

School Secondary School A for Boys
Grade 10
Subject English
Researcher Dr. Robert Kozma

Background

This is a school for boys. The school has been participating in World Links since 2003. It is also participating in several other programs, including ICDL, Intel Teach to the Future, and e-learning. The school has 3 computer labs and 54 PCs. 12 of its 40 teachers were trained under World Links program; two have become trainers. The teacher we had observed joined the program in 2003 and is now a master teacher / trainer.

Classroom Activity

During the observation, the English teacher introduced the lesson using a PowerPoint presentation on the topic: *Ways to Preserve Food*.

During the interview, he said that he wanted the students to use this topic and computer tools to help them with their English, by applying their language skills to read and write. He also said that his goal was to "use the Internet to achieve active learning, to have the students cooperate with each other to attain more information."

He told the students that they would be given a task from a list of 5 tasks:

1) Collecting facts;
2) Writing a paragraph;
3) Critiquing a paragraph;
4) Putting together a photo gallery; and
5) Putting together an e-library of URLs.

The teacher also said, "This subject depends on locating information and analyzing data. If you want to analyze, you have to create categories. To make it easier for the students, I gave them the categories. You have to tell the student what to do; 'you have to do 1, 2, 3, 4, and 5'. You have to tell them what to do and, provide them with an e-library so they don't loose track."

The students were divided into 8 groups of three students each. During the 20 minute session, each group worked together on one computer, although other computers were available on the desk.

The students used the search engines of Google and Yahoo to look for online resources. They used MS Word or PowerPoint to create selected task products. I asked the students what they were doing and they reported such things as:

- "We are collecting information on canning and writing feedback using Word."
- "We are unearthing facts and expressing our understanding; facts that we can use in our daily life."
- "We are collecting facts using Google. We used the terms like 'preservation, food, and smoking'. (The teacher provided them with the terms to use.)"

The teacher watched to see if the students were facing any difficulties. Occasionally, he would ask a question or give a hint. In the interview, the teacher said, "I gave them hints, but I could not solve problems for them; they have to figure it out for themselves."

By the end of the 20 minute session, the teacher asked a student from each group to take 2 minutes to "talk about what you have done." The students gave a brief report describing what they did during the activity. Typically, the students' short descriptive reports were in English on subjects such as:

- Smoking is a way to preserve food. We got information on smoking from the Internet.
- Canning is another way to preserve food. We wrote an introduction about preserving various kinds of food, vegetables, meat, and fruit by canning, and about the history of this preservation method.
- We searched the Internet using Google and Yahoo for sites on food preservation and made a list of the sites. We listed the URLs and described what they contained. You can go to any link.

Sometimes, the answers were more analytic, as in: "Canning prevents bacteria or germs", or, "one of the most important ways (to preserve food) is refrigeration." Similarly, "It doesn't stop the bacteria; but it only slows down the growth. So we can't use it for long periods of time."

The teacher guided the reporting carefully, saying things such as: "You were required to write a paragraph about preserving food. What did you write?" Occasionally, he would ask a follow-up question, such as: "What kind of food can you smoke?" "Can you define drying? What can you dry? How can we dry?" or, "Did you mark your source? Why do we need to do this? We do it for credibility and for intellectual property."

Sometimes the teacher would refine the student's answer, as in: Student in response to a question about how to dry said "by putting them in the sun . . ." [Teacher] "By exposing them to the sun and air", [Student] "By exposing them in the sun and air."

Then, the teacher gave the students a "self-test" on preserving food, which they found on the Internet. The test was a series of multiple choice items. Examples of the questions are:

- How often must the lid of a can be tested?
- How high must the water be when heating the jars for canning?
- Mold under the lid might be a sign of . . .?

The teacher read each question and picked a student who would read the possible answers and select the one he thought was right. The teacher would then say, "Let's see if it is right." He displayed the next slide with the correct answer and read it, indicating to the students that they were right or wrong. The students were not asked to explain their answers but the teacher would sometimes elaborate further. For example, a student selected 'true' that it is okay to taste preserved food if it smells okay. The teacher said, "The answer is 'false'. Why? Because sometimes bad food smells okay."

The Program's Impact on the Students

There was a general consensus among the Principal, the World Links teacher, his students, and the non-participating teacher whom we interviewed, that the World Links program was having a positive impact on students in World Links classes.

The non-participating teacher said, "The general feeling in the school is that the students benefited. The Principal said, "The students have now the skills to research and make projects. The students worked together and learned from each other."

The World Links teacher agreed by saying, "The students used the Internet to achieve active learning, to cooperate with each other, and get more information." He went on to say, "The students changed their thinking from traditional to modern ways. We wanted them to be creative and teach them how to learn. I taught the students how to solve problems; how to solve their own problems through thinking. They are more active, always talking about learning, 'what have we done today? What did we do yesterday? What can we do tomorrow? What does the teacher want us to do?"

The students agreed that active learning was an outcome. One student said, "We are more involved in the class." Another said, "The teamwork in this class is greater than in any other. It's so useful to be in a team and work together."

Yet another student said, "We learn to work with each other and negotiate with each other." But the students identified other learning outcomes, as well. Among them are:

- We can use the computer and the Internet to understand lessons.
- We learn how to use technology and apply it to learning the language.

- We improve our skills in English.
- It is more fun.
- It is a good way to learn. The students like using computers.
- We work with other students in other countries.

The teacher also confirmed this last point. He said, "The students were preparing to undertake collaborative projects with students in Syria, and that they just signed an agreement with the Mayor of Chicago (who recently visited the school) to collaborate with students in schools there."

The Program's Impact on the Teacher

The Principal felt that the World Links teacher was capable of "moving from traditional teaching methods to new methods using computers" through World Links training. He said, "He has received good feedback from the students and the parents. Most of them liked the program because it increased the knowledge of both the students and the teachers."

The teacher said, "My job as a teacher has dramatically changed. My relationship with the students is more of a friend rather than that of an angry teacher. My role also changed to that of a facilitator rather than a lecturer."

The Principal agreed by saying, "World Links teachers have moved from being the main source of knowledge to facilitators. The students search for information about their projects and the teachers provides help.

The teacher also emphasized the fact that he now works more with weaker students.

The Program's Impact on the School

The Principal mentioned that "Other teachers are showing interest in the World Links training and want to get involved." The World Links teacher said, "We use the program to change the methods of learning, which has an impact on the school as a whole. The non-participating teacher said, "There is a common feeling among other teachers that they should get involved in the use of ICT."

The World Links teacher said, "Some teachers asked him for help and that he invited them to join him in a class." He believes that the Principal is aware of the program and very supportive of it.

School Visit Report B

School name Secondary School B for Boys
Grade 11
Subject English
Researcher Dr. Robert Kozma

Background Information

This is a school for boys. It has been participating in the World Links program since 2004. It is also participating in other programs, such as the GLOBE program. There are six teachers participating in World Links program. It has two computer laboratories with a total of 27 computers. One of the laboratories is connected to the Internet using dial-up; the other laboratory has no internet connection. The teacher we observed has been involved in the WL program since 2004.

Classroom Activity

During the class session we observed, the teacher gave a brief introduction about the lesson and explained by saying, "You will find folders [on the computer] for each working group with instructions. Open the assigned folder; read the instructions; and you will have 20 minutes to answer the questions."

All the assignments were related to the topic of the human eye and vision. The students were given questions, such as: "What are the parts of the human eye?" "What are their functions?" And, "What is an optical illusion?"

There were 18 students in the class, divided into groups of three each. Each group shared a computer. The students were given names of websites to search for answers to the assigned questions. The teacher also gave the groups roles (leader, editor, time keeper) to which they were to assign themselves.

The teacher made rounds to check on the groups and to assist them with any problems (primarily technical problems), and to keep them on track, asking questions such as: "Who is the leader and who is the time keeper?" or "Did you find the answer?" Several groups had difficulty accessing the assigned websites. The Internet was slow for all groups. During this period, students read from the websites, cut and pasted portions of texts that answered their assigned question.

After the passage of 20 minutes, the teacher asked each group to give a brief report on their findings. The teacher would call on a group who wrote a brief statement in English on the white board, based on the researched information.

Some groups drew diagrams to illustrate what is an optical illusion. They, then, read the question, and the answer which they wrote. The teacher would repeat the answer verbatim. He did not ask for explanations or elaborations to the answer. When all groups submitted their reports, the teacher assigned homework in which each group would prepare a presentation on "What they found" using PowerPoint.

The Program's Impact on the Student

The teacher said he has four curricular related goals out of this session:

- They should learn something about the human eye and vision.
- They should develop English grammar skills.
- They should enhance the ability to say what they think and believe.
- They should enhance technology skills.

The teacher felt that he accomplished the last two goals. And that the students learned something about the eye. However, they did not discuss English because they ran out of time, due to technical problems.

In general, he felt that the World Links program enabled students to teach each other, engage in self-teaching, and learn. The teacher said, "I am only a facilitator, while they are the center of the learning process now. They look for information, discuss it, share it, and present it to each other." He added, "The students were very excited about the program, particularly the 'weak' students. They learned on their own, and are capable of finding information by themselves. On the other hand, students asked when they faced a problem, normally they don't do that."

When I asked the students about the approach which the teacher employed, they uniformly expressed that they liked it. One said it was "More interesting than other courses."

Another said, "We're learning and its fun". Another student agreed and said, "We should learn all subjects this way." Students felt that they were more active in the class, searching for and, finding information".

The Principal said, "Group work was very motivating for students, and there was more active participation." He said, "Their role was changing, and they are searching for information on the Internet rather than merely asking the teachers". He added, "The students used the Internet to explore the world outside the classroom." He mentioned a project in which students visited a 4000 year-old archeological site nearby, took pictures, and made a webpage. He felt

that the students participating in the program were "engaged and accepting changes, despite technical difficulties." But he also referred to problems with the availability and speed of the Internet connection.

The Program's Impact on the Teachers

The Principal said that as a result of the program teachers changed their approach of teaching. The Principal described the role of teachers in the program as that of facilitator; teachers were "exploring with students new techniques besides the conventional, and engaging them in research." He added, "There was group work among [World Links] teachers; they shared information, techniques, and coordinated their work".

According to the Principal; the program resulted in positive attitudes of both teachers and students, and positive relationships between them. "Teachers worked to encourage all the students."

The Program's Impact on the School

Both the Principal and the World Links teacher agreed that the WL Program had an impact on other teachers, and on the school as a whole. The Principal said that there was a "cumulative effect" on other activities in the school. He cited a school newsletter which students produced using this technology.

According to the Principal, the non-participating teacher has been very inquisitive about the program, and added they wanted to take part in its activities. The World Links teacher agreed by saying, "Colleagues are excited and want to know more."

The Principal also referred to the establishment of collaboration between his school and other schools; for example, teachers in his school traveled to other schools to see how World Links classes are taught.

CSchool Visit Report

School C Secondary School
Grade 10
Subject Physics
Researcher Izz elddin Al Noaimi

Background Information

This is a school for boys. It took part in World Links since 2005. The school also participated in several other programs, including ICDL, Intel, and e-learning. The school has 3 computer laboratories equipped with 50 computers. Eight of the 43 teachers have been trained by World Links; one has become a trainer. The teacher we observed started his participation in 2005 and is now a master trainer. The school project was ranked first amongst the 500 participating projects. Further the project was a joint initiative with the U.S.A, and ranked second for participating projects in Jordan.

Classroom Activity

During the observation, the physics teacher introduced the lesson by giving a briefing on 'electromagnetic induction' which was taught in a previous lesson, because the topic to be explained in this lesson, 'electric transformer,' directly depends on the information taken previously.

During the lesson the teacher said, "One of the very important applications for electromagnetic induction is the application of an electric transformer". The teacher used Data Show to present an image representing electromagnetic induction, and asked the students to identify the induction using the image. One of the students said, "Electromagnetic induction is a process of generating electric power in the electromagnetic field." The teacher provided an introduction to the task, saying, "Using one of the search engines provided, research the topic of 'electric transformer' as an application of electromagnetic induction concept and assembly." He added, "Use the Google search engine by typing the word 'electric transformer', and if you don't find sufficient information use the Yahoo search engine."

The students worked individually on computers, using Google and Yahoo to search for information online. I asked the students about what they were doing and they gave the following answers:

- We used the Google search engine and then typed "electric transformer". A number of subjects are available through which I can get the needed information.

- I wrote electric transformer, then got some figures about shapes and the assembly of electric transformer.
- I used Yahoo not Google and typed "electric transformer" then I found information about its components, assembly, and work.

The teacher walked around the classroom to see if the students were facing any problems. In the interview the World Links teacher said, "During the lesson I would walk around the classroom and talk to students, strengthening their understanding of the concept of Electromagnetic Induction, and the types of the electric transformers, step-up and step-down."

During the search students found animated images about "electric transformers". After finding and studying the images, the teacher asked, "How can you distinguish the various types of electric transformers?" And, "How do you know if the electric transformer is a step up transformer or a step-down transformer?"

The teacher asked one of the students to show him how he can make an electric transformer a setup transformer by using the image in front of him. The student said, "By increasing the cycles of the subordinate coil and reducing cycles of the initial coil." The teacher commended, "Indeed this is a 'step up' transformer because the number of second coil cycles is less than the primary cycles." The teacher noted a problem with one of the students explanations and said, "This student doesn't know what an electric transformer is because he made the secondary coil cycles equal to the primary (by using the simulated the image)." The teacher went on to explain how to make a transformer a 'step up' one by conducting a live simulation of the electric transformer, and told the class, "Look how the transformer position changed after we altered the number of cycles which upgraded the secondary cycles from 132 to 900 volts." In certain instances the teacher observed the formation of a step up or step down coil by students which reflected high levels of thinking standards, while the students and teacher exchanged questions and answers on how to upgrade or reduce the cycles of the transformer types. For example, the teacher observed the students using of the online simulations and asked the following the questions:

Teacher:	How many cycles do subordinate coil and initial coil have?
Student:	Primary coil 177 volts; secondary coil 101 volts.
Teacher:	What happened here?
Student:	Electric potential
Teacher:	Because the cycles of secondary coil are less than the cycles of primary one.
Student:	Because the cycles of secondary coil are less than the cycles of primary one.
Teacher	Can we reverse the situation?
Student:	Using the figure?

Teacher: Yes, yes how many cycles now?
Student: 451 volts for the secondary and 129 volts for the primary one.
Teacher: What is the name or type of the transformer now?
Students: Setup transformer
Teacher: Very good !

The teacher later gave the students a self-assessment test comprising of three questions on electric transformer which he wrote. The tasks were open-ended and they were:

- Define the electric transformer
- Draw a Step-up transformer
- List the components of an electric transformer

The teacher read the questions for the students, and then walked around the class to find out how they responded. He asked one of the students, for example, to answer the second question and the student said, "I pressed the Print Screen button on the keyboard to print the image of the transformer provided by the internet, they I transferred on the paint program and conducted a cut and paste. Then I copied the image to the answering model."

At the end of the class the teacher asked, "Was the lesson useful? Was the understanding better?" All the students answered: "Yes."

The Program's Impact on the Students

There was a general consensus by the principal, World Links teacher, and the students that the World Links Program is having a positive impact on students in classes of World Links. The Principle said, "When I enter a classroom and see how students perform, and the various methods to research information. I think this will help decrease their frustrations and fears and make them like their school and take care of it." He also said, "The students have a strong feeling that they are benefiting from the program. They feel they are distinguished through their participation in a project that won an advanced position in the directorate and this enhances and motivates the students."

The World Links teacher agreed by saying, "I felt that the students benefited 100% from the World Links Program." The teacher also said, "The interaction of students during the lesson was excellent since the subject was available on the internet." He added, "During the class I found that students were able to search for information that was new to me as well. Further as I talked to the students individually, I was able to enhance the students' understanding about the electric transformer and make constructive evaluations during the lesson and the concept of electric transformer was supported by an animated image."

The students agreed that the program had better illustrations than the text book. One student said, "This way we have a practical explanation that enables students to conduct experiments by using the internet." Another student said, "I benefited more from the lesson because I learn better from animated images than drawing on the board." Another said, "It is better for students to learn through the computer, as there are figures directly animated before us supported by a complete explanation, and the internet provides direct understanding of the lesson, while we may or may not understand from the teacher's explanation." In the interview the teacher said, "The aim of the lesson is conveyed, especially with moving figures, and this made the goals easy to achieve and apply."

The Program's Impact on the Teachers

The Principal felt that what the World Links teachers can offer has increased and the effect can be clearly seen on the students. The Principal said in the interview, "The teachers who participated in the program are now more in synergy of the teaching profession and their desire to work has doubled. A large number of those teachers told me since they have enrolled in the teaching profession they never worked like this year." The Principal also said, "The teachers are relaxed with the students because they are offering something new, new styles of learning and tools that make the profession easier. Hence this has been reflected on the physiological effect and in the way students look up to their teachers."

The Teacher said, "My role was to facilitate and enhance concepts that I want to provide to the students." The teacher went on to say, "World Links enables the teacher to improve the way of delivering information to students, and is beneficial for students."

In the interview the Principle said, "Had we postponed participating in this program, it would have been a big mistake towards our country, if we are demonstrating better progress than other countries."

The Program's Impact on the school

Regarding the program's impact on the school, the Principal said, "Schools are craving for programs such as the World Links. I am against the idea of other principles and teachers who claim that such classes have negative impacts by being at the expense of other classes." In the interview the Principal said, "The program has a unique effect on our school, I feel happy seeing the activities carried out by students. The school attained many achievements by using the World Links program, whereas our teachers became more creative, I invite other schools to incorporate technology in their schools and classrooms." The Principal concluded, "I strongly support any project which the students and teachers undertake."

The World Links Teacher commented, "Non-participating teachers felt that the program enables the teacher to introduce information easily." The teacher went on to say, "World Links

plays an important role in collaborative learning. I made a joint project between three schools under the title 'Electromagnetic Induction' that is published on the Internet."

On the other hand, some challenges surfaced upon implementing this program. In the interview the Teacher said, "We have overcrowded classrooms compared to the number of computers, which means preparing a lesson takes longer periods of time, and there is a need to reduce the number of lessons to allow teachers to prepare requirements of such lessons." The Principle agreed by saying, "The teacher faces a big curricula burden, I recommend reducing the number of lessons to give teachers more time to deliver their work properly."

School Visit Report D

School D Comprehensive Secondary Girls School
Grade 11th grade/ Scientific Stream
Subject Biology
Researcher Hussein Amin Badarneh

General Background

School D is an all-girls' school from grade 7 to grade 12. There are 570 students in the school and 51 teachers, 45 of whom attained the ICDL certificate. The school implemented the World Links Program since 2003. Three teachers participated in the World Links Program; none of them are trainers. Ten teachers participated in the Intel Program. The 11th grade science teacher we observed had 13 years of experience and had taken ICDL and World Links training. There are two computer laboratories in which there are a total of 45 computers.

Classroom Activity

The teacher started the lesson on 'cell structure and functions' by presenting an introduction using PowerPoint that entailed slides of the lesson plan. Then, the teacher presented an acknowledgement to the World Links Program clarifying its goals some of which are: using the internet for educational purposes, collaborative distance learning, and incorporating school curricula with technology. After that, the teacher presented the lesson contents and goals: to recognize, understand and identify the main parts of the eukaryotic nucleus cell, including the cytoplasm organelle in eukaryotic nucleus cell and functions of the cytoplasm organelle. The teacher, then, presented the goals of using technology: using internet websites to collect data, storing data, employing collaborative teaching, and exchanging information.

Next, the teacher reviewed the role of both the teacher and the student, emphasizing the teacher's role is to facilitate and guide, while the role of the student is to research and surf the internet, discuss and exchange views, and participate with the other members of the group or with other groups. Other strategies were also reviewed besides the use of computers that are necessary to execute the lesson including: dialogue and discussion, and collaborative teaching. The teacher spent 10 minutes reviewing the lesson resources stating they are the curricula of biology for the 11th grade in addition to the Internet. Afterwards, the teacher also presented a final assessment activity of the lesson.

The students were divided into 6 groups averaging 5 students per group with a leader and a computer, each. Each group mission was deliberately assigned after naming the groups 1, 2, 3, 4, 5, and 6 as per hereunder:

Group 1: General structure of the cell
Group 2: Structure and function of membrane plasma
Group 3: Structure and function of the cytoplasm
Group 4: Structure and function of the endoplasm web
Group 5: Golgi apparatus
Group 6: Nucleus

The time to complete the tasks was limited to 20 minutes. The students used the search engines of Yahoo and Google, and other computer programs such as PowerPoint and Microsoft Word to present the information they researched. Shortly before completing the tasks, the teacher asked students in some of the groups a few questions: "What are your tasks as a group?", "What search engines did you use?", "What were the results you found?" Some student answers were:

> **Group (2):** "Our task was to explore the structure and function of plasma membrane, and we used the search engine, Google". They said, "The plasma membrane consists of proteins and Lipids that transfer substances from one cell to another". They also obtained an image visualizing the plasma membrane.

> **Group (3):** "Our task was to explore the structure and function of cytoplasm. We used the search engine, Google, and concluded that cytoplasm consists of organelles in a liquid called cytosol. The cytosol consists of water with mineral salts and melted organic substances. It is a dynamic medium for chemical reactions".

> **Group (5):** "Our task was to explore the structure and function of Golgi apparatus using Yahoo and Google search engines. We found out that Golgi apparatus consists of a bundle of parallel flat sacs surrounded with spherical vesicles that have tiny tissues. The function is to adjust the proteins made by ribosomes and to give them their final shape, so that they can secrete inside or outside the cell. They produce some polysaccharide carbohydrates." A photo of Golgi apparatus was obtained.

After that, each group leader made a PowerPoint presentation for two minutes using images and information they collected from the internet. Some group leaders asked their classmates questions. For example, the leader of Group 2 asked, "Do the cell parts work separately?" One of the students answered, "All the organelles in the cell have a unique function and form an integrated organ."

When the leaders of the groups finished their presentations, the teacher gave the students a multiple choice exam, using PowerPoint. The exam consisted of three multiple choice questions, as follows:

Q.1 Eucharistic cell consists of main parts …
Q.2 An organelle that has a role in recognizing types of blood in human body…
Q.3 The store of the genetic substance is …

The students answered the questions correctly without any comments from the teacher.

The Program's Impact on the Students

The Headmistress, World Links teacher and non-participating teacher were satisfied with the World Links Program, as were the students. They were particularly satisfied with the implementation of the program and its positive impacts on students.

The headmistress said, "The Program facilitated for the student attaining the information, provided them with the opportunity to exchange expertise, knowledge skills, communication, and research, in addition to consistency of information for students."

The World Links teacher commented, "It provided the opportunity of self-teaching, enhanced the student role as active one in education and learning, provided them with positive attitudes toward biology, developed their research skills, their communication and cooperation, and their creativity and leadership." The non-participating teacher commented, "The program motivated the students to learn."

The students described the effect of the program on them as positive because it:

- "Made learning a living fact not abstract."
- "Provided an opportunity for distant learning."
- "Promoted team work and communication with others."
- "Provided real deployment of ICT."
- "Provided students with skills of research, knowledge skills, communication, leadership and selection of data."
- "Was a non-traditional technique through which the role of the student changed from passive recipient to an active participant."

The Program's Impact on the Teachers

The headmistress noted that the program converted the role of the teacher from dictating information to a facilitator. The relationship between teacher and student developed into close cooperation, reduced time and effort, moved from using conventional teaching methods to

modern ones, and allowed the teacher to possess new assessment strategies in addition to self assessment.

The World Links teacher said that as a result of participation in the program "she has become a facilitator." It enabled her to exploit modern technology in the classroom. It saved her effort and provided her with new strategies for teaching and assessment. The non-participating teacher said, "The program is a good chance for real professional enhancement and development, and so I am looking forward to taking part in it."

The Program's Impact on the School

The Headmistress responded positively about the World Links impact on the school, saying, "The program is a real deployment of ICT in teaching. It uses new methodologies of teaching and assessment". She also said, "The program gives a chance for cooperation and participation among schools of the same directorate." For example there had been some collaboration with another secondary school where teachers exchanged ideas and innovations.

The non-participating teacher said that the program corresponds to technological and scientific advancement. It resulted in positive participation among teachers and school-to-school participation and it paves the way to exchange expertise.

However, a number of obstacles hinder the application of the program, according to the Headmistress, including:

- Shortage in computers and laboratories.
- Problems with internet connections and slow connectivity.
- Few numbers of teachers training for World Links Program.
- Some teachers resist change.
- There is no follow up and assessment by supervisors on the implementation of World Links.
- Teachers overwhelmed with the number of classes, hindering the proper implementation of the program.

School Visit Report E

School E Secondary School for Boys
Grade 10
Subject Chemistry
Researcher Izz Al-Deen Al- Nu'eimi

Background Information

The school was involved in the World Links program in 2005. Before that, it participated in other programs such as ICDL, Intel, and computerized learning. The school has two computer laboratories with a total of 38 PCs. Two out of 31 teachers received training the World Links program but have not yet sat for the examination.

Classroom Activity

During the observation, the teacher introduced the Chemistry lesson using PowerPoint to explain the Periodic Table of Elements. During the interview, the teacher said, "The students have to distinguish between a neutral atom and an ion, define the electron distribution, and identify the place of the element in the Periodic Table of Elements. I want them also to classify the elements to metals, non-metals, and metalloids categories based on the place of the element in the Periodic Table of Elements."

The teacher explained to the students the main elements before starting the process of classification: the element, the cycle, the group, the Periodic Table of Elements, the atomic number, the atomic weight, the electronic distribution and the concept of atom as well. Afterwards, the elements were divided into metals, non metals and metalloids.

The teacher also said, "I can distinguish between metals and non-metals, and identify the place of the element in the Periodic Table of Elements, whether it is on the left side or the right side." The goal here was that the students had to completely understand the electron distribution in order to be able distinguish between metals and non metals.

The teacher then distributed working papers and students were given five minutes to answer them. The working paper consisted of three multiple choice questions:

- Which of these particles is cat-ion and what is its charge?
- Which of these particles is anion and what is its charge?
- Which of these particles is a neutral ion?

When the five minute period elapsed, the teacher selected one student to read the questions and the answers. For example, one student read question Number 3 asking about which of the particles is a neutral ion and correctly responded with Answer B. The teacher asked the students, "How do you know that this particle is a neutral ion?" The students answered, "The number of the protons is equal to the number of the electrons." The teacher confirmed the correct answer.

Students were then divided into 5 groups of 3 students each. They were given the second working paper number to be answered within five minutes. In the interview, the teacher said, "I drafted group working papers based on the information given in the individual working papers, so that I have five 5 groups of 3 students with a leader for each group who also acts as a coordinator, and then the work was divided among the members of the groups."

Regarding the contents of the working papers, the teacher said in the interview, "Each student had a group of elements containing the atomic number only. Using the atomic number, the students made a search for the Periodic Table of Elements using the internet. From the periodic number of elements, the students followed the atomic number given to him to find out the name of the element and its symbol, and to determine whether the atomic number is on the right side, the left side or in the middle of the periodic table." The students used the search engines of Yahoo and Google to obtain the answers for the questions given in the working papers. They also used Microsoft Word.

I asked the students what they did to answer the questions. Their answers were:

- I accessed the search engines of Yahoo and Google, wrote the name of the element 'sulfur' in the search box, and received many results from which I selected the information useful for me to answer. Using this information, I was able to determine the symbol of the element in the English language; find out information about the atomic number and the atomic weight.
- I copied the information using MS Word and saved it to a floppy disk and submitted it to the group leader.
- I used the search engine of Google and wrote the name of the element. I searched for the atomic number, the atomic weight, and all the information related to the element.
- Using the search engines of Yahoo and Google, I wrote 'Periodic Table of Elements' in the search box. As a result, I obtained a lot of information related to elements.

The teacher walked around the class to assist if any of the students is facing a problem. In many instances, he guided the students and explained information to the students. In the interview, the teacher said, "My role was a guide and a facilitator to the students. I always liked to assist my students in resolving problems they might face. Assisting them may narrow the

search zone. I would give them instructions on any piece of information that might help them in their search."

When the designated period of time elapsed, the students answered the questions, typed them on a special file, copied the answers to a floppy disk, and submitted it to the group leader who in turn submitted it to the teacher for assessment.

The Program's Impact on Students

There was a unanimous agreement among the Principal and the students that the World Links program has a tremendous positive impact on the students. The non-participating teacher said, "The students became interactive and competed to go to the computer laboratory and use the internet. They began to search and interact. The program is more useful to the students than the theoretical material."

The Principal said, "The effect of implementing the program is clear on students." He added that the students had changed from passive and destructive users of the computer to researchers of useful data.

The World Links teacher said, "Using the computers during the lessons increased the students' motivation to work and interact with their colleagues." He added, "We evolved from adopting the traditional method of teaching, i.e. explaining every detail to the students, to the method of learning by using the computers, which is something new. And since the students have the desire to learn, they exerted more effort was needed to obtain the information, especially that there was an endless source of information and data on the internet."

The students agreed that this program is better than the traditional methods and that they benefited from it. One student said, "The computerized lesson is much better than the traditional one, because all the tasks are carried out on the computer which is neither tiring nor boring. Furthermore, I can understand the lesson better."

Another pupil said, "Learning by means of the computer is better than the traditional method, because it involves questions that can test one's information." He added, "I could obtain more information than what I can find in the text book."

Another student said, "I made a lot of use of this new method. If I used the text book, I would have needed a lot of time to understand the topic. I advise other students to learn using this method, because it is easier and faster and gives more accurate data." The latter student added some other advantages for the program:

- The teacher made a lot of information available for us through this program, and we can understand the subject better.

- This program is distinguished by its practical aspects.
- The program promotes team work and cooperation among students.

Regarding the last point, the teacher clarified that cooperation among the students played a key role in their understanding of the lesson, while at the same time he paid tribute to individual capabilities. The non-participating teacher agreed by saying, "Student interaction during World Links classes is greater than during regular classes."

The Program's Impact on the Teacher

The Principal believes that the teacher's role has changed to that of guide and a facilitator while the role of the student has been changed into a researcher. He pointed out that the students became the ones who search for information and that this is a key advantageous outcome of this program.

The World Links teacher agreed with this assessment by saying, "I guide and direct my students while they perform the search for data." I noted that during class the teacher made rounds to direct his students and help them solve any problems that may face them.

The non-participating teacher also commented, "The relationship between the teacher and students became more personal and friendly. The traditional method is infertile and passive. We are no longer in the age of forcing information into minds, but rather it is the age of knowledge and research."

The Program's Impact on the School

Regarding the program's impact on the school, the Principal said, "Other teachers began to look forward to participating in such programs." The World Links teacher commented, "The teachers asked me about the computerized lessons I had performed, and about the students' achievements and behavior during the lesson." While the non-participating teacher said, "I heard from the World Links teachers that the program is excellent. My students who are learning based the traditional method are always asking me to incorporate computers in teaching." The Principal also said, "I am ready to help and support this program, and I encourage the teachers to join it because I strongly believe in the continuous development of their teaching skills. I will support the teachers and students, financially and morally, to carry out projects by utilizing the World Links program."

School Visit Report F

School F Secondary School for Girls
Grade 10
Subject Mathematics
Researcher Hussein Ameen Al-Badarneh

Background Information

F is an all-girl secondary school with 1000 female students and 54 teachers. Of these, 43 received the ICDL certificate and 11 have attended the Intel program. At this school, 9 teachers participated in the World Links Program; none of them are trainers. Implementation of the World Links Program started in 2003. The World Links teacher that we visited is a holder of a bachelor degree in mathematics and has 9 years of experience as a mathematics teacher. She has an ICDL certificate and World Links Program. The school has 3 computer laboratories with a total of 54 PCs.

Classroom Activities

The visited class was a 10^{th} grade mathematics class. The topic of the lesson was 'simple profit' and 'compound profit'. There were 25 students in the class.

The teacher divided the students into 5 working groups of 5 students each. Each group has to work on one computer. The teacher gave the lesson verbally explaining the goals of the lesson for 5 minutes. The teacher directed the students to get familiar with the rules of 'compound profit' and the rules of 'simple profit' and to do exercises.

Using the email, the teacher sent a working paper to each group containing the group's assignment that was to be carried out within 20 minutes. The specific instructions for each group were:

Group one: Use EduWave to search for the concept of simple profit and its rules.
Group two: Use EduWave to search for the concept of compound profit and how it works.
Group three: Use EduWave to search for the concept of annual compound profit, its rules, how it works and the difference between monthly compound profit and annual compound profit.
Group four: Use EduWave to search for the concept of Bank Profit, and how it is calculated.
Group five: Use EduWave to find out the difference between simple profit and compound profit and which is better.

Having read the instructions, each group started searching for the required data. When the groups finished their search, each group sent the collected data to the other groups, and to the

teacher using electronic mail. Each group studied the data they received from the other groups and did the various activities included in the emails sent by the other groups. Having completed the discussion and exchanged data, each group presented the results of their search using the data show as follows:

Group one: The students talked about simple profit and its rules. They recognized the equation: SI=(S × I × T), where (SI is simple profit, I is profit, T is time in years), where time is expressed in years. The teacher suggested to the students an important site that contains a lot of various examples on Simple Profit. This site is of computerized mathematics curricula in EduWave. Example: deposit the sum of JD 5000 at 5% of simple Profit for 8 years. Find out the total sum.

Group two: The students discussed the rules of monthly compound profit and explained the rules of compound profit (S×(1+ IP) T, (where S=sum, I=Profit, IP=Profit percentage, T= time in years). Time in this case is expressed in months. Many examples were given.

Group three: This group found out the rule of yearly compound profit which is: (S×(1+ IP) T (where S=Sum , I= Profit, IP=Profit percentage, T= time in years) . Time in this case is expressed in years.

Group four: The students talked about bank profit and how it is calculated. They provided examples found in the computerized curricula of mathematics.

Group five: This group realized the difference between simple profit and compound profit, and they explained that compound profit is better than simple profit. Example: Deposit an amount of JD 5000 at 4% of compound Profit for 6 years and deposit another JD 5000 at 4% simple Profit for 6 years.

At the end of the lesson, the teacher directed the students to other working papers found on the computerized mathematics curriculum on the EduWave site. She asked them to answer the additional questions on these worksheets and send the answers by email, taking no longer than 5 minutes.

The teacher's role was to guide and edit. She studied the material sent to her by students, and made sure that all the data was correct. She also checked the work of all groups to ensure the efficiency of the group members. She also answered questions and inquiries.

The Program's Impact on the Students

The Headmistress, the World Links teacher, a non-participating teacher, and the students all expressed satisfaction with the results of the program, related to student impact. When asked about World Links Program, they all answered positively.

The Headmistress commented that the program removed all the obstacles and barriers between the teachers and students saying, "The students became the core of the teaching process. The students became active participants in the process of teaching and learning." She went on to say, "The students acquired communication skills, and are now interacting with their peers. They also learnt how to use the web based search engines."

The World Links teacher said, "The program provided the students with new channels to communicate with their teacher and amongst themselves." She went on to say, "The students developed web-based search engine skills. They developed communication skills, group and, team work."

The non-participating teacher who teaches chemistry said, "The program provided the students with the opportunity to actively efficiently participate and communicate. The program helped the students understand the lesson better since their interest in the subject taught increased and they applied what they had learnt."

Several students were asked their opinions about the impact of the program on their learning. They reported that:

"The program developed and promoted my research skills."
"The student role became more active and effective."
"The program developed communication skills through the Internet."
"The teacher became more realistic and the teaching process became less abstract."

The Program's Impact on the Teacher

Respondents were equally positive about their assessment of the impact of the program on the participating teachers. The Headmistress said, "The teacher was provided with new educational tools and strategies and became capable of using modern technology in education." She added, "The teacher acquired knowledge and skills for communication, higher thinking, problem solving and the use of web-based search engines."

The World Links teacher gave the following impressions: "The program provided me with new methods of teaching and new insights about education. I am now capable of searching for information from a variety of sources and I became capable of providing my students with information using various methods." She went on to say, "The program helped me develop skills of creative thinking, in addition to methods of group interaction."

The Program's Impact on the School

With regard to the impact of the program on the school, the Headmistress noted that, “An electronic library was set up. The library includes the search topics on different subjects.” As a result, “A lot of computerized lessons on different topics have been carried out.”

The World Links teacher said, “We shared and disseminated the World Links applications among non-World Links teachers. We as World Links teachers have a great impact on our colleagues who did not participate in the program.” According to the World Links teacher, non-participating teachers developed projects and shared them with their students, after having observing the World Links approaches. For example a science teacher who did not receive World Links training presented two lessons: “the human creation cycle” and “legacies”. Another teacher presented two computerized lesson on documentation. A social studies teacher presented a computerized lesson on economics and problems of modern age.

Cooperation with neighboring schools was established to build joint projects building on the World Links approach, such as: Establishing a cooperative project with another school in mathematics, conducting a cooperative scientific project with a second school on Newton laws, and yet another cooperative project in organic chemistry with a third school.

On the other hand, The Headmistress said that there were some difficulties facing the implementation process, such as coordinating the timetable of the classes for the teachers participating in the program, the fact that the computer labs are always busy with classes, and problems with the PCs which need maintenance.

The World Links teacher said that there was an insufficient number of computers at the school in order to cover all subjects in addition to computer classes. “The high number of classes taught by the teachers added a burden on our shoulders in terms of meeting and training the students. This forced us to meet with the students after school hours or on Saturdays, which can not always be done.” The teacher added, “There were also Internet connection problems and the access was slow.”