Designing and Implementing an Effective Teacher Professional Development Program on ICT Integration: A Framework for Decision-Making

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Twenty-first century educators are exploring new paradigms of teaching and learning in ensuring that technology is used effectively to create new opportunities for learning and to promote student achievement. However, infusion of technology into the curriculum requires the assistance of educators who are required to find appropriate ways to integrate technology into the core curriculum, align it with student learning goals, and use it for engaged learning activities as they implement the Information and Communication Technology (ICT) program of studies. Change for educators comes through the process of preparing beginning teachers and continuous professional development for practicing teachers who need to have the necessary attitudes, knowledge and skills to apply ICTs to their daily professional activities. Therefore, professional development for teachers becomes the key issue in using technology to improve the quality of learning in the classroom.

This paper examines teacher development for the integration of ICT both in the pre-service teacher education and continuing professional development. This paper examines teacher development for the integration of ICT both in the pre-service teacher education and continuing professional development. The first part discusses issues and trends in teacher professional development and ICTs. The second part describes current models and approaches to pre-service teacher education and continuing professional development that address ICT integration. The third part identifies a number of key characteristics or ingredients associated with successful ICT teacher professional development drawn from both the professional development initiatives and models for educators with Information and Communications Technologies implemented in different parts of the world and from current research literature. Part four identifies barriers and critical success factors for effective teacher learning. From the wide variety of teacher professional development models reviewed in this paper, part five presents a framework for exemplary practice selection criteria developed from the synthesis of professional development initiatives and models described in this paper and from current research literature. Finally, the last part offers recommendations which flow from the understandings about effective

models and measures of effectiveness of teacher professional development programs discussed in this paper.

I. Issues and Trends in Teacher Professional Development and ICT

Technology can facilitate instructional experiences that can help students develop necessary skills. It can support lessons to develop skills to analyze, evaluate and present information. Because of this potential, the current emphasis in education is ensuring that technology is used effectively to create new opportunities for learning and to promote student achievement. However, educational technology is not transformative on its own. It requires the assistance of competent educators who are required to find appropriate ways to integrate technology into the curriculum, align it with student learning goals, and use it for engaged learning activities. Teacher quality is the factor that matters most for student learning, hence, it is essential that educators be familiar with strategies which successfully use technology to create learning environments that benefit students and models of professional development that are effective to help teachers incorporate best practices.

Current Situation

The 2005 Education for All (EFA) Global Monitoring Report[1] confirms the central role of teachers in any education system, emphasizing that the quality of education is directly linked to how well teachers are prepared for teaching. Accordingly, in today's world teachers need to be equipped not only with subject-specific expertise and effective teaching methodologies, but with the capacity to assist students to meet the demands of the emerging knowledge-based society. Teachers therefore require familiarity with new forms of information and communication technology and need to have the ability to use that technology to enhance the quality of teaching and learning.

Many countries in the Asia-Pacific region have realized the need for providing teachers with training in ICT and have launched various professional development initiatives. However, many of the training activities to date have been one-off, crash courses which focus on computer literacy and do not enable teachers to integrate ICT in their day-to-day teaching activities and master the use of ICT as an effective tool to improve teaching and learning.

The Philippines has begun to re-conceptualize the policies and strategies of ICT in education towards life-long learning, in its Information and Communication Technology Plan. And one of the four thrusts of the country's Information and Communication Technology Plan is retooling of human resources, wherein training programs will be conducted at different levels involving different sub-systems and focusing on the different components of basic education.

The following are highlights of the professional development of teachers with regard to the integration of ICT in the Philippines' educational system.[2]

- Since year 2000, it has been the policy of the DepEd to give preference to the hiring of teachers who are computer literate; most teacher-training institutions offer computer education as a required course.

For those who are already employed as teachers, inservice is provided in several ways:[3]

- Intensive training on electronics and assembly of computers for THE teachers of 110 S&T-oriented high schools and other special science high schools is offered. The objective of this training is to ensure that teachers in schools with special S&T programs have the appropriate technology skills. The Science Education Institute (SEI) allows recipient schools to keep the computers assembled by their teachers after the completion of their training.
- Training using computers in classroom management and instruction started in 1997 as a component of the Department's computerization program. It has reached about 7,500 teachers of English, Science, Mathematics and THE (including those in elementary schools)and 691 school administrators.
- The PCs for Public High Schools Project is aiming to train 20,000 teachers over a period of two years under the Intel Teach to the Future Training Program. The training was initially for 1,000 teachers of the recipient schools. Each one of these 1,000 teachers is expected to train 20 additional teachers to reach the goal of 20,000 teachers trained by the end of the project.
- Training is provided by SEI of DOST on robotics and the use of advanced ICT facilities in Physics. The Physics teachers of the Philippine Science High School acted as trainers for Physics teachers of other public science high schools being supervised by the DepEd. Robotics facilities were given to the participating schools in the program
- Training programs have been developed on the use of graphic calculators for Mathematics and Calculus for Science and Mathematics teachers in public schools. The Mathematics Association of Teacher

Education Institutions (MATHTED) was tapped to handle the teacher training program participated in by Mathematics teachers from 110 S&T-oriented high schools and other public science high schools.

- Distance training through CONSTEL is available for teachers who are unable to partake in face-to-face training in English and Science. The project has three components: development of instructional materials for teachers; production and distribution; and teacher training. The materials that have been produced and distributed to more than 2,000 schools nationwide include videotapes for English and Science teaching. Fifty-eight teachers of English and 91 teachers of Physics have been trained in the use of the materials. Videotapes in Mathematics will be produced and distributed by the Foundation for Upgrading the Standard of Education (FUSE).
- Training and capacity-building of women 's non-governmental organizations (NGOs)and grassroots groups on various ICT skills is available. Some examples are the Women 's Electronic Networking Training (WENT)series by AWORC and Wired Fridays, a grassroots women 's training project on ICTs by Isis International-Manila.

- Usually, public schools send a few teachers to computer literacy training, who would then pass on the training of peer teachers. Private schools usually hire ICT service providers to give training to their teachers.

- Public school teachers handling THE classes receive training on ICT. Since 1997, the DepEd has intensified the provision of ICT training to teachers of English, Science, Mathematics and THE.

- There has been some private sector support for teacher training. Intel and Microsoft have a current program called Intel Teach to the Future program which targets to teach 1,000 teachers on the condition that each teacher would train 20 others. Other training programs for teachers are funded by other private organizations.

Issues

Even though the Philippine government has initiated several programs and projects for the use of ICT in education, real implementation in day-to-day learning is still limited. Teachers' fear of technology still hinders the optimal use of ICT-related skills in their teaching activities. Other constraints include the traditional mindset of the school principals, inadequacy of ICT facilities, the lack of adequate maintenance of the available/existing ICT resources, dependence for financial investment on

the central government, dependence on ICT service providers for software/courseware[4] and training opportunities for teachers are generally limited.[5]

It can be noted that despite of the various training programs being provided to teachers, lack of professional development for technology use is one of the most serious obstacles to fully integrating technology into the curriculum. Many teachers do not have the technical knowledge or skills to recognize the potential for technology in teaching and learning. Just knowing how to use a computer is not enough. Instead, teachers must become knowledgeable about technology and self-confident enough to integrate it effectively in the classroom. Teachers, in other words, must become "fearless in their use of technology" and empowered by the many opportunities it offers. Most teachers want to learn to use educational technology effectively, but they lack the time, access, and support necessary to do so.

II. Current Models and Approaches to Pre-Service Teacher Education and Continuing Professional Development that Address ICT Integration

Models of Pre-Service Teacher Education Which Address ICT Integration[6]

The strategies listed below are used in various mixes within any one institution to create an institutional/ program model for the integration of ICTs into teacher education.

- Separate ICT subjects — skill acquisition
- Separate ICT subjects — curriculum/pedagogy
- Diffusion — modeling and use across course (with integration across various subjects)
- ICT Electives — skill acquisition
- ICT Electives — curriculum/pedagogy
- Face-to-face use with children expected as part of learning experience or assessment tasks within particular subjects
- Online use with children expected as part of learning experience or assessment tasks within particular subjects
- Planning, teaching and evaluation of use of ICTs for learning expected as part of professional experience requirement
- Modeling by classroom teacher expected as part of professional experience

- Online interactions with students in schools for projects/learning — virtual practicums
- Online interactions with teachers/professional communities as part of core learning experiences
- Partnerships with schools so that student teachers, classroom teachers and teacher educators engage in inquiry or development projects around the use of ICTs for teaching and learning

Models of Continuing Professional Development Which Address ICT Integration[7]

Five main sets of processes that individual teachers use for their own development. It draws heavily from the work of Sparks and Loucks-Horsley.[8]

Types of Continuing Professional Development Processes Available for an Individual

Types Of CPD	Possible Strategies
Self directed learning	Informal learning — self
	Informal learning — group
	Participation in professional teacher association
Development through observation and feedback	Formal process as part of employment conditions
	Self-initiated for purposes of development
Involvement in development/ improvement process	Curriculum development Project development
	Training for leadership in project
	Whole school improvement
Courses	Short courses, seminars, workshops
Serial courses	Serial courses with in-school components
	Summer institutes Accredited University courses
Sustained Inquiry/teacher research/action learning	Within school — whole school focus
	Within school — group project
	Across schools — project focus

The following are models of systemic professional development programs. These include the various strategies and infrastructure components that make up systemic programs.

Professional development strategies

- Sponsorship programs for self-directed formal professional development
- School-based/focused programs
- Single event programs
- Serial courses
- Curriculum development or teaching projects
- Professional learning communities projects
- Sustained inquiry/teacher research projects

Infrastructure components

- Central and advisory services
- Teachers' centers
- Navigator/Lighthouse Schools offering mentoring, practicums, courses
- Allocation of specialist staff to schools — PD coordinator
- Development and provision of resources
- Provision of hardware to teachers
- Partnerships with teacher education institutions around practicum and induction of beginning teachers
- Recognition and certification of learning/expertise

The following provide an overview of Canadian models for teacher professional development in a knowledge society. The models used illustrate the three modes of social interaction for professional development: 1) face to face interaction; 2) face-to-face and online interaction; 3) online interaction (human-computer interaction, and computer-supported social interaction).[9]

1. School-based models

1.1 The Champion Model. The program, using both face-to-face and online training, blended work and study, while using the school

curricula and the teachers own innovative teaching strategies as the vehicles for their learning. University resources and collaborative work teams, that carried over into the school day, provided challenging and motivating support. The use of technology in learning and teaching in the school became a natural part of the daily educational process.
The program was integrated with the school certification process, resulting in a school action plan whose values, goals and activities were shared among the staff, thus confirming a direction for technology in a collaborative school culture.

The school based decision making model of the school district facilitated some funding for this unique training and enabled the allocation of school, community and district resources to support the school's professional development initiatives. Keeping up with the technical knowledge while making it part of a realistic, on-going, comprehensive plan was difficult but was facilitated once the vision that developed during the professional development program in technology was shared.

1.2. The Teacher Leadership Model. This project is a school-wide initiative in all grades, with all teachers and staff, and is led by a technology team consisting of lead teachers in the school. The project not only promotes technology but inspires teacher leadership.

Teachers in the school develop and deliver their own professional development for all teachers in the school in all technologies. The focus of the school's project is to integrate technology into curriculum where it can be used as an everyday tool. The professional development is teacher-led; all technology skills of students are tracked as reading skills are tracked; a school-wide database of technology skills is maintained at the school; the project is led by teachers and is a dynamic and evolving project.

1.3 The School-within-a-school Model. This is a model where teachers and l learners are teaching and learning with a laptop computer each. The program is oriented toward a proactive or professional approach to the integration of ICT into teaching and learning. Project-based learning is both the result of the year-one teachers that focused on this approach for up to 65% of class time, and the support of the school and the school district that made this approach workable.

Partners include parents who pay for the laptops and pre-service teachers. The Department of Education as well as private partners also provide resources for professional development. Bi-monthly half-day meetings are for the collaboration action-research projects being

conducted within the school. Cooperative learning, curriculum integration, and a learning community model are also part of the renewal that is undergoing. Bridges to other classrooms are being established, and learning projects conducted concurrently. Pre-service teachers work in both "schools", and used at times the same web-based discussion forums.

The school teachers have the full support from the school district and professional personnel contribute in a number of ways (e.g. math and computer specialist as well as project-based specialist).

1.4 The Self-directed OnSite/OnLine Professional Development Model. Teachers attend conferences, as participants and presenters, take college and university courses and seminars, both online and in person. There is great emphasis on cross-disciplinary meetings and discussion, greatly facilitated by the use of groupware after school working hours.

Teachers engage in Professional Development on school time, teacher time, in both synchronous and asynchronous modes, and both face to face and online. The content includes basic skills as required, but for the most part involves learning the pedagogical and collaboration skills.

1.5 The Community-oriented Model. In this model, the school administration, with its commitment to advancing the integration of technology into the curriculum and best practices of learning and teaching, works closely with its teachers, students, parents, school district leadership and the Department of Education to take advantages of the programs available. In addition to being seen as a powerful teaching and learning tool and a vehicle for professional development, technology is seen as a motivating force that works best when it is a natural part of the culture of the school.

Through the use of a school lab, internet access and locally connected classrooms, the school administrator models the use of technology in her teaching and volunteer professional development sessions with the staff after school. Weekly staff meetings feature technology.

The school participates actively in community programs and initiatives particularly related to technology integration, and through participating in some of these programs, hardware can be purchased and computer technology is opened in a natural way to students, teachers and the community. Also, by encouraging technology leaders on staff, by using older students to assist those teachers less technologically comfortable

and by opening the school's technology to the community, these relationships facilitate the development of a community of learners.

1.6 The Small/Smart Steps Model. The emphasis has been on role modeling, with teachers' beliefs and perceptions considered, along with a significant amount of teamwork in the context of a collaborative culture.

1.7 The Web-site as a Shared Task Model. With the help of a lead teacher that had begun to develop a web-site to support her own teaching, three other teachers and the assistant principal submitted a project to their local university as an associated school for pre-service education as part of this small scale project. The team put together a professional development plan that included technology skills as well as pedagogical skills (cooperative learning, project-based learning, and integrated curricula).

1.8. The Cross-Curricular Multimedia Instructional Unit Model. The content of the project emphasized the pedagogy of the various curricula involved, treating the pedagogy of the technology very much as a tool for the former, and moving quickly to the use of such tools as the scanner and the digital camera and the building of WebPages. The concepts of each of integrated curricula, project-based learning and cooperative learning are integrated into the program and encouraged, with a further emphasis on performance assessment in that the students are expected to produce an invention.

1.9 The Mentor Model. This model involves teachers mentoring other teachers in integrating ICT in teaching and learning. This mode of professional development is based on person-to-person relationships, and mentors go to the classroom of interested teachers that have at least one computer in it. Most teachers also have access to a computer at home. The mentor has successfully integrated ICT in his or her classroom in the past.

Professional development with the mentors also includes weekly after-class meetings. Topics vary according to interests and needs of the teachers (software, cooperative learning, project-based learning). With the help of the mentors, teachers develop learning activities to be implemented in each of their classrooms. Teachers may join mentors on the phone, or by email at all times.

1.10. The "Computers for Lunch" Model. What teacher needs to know about computer literacy, is made easily digestible, byte-size servings in this web-based self-instructional computer-literacy course for teachers and would-be teachers. Teachers are able to complete the course individually or collaboratively, in 20 minute lunch-hour sessions, with enough time left over for lunch, and even a break and a chat with colleagues.

Materials and resources for instruction are made available to teachers for "downloading" (which just means copying from the Internet web site to the computer they are working on, and able to be printed out from the school printer for immediate classroom use). Instructions are provided for how to "download" any instructional materials teachers want to use with their classes.

The program seeks to empower teachers to approach a new application and have a sense, both conceptual and practical, of how they might use it. The idea, in essence, is this: don't teach people what a program expects from them, teach them what to expect from the software. Then they can sit down in front of almost anything and have a sense of how it should work.

1.11 The College-wide Model for Professional Development of Faculty. The use of instructional technology and the development of exemplary post-secondary learnware is promoted through a broad series of initiatives designed to lead staff through three phases of cognitive development.

In the Awareness phase, faculty is been exposed to the potential of instructional technology through demonstrations, seminars, online conferencing and hands-on exposure to hardware, software and online resources. The emphasis has been on peer presentations, "faculty show and tell", to increase buy-in, reduce technophobia and alleviate fears of redundancy. These efforts, coupled with the intense media coverage of new technology have ensured that most staff are aware of the increasing role that interactive, instructional technology can play in education.

In the Training phase, several approaches is taken to training professors in new media development, recognizing the steepness of the learning curve in acquiring the knowledge and skills necessary for multimedia development. The first approach is to recognize that the professor is most appropriately designated as a content expert who needs to be supported by a team of technical, creative and instructional design

specialists. This is most appropriate when the project being undertaken is complex and sophisticated. The second approach has assumed that the material being designed is adjunctive and more presentation than interactive multimedia. In this latter case, success is achieved by targeted training in software and hardware appropriate to the scope of the project.

In the Implementation phase and with respect to the objectives above, several major initiatives may be taken such as the establishment of a learning center to provide the technical support to convert the faculty's designs into online or other multi-media format. In addition, faculty may drop into this center anytime to obtain ongoing, just in time and as requested assistance in developing any technology based curriculum materials of courses.

2. District, Group of Schools, and Partner-driven Models

District models, seem to be characterized by the following Cascade model (teacher representing school and assumed to teach their colleagues back at school); peer coaching and "just in time learning"; networks of contact persons. There seems to be a progression from a simple cascade model (without much local structures to support the peer coaching) to a structured network approach (in which a system is put in place, through a variety of mechanisms, so that peer coaching happens at a deeper level).

2.1. The Inclusive Partnership Model. The professional development program was presented as a smorgasbord for "gourmet omnivores", with teachers selecting technology topics of interest. From this approach emerged small teams of teachers, who become trainers for other teachers. Also, it was understood that there would be on-going staff development in technology, such as after school training, the use of the four professional days and the release days allocated to the school by the school board. Many staff members were involved in related university courses.

The integration of technology in learning and teaching was facilitated by every teacher having a lap top, every class with at least three computers and a fully equipped school lab (without a lab teacher) into which regular classes and their teachers were scheduled. Also, the lab was heavily used by students and teachers during unscheduled time.
Much of the training in technology used the curriculum and innovative instructional strategies, such as cooperative learning and multi age/multilevel teaching, as the content through which the technology was learned. More creativity was used in scheduling classes to facilitate the

integration of technology in learning and teaching. This technology training included support staff and involved parents, thus embedding technology into the culture of the school.

2.2 Learning Partnership Model. This is a private-public sector partnership. The key feature is the focus on the development of teacher skills firstly, provision of hardware, integration to curriculum and connectivity to other teachers for continued professional development. Additionally, the project's major goal is the development of collaborative cultures in schools.

2.3 The Collaborative Action-research Model. This is a professional development project for teachers based upon action research. The essence of the project is to offer teachers the time and opportunity to try new things, to reflect upon their experiences and learn from others, thus realizing how technology can improve student learning and achievement and becoming, with technology, capable of much more.

For the most part, basic technology skills and even most techno-pedagogical skills are assumed, with emphasis placed on learning and teaching with technology and research about sound uses of technology in the classroom. Given the pedagogical thrust of the project, other forms of innovative teaching such as integrated curricula, project-based learning and cooperative learning are woven into the fabric of the project.

Teachers have free access to computers in the Professional Development setting, while most have computers at home with no district-mandated incentive program. Various arrays of computers are to be found in the schools.

Given that the essence of the project is action-research, reflective practice and critical inquiry follows easily and teachers begin to share their knowledge about how their work fits into educational theory.

2.4 The Cooperative Model. This university-school project connects schools from rural areas to an established university. School boards provided funding for professional development, and equipment to the schools. Some local communities also got involved, and offered computers to schools or free Internet access. The research project first provided teachers with technical training (word processing, email, introduction to Internet), as well as training in cooperative learning. Professional development now includes face-to-face meetings with other teachers handling the same difficulties, and individual help to the teachers to

effectively integrate technology in their classrooms. Support is also extended through electronic mail.

2.5 The Entrepreneurial, High Tech Model. An entrepreneurial spirit permeates the system from the entrepreneurialism emanating from the supportive school district, to the business partnerships that equipped this high tech school, to the school leadership who asks of their teaching, "what knowledge and skills do we want our kids to have when they leave our school?", to the students' own initiatives in technology.

A partnership provided a ratio of three students to one computer in a school with three fully equipped labs, a resource center of computer equipped pods, computers in every classroom and a computer for each of teacher.

Respected in-school practicing teachers with technology application backgrounds were used as coaches and when district personnel were used to help teachers with identified technology needs, coaching and "just in time learning" rather than large group presentations emerged as the most suitable professional development in the integration of technology in learning and teaching in this school.

Through a supportive district infrastructure, and school/district entrepreneurial partnerships with business, coaching teams of teachers on the integration of technology in curriculum and innovative teaching practices became the most successful professional development model. Networks of teacher teams meet regularly to examine best practices and support each other in the use of technology. Departments and groups of teachers meet after school or are released from teaching to explore with an experienced colleague some technology that they find pertinent to their teaching. Naturally, professional days are used for application training, often taught by a peer or a trainer for some identified need.

2.6 The Teacher Center Model. A variety of training sessions directed to promote the integration of ICT in teacher practice are offered such as technical training with word processing or the Internet, and pedagogical training on project-based learning, cooperative learning and skill development, and teaching strategies to integrate computers in the classroom.

These training sessions take many forms. Some are offered during several days distributed over the year, others are held after school hours, and others still are held during lunch conferences. Networks of contact

persons in schools are developed to further improve liaison with school teachers, and help create or expand teacher networks. The success of these networks is linked to the diminishment of professional isolation, by offering teachers the opportunity to share their knowledge and experiences.

2.7 The Curriculum-centered Model. This is professional development program focusing on the integration of technology into the curriculum. Teachers engage in face-to-face sessions and access the materials online.

The program emphasizes modeling of best practices, usually through the use of video-conferencing, and assumes/supports other forms of innovative teaching, such as Integrated Curricula, Project-based Learning and Cooperative Learning. teachers are encouraged to develop school web sites.

2.8 The Three-dimensional Model. There are three components to IT professional development in this model: (a) self-directed professional development (teachers' centers, focused study groups lead by leadership team members, school-based study groups, school-based action research, after-school workshops and programs, consultation with district curriculum staff, distance learning options (web-based), and resource based learning (videos, journals, texts, audio)); (b) Board and Department of Education-Sponsored professional development (in school mentoring and coaching, school and district in-service sessions, summer institutes, out of district conferences, staff members on provincial curriculum leadership teams, after-school workshops and programs, teachers' centers planned programming, consultation with district curriculum staff, curriculum staff led professional development opportunities, Department of Education sponsored and lead professional development), and (c) Board Partnerships (partnerships for professional development activities/speakers, University graduate level action research program, University MEd programs of study, long term in service relationships with University, Faculty, Summer institutes, Distance learning, after hours, partnerships for construction of new schools).

2.9 The Remote-coordinator / mentor Model. This is focused on a dedicated resource facility for all home-based learning families. It offers a variety of courses students who wish to receive their education outside of the traditional restrictions of time and space.

Since the learning needs of students are unique, it must hire teachers who are particularly interested in students and their learning. However, these teachers must become technologically savvy very quickly. Further, their knowledge and skills must be constantly up-dated. Since the professional development is very much individual and self-directed, teachers manage it and it is strictly a school-based program, with, however, clearly-stated goals and expected outcomes and a great degree of role modeling. Given that it is internal to the staff, it is usually face-to-face, continuous and takes a variety of forms, and occurs approximately half on school time and half on teacher time. Teachers are encouraged to have or bring a computer at home.

The content touches on basic Internet skills, and the use of the Internet for both information and communication, but quickly moves into the pedagogical skills necessary to integrate the technology into all subject areas.

III. Key Characteristics or Ingredients of Successful ICT Teacher Professional Development

To reach the goal of preparing teachers for effective technology use, a well-designed professional development program is essential. Professional development in a technological age requires new definitions and new resources. It cannot take the traditional forms of individual workshops or one-time training sessions. Instead, it must be viewed as an ongoing and integral part of teachers' professional lives.

Professional development for technology use should be an integral part of the school technology plan or an overall school-improvement plan, not just an add-on. Initial inclusion in the technology plan ensures that professional development is considered an essential factor in using technology to improve teaching and learning.

Professional development for technology use should contain essential components that research has found to be important. These components include the following: a connection to student learning, hands-on technology use, variety of learning experiences, curriculum-specific applications, new roles for teachers, collegial learning, active participation of teachers, ongoing process, sufficient time, technical assistance and support, administrative support, adequate resources, continuous funding, and built-in evaluation.[10]

❖ **Connection to Student Learning.** The ultimate goal of professional development is to improve student learning. Schools should provide teachers with abundant opportunities to become fluent in using technology to bolster instruction and help students develop higher-order thinking and problem-solving skills. As a result, the use of technology enables teachers to implement new teaching techniques, to help students work collaboratively and develop higher-order thinking skills, to encourage students to be engaged in the learning process, to assist students who have various learning styles and special needs, and to expose students to a broad range of information and experts.

❖ **Hands-On Technology Use***.* Recent research has shown the importance of current professional development emphasizing hands-on technology use. Teachers who received technology training in the past year are more likely than teachers who hadn't to say they feel 'better prepared' to integrate technology into their classroom lessons. They also are more likely to use and rely on digital content for instruction, and to spend more time trying out software and searching for Web sites to use in class.[11]

Initially, teachers will need to acquire core technology competencies and skills; but during these initial experiences, teachers should be thinking in terms of how the technology can enhance student learning and how it can be used in different content areas. Hands-on technology use at school and at home allows teachers to develop confidence in their skills and a comfort level with the technology. When teachers are accustomed to using the equipment to boost their own productivity, they are more likely to see ways in which similar uses could support the projects they want their students to do.

❖ **Variety of Learning Experiences.** To help teachers incorporate technology in ways that support powerful instruction requires an array of professional development experiences quite different from traditional workshops and how-to training sessions.[12] Whatever the format, effective professional development utilizes key points from adult learning theory. Adults require relevant, concrete experiences with adequate support, appropriate feedback, and long-term follow-up.[13] This type of professional development is very different from traditional one-time teacher workshops. Research indicates that teachers learn and incorporate new information best when it is presented over a long time frame instead of a single session.

Preferably, new strategies are modeled during routine school days in the classroom. Such practical demonstrations encourage teachers to accept and use the new strategies in their own classrooms. Teachers then need opportunities for hands-on experience in using the new skill, developing a unit, and implementing it. Finally, follow-up support as well as opportunities for ongoing discussion and reflection on the new procedures are essential in ensuring change. Practice logs can promote these helpful activities. Such logs can show how often teachers use a new practice, how it worked, what problems occurred, and what help they needed.[14]

❖ ***Curriculum-Specific Applications.*** If technology is to be used to produce improvements in student achievement, teachers must see a direct link between the technology and the curriculum for which they are responsible.[15] Professional development for technology use should demonstrate projects in specific curriculum areas and help teachers integrate technology into the content. In particular, professional development activities should enhance teachers' curriculum learning and assessment competencies and skills as well as classroom and instructional management competencies and skills. Specific content can help teachers analyze, synthesize, and structure ideas into projects that they can use in their classrooms.

A good professional development program is job embedded and tied to learning goals: It provides activities in the context of practice. The best integration training for teachers does not simply show them how to add technology to their what they are doing. It helps them learn how to select digital content based on the needs and learning styles of their students, and infuse it into the curriculum rather than making it an end in itself. Using technology effectively also requires having a wide repertoire of teaching approaches.

❖ ***New Roles for Teachers.*** Technology encourages teachers to take on new and expanded roles, both inside and outside of the classroom. Within the classroom, technology supports student-centered instruction. The teacher assumes the role of coach or facilitator while students work collaboratively. Outside of the classroom, technology supports teacher collaboration. Instead of working in isolation, teachers can work together on school-wide programs. They can help find solutions to problems, act as peer advisors to provide information and feedback, and collect data to test hypotheses. Their new roles may involve distance collaboration with cross-school peer groups and study groups through telecommunications.[16] Professional development for technology use provides opportunities for teachers to become comfortable and effective in these new roles.

❖ ***Collegial Learning.*** A professional development curriculum that helps teachers use technology for discovery learning, developing students' higher-order thinking skills, and communicating ideas is new and demanding and thus cannot be implemented in isolation. In addition to working in pairs or teams, teachers need access to follow-up discussion and collegial activities, as required of professionals in other fields. Teachers also need time to discuss technology use with other teachers, whether face-to-face, through e-mail, or by videoconferencing.[17] Creative ways should developed to build teacher networks so that teachers have additional opportunities to discuss the new instructional methods that technology promotes.

❖ ***Active Participation of Teachers.*** If technology is to be used equitably for all students, a majority of teachers should be included in the professional development program. One strategy to motivate teachers to spend the time and energy necessary to develop technology competency is to mandate participation in technology professional development. Another strategy for encouraging teachers to participate in professional development for technology use is creating incentives for technology use. Possible incentives include the following: a judicious use of contingency pay, in which a certain segment of the teacher's base pay (such as 5 percent) is reserved contingent upon participation in a wide range of professional development activities; bonuses; or a compensation system that rewards knowledge and skill along a career continuum.[18] A less traditional incentive program could give teachers credits for hours spent in professional development; teachers could use these credits to earn technology for their classrooms, loans of hardware and software to be used at home, or reduced prices on personal equipment. Mini-grants might reward teachers who have innovative ideas for using technology in instruction.

Incentives must be used carefully, however. Although group rewards may motivate some teachers, individual rewards may increase competition among staff or lead to less equitable distribution of technology. The only way to ensure that all students have the same opportunities is to require all teachers to become proficient in the use of technology in content areas to support student learning.

❖ ***Ongoing Process.*** A high-quality professional development program is conducted as an ongoing process, not a one-shot approach. Teachers need continued practice to become comfortable with and to implement change, especially in technology use. Professional

development takes time and must be conducted over several years for significant change in educational practices to take place. Administrators must take into account this long time frame, and teachers must be prepared to be involved in professional development throughout their careers.

❖ ***Sufficient Time.*** An effective professional development program provides sufficient time and follow-up support for teachers to master new content and strategies and to integrate them into their practice.[19] For any professional development activity, teachers need time to plan, practice skills, try out new ideas, collaborate, and reflect on ideas. Acquiring technology skills and becoming proficient at new ways of teaching in which technology is appropriately integrated requires additional time. Teachers need large blocks of time to gain initial familiarity with new hardware or software, learning and practicing for sustained periods. Time built into teachers' schedules can provide teachers with opportunities to discover what the technologies can do, learn how to operate them, and experiment with ways to apply them.

To address these professional development issues and to acknowledge that the demands of engaged learning using technology may lead to longer class periods, more team teaching, and more interdisciplinary work. Some adjustments may have to be made to the school-day schedule. One adjustment might consist of arranging preparation times of teachers in the same content areas to coincide in order to allow collaboration in planning and study. Another adjustment is to make small changes in daily scheduling in order to make a substantial difference over time

❖ ***Technical Assistance and Support.*** Another important component of effective professional development for technology is access to on-site technical support personnel who are responsible for troubleshooting and assistance after the technology and lessons are in place. When teachers are trying to use technology in their classrooms and they encounter difficulties, they need immediate help and support. Technology that is not easily accessed and implemented will not be used. Teachers will return to more traditional ways of teaching if the problems they encounter cannot be solved quickly and efficiently. Schools, therefore, have a vested interest in providing technical support. “The best way to win widespread use of new technologies is to provide just-in-time support, assistance, and encouragement when needed. Not tomorrow. Not next week. Now!"[20]

❖ ***Administrative Support.*** Fully implementing an effective professional development program as part of a well-designed technology plan requires support from school administrators and leaders. Administrators must have a clear vision of technology to support student learning and an understanding of the roles that all school staff must play in achieving that vision. They must be the cheerleaders and visionaries who see beyond the daily routine to a vision of what is possible through the use of technology. Administrators also can participate in professional development activities so they are aware firsthand of how technology is used and what problems are experienced by the staff. It also is important for each administrator to have a networked computer on his or her desk for use in daily tasks. In fact, professional development in technology use for teachers will not be successful unless the principal is invested in the process.

❖ ***Adequate Resources.*** The overall technology plan and its professional development component cannot occur without a significant commitment of resources by the school district. The district, first of all, must purchase the type of technical equipment necessary to meet the learning goals identified and provide for ongoing maintenance and upgrading. Skimping on this step can be more expensive in the long run because teachers and students eventually will want and need access to multiple technologies (such as CD-ROM, satellite, and full-motion video) that will enhance the curriculum and expand learning opportunities. The technology used for professional development should be the same as the technology used in the classroom. Funds should be available to provide teachers with technology that they can use at home or in private to become comfortable with the capabilities it offers. Funding also should be considered for a networked computer on every teacher's desk to allow telecommunications support for teachers and provide easy access to programs and files.

A significant portion of the technology budget should be allocated for professional development.

❖ ***Continuous Funding.*** Finding the funding for ongoing technology needs and professional development can be difficult. The costs of using technology to improve teaching and learning should become a line item in school budgets. These costs are not considered a one-time investment but an ongoing expense. This approach may require rethinking a school district's funding priorities.

❖ ***Built-In Evaluation.*** Effective professional development uses evaluation to ensure that each activity is meeting the needs of the participants and providing them with new learning experiences. Evaluation is built into the professional development program during the planning process, before the actual activities begin. It consists of three types: preformative evaluation, formative evaluation, and summative evaluation.

Preformative evaluation assesses educators' needs during the planning process. During this phase, intended goals are clarified and strategies for gathering data about reaching them are set using agreed-upon guidelines for evaluating professional development.[21]

Evaluation continues with *formative evaluation*, which is conducted during the professional development activity. Formative evaluation provides feedback and determines changes that can be made during the activity to make it more valuable to participating educators.

The evaluation process concludes with *summative evaluation*, which is conducted after the activity. Summative evaluation allows participants to judge the overall merit or worth of the activity and gives decision makers the information they need to plan for the future. Good summative evaluation uses a variety of techniques to gauge five levels of professional development evaluation. These levels are: participants' reactions, participants' learning, organizational support and change, participants' use of new knowledge and skills, and student learning outcomes.[22]

The ultimate goal of evaluation is to determine whether professional development promotes using technology to improve student achievement. No longer can administrators simply assume that professional development is good by definition. Now that students are being held to higher standards, teachers are being held accountable for student achievement; educators must show that professional development has an impact on achieving the learning goals that were identified in the original plan. This part of the evaluation process assesses whether the specific learning goals for students using technology have been met or whether unintended results have been achieved. Using multiple measures is essential. These measures might include grades, scores from standardized tests, and results from alternative assessment (such as portfolio evaluations that focus on students' ability to use higher-order thinking skills). School-wide indicators--such as enrollment in advanced classes, membership in honor societies, participation in school activities, disciplinary actions, and retention or dropout rates--also might be considered. Sources of this information might include student and school records, questionnaires, and interviews with students, parents, teachers,

and administrators. This information can be used to document the return on investment from professional development. It also allows teachers to evaluate how technology improves the quality of student learning.

For teachers to implement technology in the classroom to increase engaged learning and improve achievement among their students, a well-planned professional development program for technology use is essential. Such a program gives teachers the skills they need to incorporate the strengths of technology into their lesson planning rather than merely to add technology to the way they have always done things. Effective professional development requires careful planning, job-embedded and hands-on activities directly linked to the curriculum, plenty of follow-up, built-in evaluation using several assessment techniques, adequate time, sustained funding, and the willingness of educators to take on new and expanded roles.

IV. Barriers and Critical Success Factors for Effective Teacher Learning

The following barriers and critical success factors are frequently identified as implementation pitfalls for effective teacher learning.[23]

❖ **Lack of systemic attention to sustained work-based teacher development** One of the greatest barriers to effective professional development is the absence of the conditions for effective, ongoing professional development built into the daily working lives of teachers.

❖ **Funding**

❖ **Time.** Teachers, researchers, and policymakers consistently indicate that the greatest challenge to implementing effective professional development is lack of time. Teachers need time to understand new concepts, learn new skills, develop new attitudes, research, discuss, reflect, access, try new approaches and integrate them into their practice; and time to plan their own professional development.

Time is also a significant budgetary issue, when it involves funding teachers' time to participate in PD activity. Increased allocation of funding is necessary if 'teacher relief ' is required to enable teachers to participate in any PD activity. The issue of whether PD is an organizational or personal responsibility is not resolved and is an issue that has industrial as well as professional implications.

A major theme in Prisoners of Time, the National Education Commission on Time and Learning report (1994), is that U.S. students and teachers are victims of inflexible and counterproductive school schedules. School schedules do not normally incorporate time to consult or observe colleagues or engage in professional activities such as research, learning and practicing new skills, curriculum development, or professional reading. Typically, administrators, parents, and legislators view unfavorably anything that draws teachers away from direct engagement with students. Indeed, teachers themselves often feel guilty about being away from their classrooms for restructuring or staff development activities.

Although time is consistently identified as a crucial key to successful professional development (or, more often, lack of time identified as a barrier), the mere provision of time alone is unlikely to eventuate in significantly changed practice in the use of ICTs. Importantly, the provision of time for ICT professional development must be one component of multi-faceted planning. More crucial still is the recognition that the provision of time must accompany a major redefinition of the nature of teachers' work.

❖ **Links between pre-service teacher education and educational systems.** The lack of linkage between pre-service teacher education and educational systems creates a cycle of difficulties for any innovation or change within the education sector. On the one hand, the teacher education programs find that the schools in which their student teachers undertake their professional experience, do not have the resources, expertise or classroom practices that support student teachers becoming competent and confident in that area. On the other hand, employers find that new qualified graduates do not have the necessary skills and understandings that are required for effective teaching in their schools and classrooms. Often this dilemma is characterized as a chicken and egg situation, where one cannot happen without the other, but neither can 'be first' without the other. New thinking is needed if there is to be any resolution of the serious and recurring problem which extends well beyond the area of the integration of ICTs for teaching and learning.

V. A Framework for Exemplary Practice Selection Criteria

The following framework for an effective teacher professional development program on ICT Integration is an offshoot of the professional practice models and from current research literature.[24]

When selecting teacher professional development program on ICT integration that demonstrate exemplary practice, two categories should be applied: objectives and process.

Program Objectives

Three related clusters of objectives for teacher professional development programs with a focus on ICTs should be considered when selecting exemplary practices. The objectives within the clusters are described as competencies that teachers need to demonstrate to be successful with the integration of ICTs in their teaching practice.

- ✓ Technology competencies,
- ✓ Discipline-based competencies, and
- ✓ Analytic and reflective competencies .

1. Technology competencies. Technology competency is a fundamental aspect of teacher knowledge with respect to ICTs in professional programs. Three essential components of technology competence for teachers include:

- ➢ The use of technology as a tool to enhance a teacher's work with students;
- ➢ The use of technology as a productivity tool in the education setting; and
- ➢ The use of technology to enhance a teacher's professional knowledge.

2. Discipline-based competencies. For teachers to effectively integrate ICTs with professional practice requires them to develop competence in the use of technology in curriculum-related applications. Teachers also need to demonstrate competence with the instructional models and pedagogies that ICTs can facilitate and support. Key competencies in this area include:

- ➢ The evaluation and assessment of computer-based instructional resources;

- The use of technology to develop curriculum materials to meet learning outcomes;
- The use of technology to deliver educational content to meet learning outcomes;
- The integration of ICTs to provide information-rich environments for student learning;
- The use of ICTs to promote communication, collaboration, and communities of learning;
- The use of ICTs to support a variety of learning styles or to accommodate students with special needs or abilities; and
- The use of ICTs to extend learning beyond the classroom, to the community and to the world.

3. Analytic and reflective competencies. For teachers to incorporate ICTs in their teaching practice on an ongoing basis requires that they develop competence with ICTs on a personal level, and that they continue to enhance their knowledge of ICTs throughout their careers. It is also essential that professional programs for teachers be viewed holistically, recognizing that competence with ICTs is only one component of the knowledge, skills and attitudes required by teachers in their classroom practice.

For teachers to continue to add to their professional knowledge about the integration of ICTs in education requires that they take personal responsibility for their own learning. Key competencies with respect to ongoing professional growth and reflective practice include the following:

- Understand, describe and compare perspectives on technologies and their roles in society, and in education in particular;
- Understand, describe and compare models of learning implicit in use of ICTs;
- Identify and analyze trends and issues related to the use of ICTs in education;
- Identify and analyze social, cultural and equity issues with respect to ICT use in education;
- IImplement classroom practices with ICTs congruent with research findings and personal beliefs about the use of ICTs in education;
- Evaluate personal needs with respect to ICT knowledge on an ongoing basis and design a learning plan to achieve personal learning goals;
- Contribute to the community of knowledge with respect to ICTs and support colleagues or students in their process of inquiry; and

- Assist colleagues and students to solve problems with respect to ICT use in education.

Process Criteria

Selecting exemplary practices based on objectives needs to be balanced by applying process criteria. Process objectives are factors that are included in the exemplary practice framework because they have been shown to improve the effectiveness of professional programs, particularly in their development, implementation, and ongoing improvement.

The process criteria to be applied in selecting exemplary practices include:

1. A clear needs assessment phase in the development of professional programs for teachers. Since teachers may be at different levels in their competencies, it is important to plan professional development using information about their levels of competency.

2. Teacher involvement in the planning, delivery and evaluation of professional programs. Collaborating with teachers from the outset of professional development enhances the possibility that they will implement new skills or knowledge in their classroom practice.

3. The use of ICTs to deliver professional programs on ICTs to teachers – modeling desired outcomes and practices using ICTs. If teachers have the opportunity to “practice” as part of their professional development, they will be better prepared to use the skill in their classroom practice.

4. Implementation of professional programs for teachers through appropriate partnerships among stakeholders – teachers, teacher associations, school boards, universities, government and the private sector. There are many stakeholders and all have a role to play in planning professional development.

5. Ongoing evaluation and program improvement practices designed to optimize ICT professional programs for teachers, through feedback loops between research and practice that lead to evidence-based practice in the classroom. “Translating” research results into jargon-free language to make data more accessible to practitioners, and vigorously evaluating professional development programs themselves are critical to success.

VI. Recommendations

An understanding of current models and approaches to pre-service teacher education and continuing professional development that address ICT integration effective and measures of effectiveness of teacher professional development programs discussed in this paper, the following recommendations are offered:

1. A national set of ICT in education standards based on international ICT competency standards for beginning teachers that address three of the four types of integration: skills, changing pedagogies, changing content and curriculum frameworks should be developed collaboratively by all stakeholders. These standards need to be based on desired student learning outcomes and also form part of a continuum with advanced standards for experienced teachers.

2. Develop appropriate pre-service teacher education curriculum and pedagogies so that student teachers have ample opportunities to develop, plan, implement and evaluate ICT use in their own teaching and learning, and to use ICTs with children in classrooms and online in a variety teaching and learning situations.

3. Foster partnership between teacher education institutions and school systems in regard to professional experience that integrates the use of ICTs for teaching and learning and professional support.

4. Develop more effective system-wide strategies for continuing professional development for the effective use of ICTs for teaching and learning which are based on known principles of effective teacher development.

5. Develop a professional development program based on research on training teachers for using technology that will meet the educational

goals for the use of technology. Look at the model professional development programs as examples of best practice.

6. Pursue strategies for obtaining and sustaining funding to provide the necessary technology, professional development, technical support, equipment upgrades, and equipment maintenance to achieve educational goals.

References

[1] UNESCO, EFA Global Monitoring Report 2005

[2] Ms. Marivic Abcede of the Department of Education (http://www.unescobkk.org/index.php?id=1165))

[3] Belawati, Tian, Ph.D. "Philippines: ICT Use in Education." UNESCO Meta-Survey on the Use of Technologies in Education."

[4] *ibid.*

[5] Tinio, Victoria L. "Survey of Information & Communication Technology Utilization in Philippine Public High Schools." Preliminary Findings, Foundation for Information Technology Education and Development, Commissioned by the Center of International Cooperation for Computerization, Government of Japan, March 2002.

[6] Downes, Toni, Fluck, Andrew, Gibbons, Pam, Leonard, Ralph, Matthews, Caroline, Oliver, Ron, Vickers, Margaret, and Williams, Michelle. Making Better Connections. Models of Teacher Professional Development for the Integration of Information and Communication Technology into Classroom Practice. A project funded by the Commonwealth Department of Education, Science and Training, Commonwealth of Australia, 2001.

[7] *ibid.*

[8] Sparks, D. & Loucks-Horsley, S. "Five models of staff development." Journal of Staff Development. 10(4), 1989. http://www.nsdc.org/library/jsd/sparks104.htm

[9] In-service Teachers Professional Development Models in the Use of Information and Communication Technologies. A Report to the SchoolNet National Advisory Board, Canada, Prepared by TeleLearning, Inc. with the collaboration of Thérèse Laferrière, Alain Breuleux, Pat Baker, and Ray Fitzsimons, March 15, 1999.

[10] Killion, Joellen. Excerpted from a videotaped presentation at the Technology Leadership Team Institute, July 1999 in Leesburg, VA. North Central Regional Educational Laboratory, 1999.

[11] Fatemi, E. "Building the digital curriculum." Education Week on the Web (1999, September 23). [Online]. Available: http://www.edweek.org/sreports/tc99/articles/summary.htm

[12] David, J. L. "Developing and spreading accomplished teaching: Policy lessons from a unique partnership." In C. Fisher, D.C. Dwyer, & K. Yocam (Eds.), Education and Technology: Reflections on Computing in Classrooms (pp. 237-245). San Francisco: Jossey-Bass, 1996.

[13] Speck, M. "Best practice in professional development for sustained educational change." ERS Spectrum, 33-41, 1996 Spring.

[14] Sparks, D. "Making assessment part of teacher learning: An interview with Bruce Joyce." Journal of Staff Development, 19(4), 33-35, 1998, Fall. Available online: http://www.nsdc.org/library/publications/jsd/joyce194.cfm

[15] Byrom, E. Factors influencing the effective use of technology for teaching and learning: Lessons learned from the SEIR-TEC intensive site schools, 1998. [Online]. Available: http://www.serve.org/seir-tec/publications/lessons.html

[16] Kosakowski, J. "The benefits of information technology." ERIC Digest, 1998. [Online]. Available: http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED420302

[17] David, J. L. "Developing and spreading accomplished teaching: Policy lessons from a unique partnership."

[18] National Commission on Teaching and America's Future, 1996.

[19] Corcoran, T. B. Helping teachers teach well: Transforming professional development, June 1995. [Online]. Available:

http://www.ed.gov/pubs/CPRE/t61/

[20] McKenzie, J. "Adult technology learning: Creating learning cultures with just-in-time support", April 1998. ESchool News [Online]. Available: http://staffdevelop.org/adult.html

[21] Guskey, T. R. "The age of our accountability". Journal of Staff Development, 19(4), 36-44, Fall 1998. Available online: http://www.nsdc.org/library/publications/jsd/guskey194.cfm

[22] *ibid.*

[23] Downes, et. al. Making Better Connections. Models of Teacher Professional Development for the Integration of Information and Communication Technology into Classroom Practice.

[24] Integration of Instructional and Communications Technologies (ICTs) Through Teacher Professional Development: Framework for Exemplary Practice Case Studies. Judy Roberts & Associates / Associés Inc., British Columbia, Canada, April 30,1999