Preparing Pre-Service Teachers: A Faculty Review Strategy

Jon K. Price, Ph. D. Intel Corporation Jon.K.Price@intel.com

Martina Roth Intel Corporation Martina.Roth@intel.com

Steve Andrews Intel Corporation Stephen.C.Andrews@intel.com

Shelley Shott Intel Corporation Shelley.Shott@intel.com

Abstract - Through a review of evaluation data and reports collected from studies of successful Pre-Service courses delivered in teacher education institutions over five years and across multiple countries, the contextual factors regarding how universities can effectively integrate ICT into pre-service education is examined. A meta-analysis of multiple evaluation reports and studies collected will describe Intel’s process of applying this large scale ICT integration strategy and discuss the systemic factors associated with understanding classroom level change. A synthesis of these studies illustrates the effectiveness and impact of the Intel® Teach program in supporting teacher educators in the successful implementation of ICT within their course curriculum.

Results from multiple studies provide evidence of the immediate outcomes and longer term impact of this professional development course for teachers, such as:

- Lesson plan development where teachers develop and use curriculum framing questions to guide learning.
- Instructional strategies where teachers use curriculum framing questions to guide student work and student thinking.
- Implementation of new technology-rich activities where teachers integrate technology use to support specific components of a learning activity (research, writing and revision, communication)

Keywords: Pre-Service, Professional Development, ICT.

INTRODUCTION

Around the world, there is increasing attention on the role technology can play in preparing students for the 21st century. The alignment of vision, goals and policies across governing education bodies, Teacher Education Institutions and schools plays a critical role in enabling future teachers with the tools to effectively integrate technology. At the same time, the development of the teachers’ capacity to use new educational technologies to support student learning is a critical need for most teacher preparation programs. However, a gap remains that prevents teacher educators from being sufficiently prepared to provide the necessary instruction and modelling of these technologies. Many teacher educators lack the knowledge to model technology use and the skills to teach their students how to effectively integrate technology into their teaching and learning strategies. To adequately prepare future teachers, teacher educators need professional development, not only in technology skills and applications, but also in new pedagogical methods of incorporating technology into the classroom.

To meet the demand in providing sufficient training in these areas, the Intel Teach Program was developed to improve teacher effectiveness through professional development, helping teachers integrate technology into their lessons and promoting students’ problem-solving, critical thinking, and collaboration skills. With more than 9 million teachers trained in over 60 countries, Intel Teach is the largest, most successful program of its kind. These programs are designed to provide teachers with the knowledge and skills to develop 21st Century skills with their students, encourage project based, collaborative and personalized learning and effectively integrate information and communication technologies as critical tools into the classroom. A pre-service component of the initiative provides professional development for teacher educators in order to enable future classroom teachers in the development of student-centered learning through technology integration and project-based approaches where faculty are taught how to design content-based unit plans using technology for organization and instruction.

For the private sector involved in the many aspects of education and technology today, the most frequent questions concern motives, responsibilities and impact of their involvement, and the efforts associated with understanding the effectiveness of these efforts, including the long term commitment to guarantee scale, access, equity and sustainability. There is rarely agreement on the roles and methods of private sector involvement, but there is agreement that as the demand for high-level subject based skills and higher order 21st Century skills continue to grow within schools and beyond, for future employability, the tasks associated with transforming traditional models of schooling to meet these demands are often hidden within the complex political, social, and educational systems in which they are so deeply embedded. Increasingly, the private sector has been establishing partnerships with governments, non-governmental organizations, academia, educators, practitioners and industry to address the challenges associated with the numerous education reform efforts. For multinational corporations, their global presence and needs as employers and agents of innovation, provides a perspective that can inform agencies intent upon transforming learning environments and learning outcomes in local and global ways.
Intel Corporation seeks to be a global partner to national governments and to contribute to the development of modern, high-quality educational systems worldwide, to help prepare young people for the 21st century, and to adopt global standards to meet local requirements. Intel’s involvement in Education stems from the assumption that Intel Teach can only add value to a country’s educational system if there is a demand for it, and if it can be endorsed by the Ministry of Education. The endorsement is essential because it allows teachers to enrol with confidence, and because it is essential that energies are focused on the existing system of professional development, rather than on a new, parallel system. The collaboration with the Ministry of Education is based on the principle of a Public Private Partnership (PPP), a structure which allows the transfer of resources and knowledge from the private sector, without the fear of the public sector to unwittingly become a marketing channel. A successful PPP will also take into consideration the amount and degree of localisation needed, for a program like Intel Teach to be successful in a particular country.

A core component of Intel’s holistic approach to support Education Transformation is the identification of the activities that support a shift from traditional education systems to the desired innovative, project based collaborative and personalized learning environments. This will require exploration beyond the classroom to include the wide-ranging systemic change of programs, practices, and policies based on the application of a clear theory of change.

The goal of this paper is to discuss an effective strategic professional development design for successful technology implementation adopted by the Intel® Education Initiative that recognizes, among other critical aspects, the opportunities available within pre-service institutions. By referencing established, yet evolving evaluation findings, the Intel Teach strategies will be discussed, to assist education leaders in understanding the larger, systemic factors associated with understanding classroom level change.

**BACKGROUND**

It was during the introduction of computers in US classrooms in the early 1990’s when the newly established Intel Foundation examined the few teacher professional development programs available to help teachers use this new technology in their efforts to improve student learning [1]. The critical issue at the time was whether or not teachers understood how technology contributed to classroom instruction. As a result, the type of teacher professional development—meaning the methods of teacher-training, the length of that training, and the training content—began to shift beyond hardware and software use to emphasize the instructional purpose of the technology and the impact on education [2], as well as the need for an improved quality and nature of teacher-training [3].

At that time, U.S. Secretary of Education Richard W. Riley stated in a speech at the National Conference on Education Technology, “Teaching and learning that uses technology effectively can lead to greater academic success and make a real difference in the lives of students.” He also added that, [technology] “…is not a substitute for solid teaching and learning - but a tool to help teachers teach and help students learn at the highest levels and helps teachers teach more effectively. Technology is one part of a comprehensive quality learning experience that, at its very core, involves the concept of teaching people to think and to continue to learn throughout their lifetimes so that they can benefit from change” [4].

To address the need for teacher professional development that moves beyond applications, the Intel Foundation contracted with the non-profit Institute of Computer Technology in March 1998 to collaborate on content development and to create a program designed to train classroom teachers to integrate computers into their existing curriculum. In 2008 the program began to be recognized as the Intel Teach Program, and had trained more than five million teachers in more than 40 countries. To date, the program has trained more than ten million teachers in more than 70 countries to be more effective educators by providing content and instruction in ways to effectively integrate technology into their lessons in order to promote problem solving, critical thinking, communication and collaboration skills among their students, and is committed to reaching millions more [5].

Now managed through the Intel Corporate Affairs Group, additional investments in research and rigorous program evaluation to establish and sustain continuous improvement of these educational products and activities occur. The research and evaluation compiled for this purpose has not only enabled the improvements of the program development efforts, but now also comprises a comprehensive body of evidence that demonstrates program impact [6]. As a result of these efforts, critical evidence has emerged that may inform other evaluation activities designed to measure impact related to ICT in education in terms that extend beyond logistical measures and student assessment.

**FACTORS INFLUENCING TECHNOLOGY INTEGRATION FOR EFFECTIVE TEACHING & LEARNING**

3.1 **Teacher Professional Development**

Intel officers and Sr. Management regularly remark that, “Computers aren’t magic, teachers are.” This comment stems from the awareness that although ICT in education may enable change at an accelerated rate, transforming the activities within the classroom depends on the teacher’s knowledge, attitudes and behaviours. Following recent advances that allow ICT to be more available and mobile, there is increasing use of technology...
in education. For education policies that include uses of ICT to be credible and show impact, much more than the technology itself must be considered. In fact, many believe primary challenges are more in the area of institutional capacity and teacher professional development, rather than in technical areas [7].

Over the last several years, the demands on the teaching profession have increased. Much of these challenges are due to increased accountability requirements. As a result of these shifts in the demands on teaching have occurred, monitoring the accountability requirements have increasingly fallen upon the school leadership. In turn, the preparation of teachers has received much attention from both researchers and policymakers alike. While some studies indicate the answers to teacher preparation can be found through developing advanced content knowledge, others suggest the need to require advanced degrees will improve teacher preparation [8]. Yet, additional research indicates that factors such as working conditions, which include class size, administrator support, peer support, and student discipline, are associated with teacher preparation [9].

Intel has spent a great deal of time, effort, and money studying effective teaching and learning, and has chosen the approach that one of the best investments a government can make to improve student learning is to invest in teacher professional development. Access to technology without systemic supports such as policy, curriculum alignment, assessment and leadership that does not have a strong teacher professional development and support strategy will only lead to disappointing results. In a 2003 article titled “Resources, Instruction, and Research,” the authors discuss the importance of the interactions and processes that surround classroom instruction, saying, “Teaching is what teachers do, say, and think with learners, concerning content, in particular organizations and other environments, in time” [10]. Therefore, any effort possible to support teachers’ knowledge, attitudes and behaviours in shaping classroom instruction and collaboration are critical.

Most notably, the primary condition for sustaining an innovation is teacher support. Without teacher support, the innovation simply cannot occur. As identified through the SITES-M2 study of innovative pedagogical uses of technology [11], essential contributions to teacher support include: the perceived value of the innovation, professional development, and student support. More specifically, as stated by Fullan and Hargraves, “However noble, sophisticated or enlightened proposals for change and improvement might be, they come to nothing if teachers don’t adopt them and translate them into effective classroom practice” [12]. As such, teachers must understand the relevance of the proposed change, the benefits to the students, and receive sufficient professional development that provides transformation of the teachers’ knowledge, attitudes and classroom behaviours. While multiple issues such as leadership across multiple levels, school level sustainability, and in-service professional development are critical factors for innovative technology based education transformation, for the purpose of this paper, our focus is on teacher preparation within the pre-service institution.

3.2 Pre-Service Professional Development

As a result of the increasing attention on technology integration in K-12 institutions, and the challenges teachers face of knowing how to use technology, teacher education programs also initiated reforms. Similar to the in-service efforts, most of these initiatives resulted in stand-alone technology courses that focused primarily on technical skills and trouble-shooting strategies to prepare teachers to use technology [13]. Likewise, most in-service and pre-service teachers felt ill-prepared to effectively integrate technology into their courses and faced similar barriers related to technology integration [14]. Additional research has shown much of the faculty of education effort goes into capacity building or technical support [15].

Much of what was studied in the early days of technology integration still applies. Common barriers that pre-service teachers experience is that most instructors regard technology training as separate courses that are not necessarily integrated into a specific content area [16]. As a result, problems inherent in a stand-alone course include short-term exposure to applications in a narrow technical focus [17] without sufficient instruction and understanding of integration and curriculum connections framed by a clear technology integration planning that can provide teachers sound practical guidance [18]. Our classroom observations have shown that without understanding of effective integration knowledge and strategies, teachers continue to use computers for low-level, supplemental tasks such as drill and practice activities, word processing, educational games, and computer-based tutorials [19].

After a decade of analysis, we now know that stand-alone technical skills courses isolated from content curriculum are insufficient for effective classroom technology integration. Research suggests that the best way we can hope to see improvements in technology integration across the system is with reform of the teacher education programs linked to well-illustrated standards [20]. As such, one framework that has gained much attention recently is the Technological Pedagogical Content Knowledge (TPACK) framework [21] that builds upon Shulman’s [22] pedagogical content knowledge (PCK) framework. TPACK has been regarded as a potentially fruitful framework that may provide new directions for teacher educators in solving the problems associated with integrating ICT into classroom teaching and learning [23]. Mishra and Koehler [21] contend that for teachers to integrate ICT in their teaching, their technological knowledge, pedagogical knowledge and content knowledge should be synthesized to form TPACK. The TPACK framework has been embraced as a theoretical basis for structuring ICT curriculum in teacher education programs [24] and has been illustrated by Chai et al, (p. 1185) within the seven constructs as [25]:
a) Technological Knowledge (TK) – knowledge of how to operate computers and relevant software.
b) Pedagogical Knowledge (PK) – knowledge of how to plan instruction, deliver lessons, manage students and address individual differences.
c) Content Knowledge (CK) – subject matter knowledge such as knowledge about languages, Mathematics, Sciences etc.
d) Technological Content Knowledge (TCK) – knowledge of how content can be researched or represented by technology such as using computer simulation to represent and study movement of the earth crust.
e) Pedagogical Content Knowledge (PCK) – knowledge of “the ways of representing and formulating the subject that make it comprehensible to others[22]” (p. 9).
f) Technological Pedagogical Knowledge (TPK) – knowledge of how technology can facilitate pedagogical approaches such as using asynchronous discussion forum to support social construction of knowledge.
g) Technological Pedagogical Content Knowledge (TPACK) – knowledge of facilitating students’ learning of a specific content through appropriate pedagogy and technology.

A MODEL FOR STRATEGIC PRE-SERVICE TEACHER EDUCATION

4.1 The Intel Teach Design

The Intel Teach Essentials Course professional development program is designed to assist teachers with the integration of technology into everyday classroom practice. The goal of the training is to help teachers integrate ICTs effectively into their teaching practice by emphasizing student-centred and inquiry driven learning activities.

The core of the Essentials Course curriculum is the creation of a unit plan, including model student work samples, support materials, and an implementation plan. This structure allows teachers to expand their technical skills in the context of a curriculum development process. The process of designing the unit plan is intended to give participants a chance to think deeply about the issues involved in integrating ICT into their teaching. By stipulating the creation of immediately relevant materials, the curriculum puts the teachers’ classroom needs at the center of the training experience to understand ICT as a critical tool to encourage active student learning. A core component of Intel’s efforts is to partner with governments in order to promote student-centered, personalized and collaborative teaching and learning worldwide. With the collaboration and unparalleled public-private partnerships with government ministries and teacher education institutions worldwide, Intel Teach has reached more than 10 million teachers in over 70 countries. Intel Teach courses are currently delivered in 14 EUR countries. From 1999 to 2010, 1.2 Million teachers were trained on Intel Teach in EUR of those, 150k were pre-service teachers.

4.2 The Intel Teach Pre-Service Program, a Faculty Review Strategy

The Intel Teach professional development program was originally designed to be delivered, via a train-the-trainer model, as a 40 hour long in-service professional development course. However, managers of the program became increasingly aware of the need to not only train practicing teachers, but to ensure that individuals just entering the profession would also be well-prepared to use technology constructively with their students.

Beginning in 2002 the course was first offered to college and university faculty who teach undergraduate or graduate students studying to become K-12 teachers. Using the same curriculum, Senior Trainers from the Intel Teach to the Future program offered a 40-hour training to teams of faculty from any School of Education who chose to participate. These faculty members agreed to use the curriculum in their teaching, and were encouraged to distribute the 10 modules of the curriculum across various core education courses so that students would be exposed to the curriculum content over an extended period of time and in the context of learning other core content of their area of concentration. Copies of the curriculum were provided at no cost to graduate or undergraduate students whose faculty made use of it in their courses [26].

Initial development of this pre-service version of the Intel Teach program in the U.S. aligned with many universities’ participation in a major federal initiative aimed addressing similar challenges: the Preparing Tomorrow’s Teachers to Use Technology grants. Since that time, teacher education institutions in countries around have joined this initiative with a goal of “supporting high-quality reforms in teacher preparation programs for the purpose of increasing the knowledge, skills, and abilities of prospective teachers to use technology efficiently in their future teaching practices.” As a result, we now have a number of reports and examples of various ways that universities leveraged the Intel Teach program to support their future teaching practices and to meet their overall goals of preparing their students to become teachers capable of effectively integrating technology into their courses.

In 2008, the course was redesigned to align with the US National Council for Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) technology standards for teacher preparation. At the same time the course was adjusted to compliment the skills that teacher educators...
already possess & focus on integrating the technology & pedagogical interaction and facilitation skills for integration into syllabi and/or use for development of new courses; and develops faculty expertise in 21st century skills, online tools and resources, and strategies for transforming credential/graduate programs to technology-rich programs.

According to a recent study conducted by faculty at California State University Fullerton, the format of the Intel Teach Faculty Review is designed for practitioner use, and allows teacher educators to practice use of interactive online applications and Web 2.0 tools, resulting in the development of project ideas for use in their university classrooms. Also noted within this study is the addition student assessment activities where faculty are able to identify specific areas where candidate skills are lacking through an assessment that is aligned with NETS-T and NCATE standards [27]. In 2010-2011, a new series of multi-media online Intel Teach professional development courses were developed incorporating key concepts from the historic Intel Teach face-to-face program. Intel Teach Elements courses explore 21st century learning concepts through a series of compelling online interactive e-learning tutorials. Five new Intel Teach Elements courses are now available for use by pre-service teachers and graduate students. The multi-day Faculty Review has been replaced in favour of online resources for faculty, with free access to courses and course content in multiple formats. Course content can be streamed online, run independently from CDs or hosted in University learning management systems. Course “shells” are available without charge for import. Local customization for use in pre-service coursework is enabled through a free license from Intel.

| Project-Based Approaches Course | Project-Based Approaches helps teachers improve their understanding and application of project-based approaches in the 21st century classroom. By the end of the course, participants who complete an Action Plan will have designed materials and activities to implement or improve project-based approaches in their classrooms. |
| Assessment in 21st Century Classrooms Course | Assessment in 21st Century Classrooms helps teachers see how assessment strategies can benefit their teaching practices and students’ learning. Participants learn how to plan, develop, and manage student-centered assessment. The course offers opportunities to apply the assessment concepts with action planning exercises. |
| Collaboration in the Digital Classroom Course | Collaboration in the Digital Classroom helps teachers develop students’ 21st century thinking skills, deepen content understanding, and prepare for the global world. Participants learn how to plan and manage collaboration activities that integrate online collaborative tools that are increasingly part of our globally connected workplaces. |
| Thinking Critically with Data Course | Thinking Critically with Data helps teachers prepare students to think critically in our information-rich world. Participants explore practical skills and strategies to draw on when teaching students to think critically about the information around them. |
| Educational Leadership in the 21st Century | Educational Leadership supports exploration and discussion of school leadership in our students’ technological 21st century world. School leaders review best practices, examine leadership behaviors, and develop strategies to better support their teachers. |

4.3 The Intel Teach Pre-Service Data & Results

From the earliest formative evaluations of the Intel Teach Pre-Service program conducted during the Winter and Spring of 2003, conducted by the Education Development Center/Center for Children and Technology [28] the focus was on determining whether and how faculty members are using the curriculum with their pre-service students, describing benefits and challenges faculty associated with the experience, and presenting preliminary evidence of the impact that program participation may have had on their teaching and use of technology with pre-service students. These findings indicated that:

- The faculty had positive responses to the curriculum designed for the pre-service environment with 90% of survey respondents reporting that they would “probably” or “definitely” recommend the training to a friend or colleague.
- The large majority of faculty members who completed the training did make use of part or all of the curriculum components in their own teaching with 80% of survey respondents reporting using at least one module once or more than once since their training.
- In some cases, program participation supported larger planning processes focused on redesigning how pre-service students were introduced to educational technology. This reflects both the presence of both broad pressures to address the role of technology in pre-service education and faculty recognition of the curriculum as both innovative and relevant to their students’ needs.
- Early adoption was identified through various modes of implementation used by participating faculty. These modes of implementation ranged from offering freestanding workshops to the pre-service students outside of regular class time to introduce them to specific applications or practices described in the curriculum, to use of a small number of curriculum modules, to use of all or almost all of the modules within the prescribed curriculum as the primary curriculum for an instructional technology course.
As the pre-service course expanded beyond the pilot sessions and was implemented in a number of US
teacher training institutions, a series of studies were conducted by individual faculty within various colleges of
education, independent of the Intel evaluation efforts. One such report [28] following a study of the course at
Portland State University noted, “As a result of our work with this curriculum, the overall technology expertise
of faculty has improved, and expectations for pre-service teacher use of technology has increased. This is
reflected in increased demand for computer lab space by classes and increased circulation of portable
equipment.” (p.2) The same report also included findings from the course conducted at The University of New
Mexico. In this case, the report described the experience of the Intel workshop involving faculty as
demonstrating the difficulty in faculty efforts developing technology applications within their courses on their
own. Acquiring more expertise with technology tools requires resources such as the Pre-Service course especially
to the faculty development. Here [29], the authors note one participant as saying, “The Intel materials not
only train the instructor on tools but also provided a curriculum framework that can benefit our students.” (p.3)

When an additional study [30] was conducted by researchers at Arizona State University, the focus of the
study was an exploration of the potential relationship between developing digital teaching portfolios and any
propensity to integrate technology in the classroom. Using the portfolio generated by the Intel Teach Pre-Service
course as the evaluand, analysis of data indicated that there was a positive change in the participants’ perceptions
of their technology skill level and their use of digital portfolios as a learning/assessment tool in their classrooms.
Results also indicated that the course consisting of graduate students working on an advanced degree while
teaching, also developed technology skills that they could use in their classrooms.

In 2005 the Intel Teach Pre-Service program was deployed internationally. As such, a comprehensive
evaluation plan was initiated among the earliest teacher training institutions in eight countries across Asia. The
agency selected as the evaluation team responsible for coordinating local teams in each of the implementing
countries was Deakin University located in Melbourne, Australia. The evaluation design was to gain evidence
and understanding of the program’s impact on the teaching practice of teachers who had undertaken the program
during their pre-service course and the factors that factors that facilitate and hinder its effective implementation
in pre-service education.

The evaluation plan consisted of three phases:

- 2005 – Development and piloting of the evaluation strategy and instruments in selected countries with the
focus on course implementation.
- 2006 – Implementation of the study, including both qualitative and quantitative data on the impact of the
course on current pre-service teachers and former pre-service teachers who began teaching in schools.
- 2007 – Sustainability and impact, gaining additional qualitative data to better understand key influencing
factors and practices that affect success.

The Asia Pacific countries involved at various levels over the three years included Vietnam, Taiwan,
Philippines, Pakistan, Malaysia, Korea, Japan, India, China, and Australia.

The final report [31] of a comprehensive, multi-stage study highlights the positive impact of the Essentials
Course on Teacher Education Institutions, teacher educators, pre-service teachers and new teachers who
completed the program during their pre-service training. It also identifies the factors that underpin success.
During the first stage of the study, the purpose of the evaluation was to better understand what is needed for
effective delivery of the pre-service course, such as: length of time, the number of modules being implemented,
etc. Findings from this study indicated that overall, responses from program participants had been positive, with
many indicating they were ‘eager to use ICT in the classroom’. However, one key finding at this point was that
some participants found that if the course was conducted before they had practicum/classroom experience, they
had difficulties grasping the concepts necessary for developing the unit Plan. In addition, the development of
partnerships between country based Intel Teach teams, the Ministries of Education, pre-service governing bodies
and the Teacher Education Institutions were instrumental in promoting, driving and sustaining the increasingly
robust implementation of the course across the pre-service institutions. The Intel Teach course is localized at the
country level and the scope for implementation in the Teacher Education Institution is flexible enough to address
the needs of the vastly different pre-service approaches and contexts.

As the study progressed into analysis of factors associated with effective implementation of the course
concepts, leadership commitment and a coordinated and collaborative approach within the Teacher Education
institution were identified as helping to overcome some of the significant challenges around technology
resourcing, resistance to change and an already crowded pre-service curriculum. The links established between
local schools and the teacher training institutions were shown to benefit teacher educators, pre-service teachers
and classroom teachers where these students complete their practicum assignments.

Additional aspects identified as key to effective implementation include: providing all or most components
of the course and ensuring that the teaching and learning strategies are modeled by the instructor, discussions are
reinforced across the range of the curriculum, not as isolated concepts. At the institution level, formally
accrediting the program within the pre-service qualification increases its status and attracts greater commitment
from all involved.

The conclusion of the study [31] indicated that feedback from a range of Teacher Education Institutions
described that, for many, the Intel Teach Program Essentials Course had transformed their teaching approach and
content. For some, involvement in the course had also benefited their status, activities and influence within their broader education community, as their graduates were considered ‘more employable’.

Beyond the student participants, the course also had immense personal and professional impact on many Teacher Educators. Many reported that they began to change their lecture style approaches in their teaching to student centered, collaborative approaches. In addition, their perceptions of the role of technology in teaching changed from technology skill development to the use of technology as part of an innovative approach to teaching.

Moving forward, the newest pre-service course that provides professional development for teacher educators, prepared to support classroom teachers in the development of student-centered learning through technology integration and project-based approaches using Web 2.0 tools is now in development. In this new version of the Pre-service course, faculty learn how to build wikis for student and faculty collaboration, design blogs for student reflection and use various interactive online objects to involve students in critical-thinking available via CD ROM and through the Intel Education resources for K-12 Educators [32]. As such, a study was designed to investigate the impact of the Intel Teach Faculty Review on developing faculty capacity to use and model the use of technology for teaching and learning. Findings of this study indicate that pre-service teacher educators identified many of Intel Teach resources/areas of skill development as useful in their preparation of teacher candidates in the use technology to improve teaching and learning. This study states, “Evaluation of the Intel® Teach Faculty Review indicates that the new format has been successful in giving teacher education faculty the skills they need to incorporate technology into their curriculum in ways that promote effective use of technology by pre-service teachers. Surveys of Intel Faculty Review participants document that they learned a significant amount of technology skills over the course of the three-day training and have incorporated Intel Teach curriculum materials into their credential and graduate courses. Further, the use of the Action Plan has prompted systemic approaches to the integration of technology across their teacher education programs [27].”

CONCLUSION

Transforming education systems and supporting national competitiveness are difficult, long-term endeavours. However, embedded teacher education programs aligned to sustained professional development can help inform policy development that supports real change. Likewise, awareness of systematic, replicable methods in establishing a common framework that begins with clear goals and objectives, implementation strategies, and local contextual dependencies may also enable sustainable change.

Socio-economic growth requires long-term, incremental change, entrepreneurship and innovation – and young people prepared for these. Twenty-first Century educational systems are those that can adequately prepare young people for the challenges today and opportunities of the future. They must make best use of effective teaching and learning strategies and to contribute to the improvement of project based, personalized and collaborative learning in classrooms worldwide. The countries currently participating in the Intel Teach portfolio of courses are each at a unique point in the process of building the human capacity, technical infrastructure, and policy environment that will enable educators to make real, lasting improvements in how teaching and learning occurs in their schools and classrooms.

The Intel Teach Pre-Service Program, teacher professional development course and Leadership Forums are based upon current research on quality instruction and learning that links project-based teaching strategies with student-driven technology use that is closely aligned with the objectives of 21st Century education that many Ministries of Education are seeking to achieve. Evaluation of the courses consistently show that two key strengths of the initiative are its ability to build upon teachers’ existing knowledge, skills and interests, and to help teachers identify and achieve incremental changes in their use of technology and of project-based teaching methods. Recognizing the challenges of teacher technological, pedagogical and content knowledge in emerging economies where many more teachers are coming into the profession with little or no prior awareness of the project-based and student centered, collaborative teaching methods emphasized in the courses, the Intel Teach portfolio of programs can serve a vital role. Teachers in these countries are much less likely to have prior knowledge of the targeted instructional strategies and are less likely to have access to computer and internet resources.

Integrating technology into teacher education programs is involves complex choices about classroom instruction, faculty time, student achievement, program priorities, and content & curriculum issues. The importance of faculty modeling effective teaching and learning strategies are critical. The knowledge, skills and abilities of the teaching faculty makes a difference. Furthermore, case studies and other qualitative evaluation efforts show that in countries where these approaches to teaching are least familiar, teachers are struggling to envision how strategies - such as having students work in groups - can become integral parts of a coherent shift in overall classroom practice [19].

Evidence from multiple studies of the Intel Teach programs suggests that teacher expertise can have an immediate and long-lasting effect on student-centered teaching practices, and collaborative learning. In addition, as discussed, teacher expertise also plays a critical role in successfully implementing and sustaining classroom pedagogical innovation using ICT. As a result, supporting effective teacher technology use is one strategy that

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governments can use to help teachers increase their expertise. To be effective this support must be directed toward implementing learning initiatives that are on-going, school-based, and focused on areas of the curriculum in which students are having difficulties. Education transformation efforts that support teacher learning of this kind will benefit from improved learning environments and student performance. The development of partnerships between country based Intel Teach teams, the Ministries of Education, pre-service governing bodies and the Teacher Education Institutions has been instrumental in promoting, driving and sustaining the increasingly robust implementation of technology integration across the pre-service sector.

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About the authors

Dr. Jon K. Price: Intel® Corporate Affairs Group Program Manager for Research and Evaluation has been managing the education technology program evaluation efforts for Intel’s global K-12 education initiatives since 2003. In 2008 his responsibilities expanded to include additional research and evaluation into how effective integration of technology into multiple levels of education can impact teaching, learning, education reform, and economic growth. Jon has authored several articles on effective integration of education technology and has presented on the subject worldwide. He is a graduate of The University of New Mexico, the Harvard Graduate School of Education and received his PhD in Education from the Texas A&M University College of Education. Jon currently lives in Albuquerque, New Mexico, USA with his wife and three children.

Dr. Martina A. Roth: Director of Global Strategy, Research and Policy at Intel® Corporate Affairs Group is responsible for global strategy, research & related policies, Intel® engagement with strategic alliance partners like the Global Education Initiative of the World Economic Forum, UNESCO, OECD, IEA, EUN, ATC21S. She is Board member of various Education Initiatives, the Austrian Research Studios, the ESTABLISH Advisory Board. Prior to her global role she has served as Director of the Intel® Education Group for Europe, Middle East and Africa region responsible for the development and implementation of education programs covering approximately 50 countries on three continents. Dr. Roth holds a M.A. in Pedagogy and a Ph.D. in Philology from the University of Jena, Germany.

As U.S. Intel® Teach Manager for Intel Corporation, Steve Andrews leads professional development serving over 300,000 school administrators, teachers, and teacher-education faculty throughout the United States. Intel Teach professional development focuses on integration of technology for teaching and learning to promote 21st Century skills. [Website]

A former middle-school science teacher, pre-service University instructor, NSF principal-investigator and school administrator, Steve has sought throughout his career to engage students in “learning by doing.” Steve is currently co-chair of the Partnership for 21st Century Skills State Leadership committee. He serves on the Achieve (ADP) Content Advisory Committee for the refresh of the American Diploma Project Core Mathematics Benchmarks.

Shelley Shott is currently the Global K12 Education Manager at Intel, working with Ministries of Education, school leaders, and teachers worldwide in helping improve teaching and learning. She has presented on a variety of topics, including the Intel Teach program, at conferences around the world.

A former middle school science instructor, academic chair, and developer of grade K-8 district curriculum in Arizona, she has won numerous awards for the integration of technology in the classroom.

A published author of several articles on science education methodology and pedagogy, Shelley has served as adjunct faculty at Northern Arizona University and currently teaches online classes at California State University Fullerton.