Sabbatical Summary for Sharon Hirschy, Professor, Child Development and Family Relations

The goal of the Sabbatical was to explore technology in education by examining and developing materials regarding its use by adult educators, including college faculty and early childhood educators.

Sabbatical Objectives:

1. Develop a strategic plan for Collin College faculty on the integration of mobile and Internet technologies in the classroom.
2. Advance the field of early childhood teacher training through the development of a Train-the Trainer and professional article on technology in the Early Childhood classroom.
3. Provide Texas with leadership and guidance from Collin College in effective use of technology in the early childhood classroom.

Activity Proposals for Sabbatial and Completion Information

- *Professional resources will be developed for the integration of technology in early childhood education*
    - A model was developed on how to integrate technology into early childhood classrooms including knowledge, skills and attitudes needed by early childhood educators, stages of technology integration for early childhood educators and a skills checklist.
    - A professional article based on the research was developed and submitted to a peer-reviewed journal.
        - One article was written for the Texas Child Care Quarterly and accepted and is scheduled for publication this summer.
        - Two additional articles have been written and are being submitted to journals.

        - The report on an early childhood model for technology integration was accepted as a link for the Erikson Institute Technology in Early Childhood Center.
    - A train-the -trainer was developed to train early childhood teachers on the appropriate use of technology in the classroom.
        - The trainer includes presenter guide, handouts and activities, and PowerPoint presentation and is available on the website.
        - The trainer was presented at the Texas Computer Educator's Association meeting and is being presented this summer at the National Association for the Education of Young Children Professional Development Conference.
    - A website was developed providing resources including video tutorials, links and other information on the integration of technology in classrooms with young children for early childhood teachers, trainers, college faculty in early childhood, and administrators. The website, https://sites.google.com/site/ecetechintegration/ provides links to all of the information identified.
        - The website has received accolades from the Fred Rogers Center for Early Learning and Children's Media, the Erikson Institute's Technology in Early Childhood Center and several early childhood leaders
- *Funding sources for the development of The Texas Early Childhood Center for Technology will be identified and approached.*
    - Sources including KERA, TCEA, TAEYC, and HeadStart were informed about the project, provided with materials and discussions held on feasibility and funding. All of the groups are showing interest and this will be pursued in the coming months.
- *A strategic plan on the implementation of training for Collin Faculty on the integration of mobile and Internet technologies in the classroom was developed.*

- A report including an annotated bibliography of research and proposals for further faculty development in integrating technology at Collin was prepared.
- The report and recommendations were presented to the Collin College Technology Committee.

Summary of Experience

I did extensive research in two areas: higher education faculty integration of technology and technology integration in early childhood. The two avenues of research were very complementary and allowed me to intersect ideas and understanding. I built a proposed model for further technology integration at Collin College and a model for technology integration in Early Childhood.

This is the first such model for early childhood and delineates what teachers need to know, practice and implement in order to successfully integrate technology. It also includes resources for them. This is something the field has been lacking and appears to be a significant contribution to our field. The model and website I created have been recognized nationally and I plan to submit several articles based on the research.

I am grateful to Collin College for providing me with the opportunity to research and develop an understanding of technology integration in such as way that I can apply it to the two most important areas of my professional interests: teaching at Collin College and working with early childhood professionals to help them better understand and implement technology integration.

Appendix A

Technology as a Teaching Methodology in Higher Education: Utilization Versus Integration

Technology as a Teaching Methodology in Higher Education: Utilization Versus Integration

Sharon Thompson Hirschy

Collin College

Abstract

Teaching today requires the use of technology by faculty in higher education. Technology increases productivity, grading accuracy, and communication within higher education. However, utilization of technology is not the same as integration. Integration of technology involves incorporating it as part of teaching methodology and philosophy. This paper provides a literature review of the use of technology by higher education faculty. Utilization versus integration is discussed as well as best practices for integrating technology into pedagogy. A model for technology integration for Collin College is presented.

Technology as a Teaching Methodology in Higher Education: Utilization or Integration?

Technology use in the classroom is not new. It is, in its basic form, the use of tools. Blackboards, slates, pencils, quill pins, scrolls are all examples of technology. Today "technology" usually refers to "digital or electronic technology and media", and focuses on the use of electronic devices and methods to provide or manipulate information. It is a critical part of today's instructional landscape.

Technology in higher education can be divided into two types: utilitarian and instructional. While these areas often overlap, they are fundamentally different. Utilitarian technology is the use of technology for productivity, to access and exchange information, to increase efficiency, and to deal with time and distance issues (Ellis, Hughes, Weyers & Riding, 2009; National Forum, 2002). Instructional technology is to enhance and motivate learning, provide assessment and communication and feedback for students (Bowen, 2012; Brown, 2011; Clift, Mullen, Levin, & Larsen, 2001). Instructional technology assists in meeting learning outcomes and provides activities that encourage learning, retention and application of concepts and ideas.

Higher education institutions spend over $21 billon dollars annually on instructional technology (Landrey, 2014). This magnitude of spending indicates that universities see value in technology's use in instruction. Spending is also driven by demands of parents and students for technology in their classrooms. While this number probably includes utilitarian technology as well, integration is an important issue. Can faculty effectively use this technology to enhance learning?

Pedagogy in higher education is problematic. Knowledge of subject matter, research and publications are the criteria for faculty hiring and promotion. Skills and knowledge in the science

of educational instruction is not a requirement for faculty in most institutions, yet technology integration requires knowledge of how to incorporate it into the instructor's pedagogical methods. The ability to use technology in the classroom is seldom addressed in the hiring process of new faculty.

Pedagogical requirements in higher education are changing. Students are arriving in classrooms from public schools where learning with technology was an integral part of the learning experience. They find higher education classrooms in which few professors can use and integrate technology appropriately. Research has identified the learning benefits of using technology for students, as well as concerns regarding its improper use in classrooms. A recent large survey reported that 80% of IT Administrators stated that helping faculty integrate technology into their instruction would be their biggest concern during the next few years (Winton, 2014).

Technology integrated in the classroom affects student learning and outcomes. The impact of integration in K-12 has been demonstrated in several studies in which students exhibited higher-order skills and attitudes toward learning, more self-motivation and improved self-concept (Ringstaff & Kelley, 2002) when technology was used. Technology can enhance performance on achievement test, test scores, writing, math and reading (Purcell, Buchanan, & Friedrich, 2013; Weathersbee, 2008). However, the way technology is integrated in the classroom is a major factor in such student improvement.

Abraham Lincoln stated, "The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think anew and act anew." This statement summarizes the current issues regarding the use of technology in higher education.

Literature Review

Influences on Faculty Use of Technology

Digital technology is used in some form by all faculty, whether it be an email system, a course learning management system or the use of Web 2.0 tools in the classroom (Meyer & Xu, 2007). Faculty use of technology is influenced by a number of factors including time, academic status, self-efficacy, current pedagogical approach, instructional load, student responsibilities, administrative support, and whether or they feel they the technology will actually support learning (Agbatogun, 2013; Georgina and Hosford, 2009; Georgina & Olson, 2008; Meyer & Xu, 2007; Sturgeon, 2011). While all of these factors are significant, one that consistently stands out in research is self-efficacy.

Self-Efficacy

Self-efficacy, the belief in one's ability to accomplish a task and to become proficient, is a critical component in faculty use of technology (Ajjan & Harshorne, 2008; Browne, 2011). Faculty members who are older often feel uncomfortable with all but basic technology. They can feel inadequate to the task of learning and using technology effectively and may be negative about its use in classrooms. Assessing faculty needs and concerns regarding the use of technology can provide an important tool in developing successful integration programs (Brown, 2011). Faculty may recognize their need for training but most feel that it is the responsibility of the institution to provide this training (Georgina & Hosford, 2009).

Other Influences on Faculty Technology Integration

Time is required to learn new technologies. The constantly changing technological world requires continual learning and re-learning of technologies. New Web 2.0 tools are developed daily and while many can enhance teaching, it requires the time to locate and then learn them

(Ajjan & Hartshorne, 2008). Faculty members who are younger and less experienced tend to be more open to the use of technology in the classroom (Agbatogun, 2013). Agbatogun's study indicated that lack of administrative support and encouragement was a major barrier in integration.

Technology Integration Versus Technology Utilization

Technology Integration requires teachers to focus on the learner and to use technology to activate higher order thinking, meet the needs of diverse learners, and to empower students to meet instructional learning outcomes (National Forum, 2002). Technology utilization as stated earlier refers to the use of technology for planning, grading, information access and delivery, communication, and design. Course management systems are designed primarily for technology utilization.

> Course-management systems were not created to enhance learning, but to make it easier for a faculty member to deliver materials to students. Even though most of the systems now include basic tools that allow students to turn in assignments, take exams and surveys, and communicate with each other through discussion boards and chat programs, those tools tend to be limited in functionality, generic in form (Maloney, 2007, pp.1-2).

Technology utilization is such a critical component of assessment, communication and outcomes that institutions tend to focus only on technology utilization skills in faculty development (Antonacci, 2002). Ignoring the integration of technology into the pedagogical methods of faculty limits the ability of instructors to provide a more meaningful learning experience, which can inhibit learner outcomes in courses.

Outcome-based Education and Assessment

There has been a shift in the focus at many institutions to outcome-based education, focusing on the development of skills and understanding that prepare students for higher-level courses or for career and societal roles (Lee, 2000). This constitutes a major paradigm shift from teacher-centered approaches to learner-centered outcomes.

Outcome-based education focuses on the ability to integrate and apply knowledge to attain the appropriate outcome. Critical thinking and reflection become a necessary part of instruction, and technology offers multiple opportunities for this type of instruction (Lambert, et.al. 2014). Technology has the ability to maintain portfolios, longitudinal information on student outcomes, and to assess achievement in ways that simple testing cannot. When corporate cultures integrate technology into their training they focus on preparing individuals for a job or project much more than higher education (Collis, 2003). This should also be the focus of technology integration.

Increasing Technology Integration in Higher Education

How do faculty learn different technologies? New faculty members have often grown up in a world of technology but growing up using technology and understanding how to integrate it in the classroom (Brown, 2011; Bryan, 2008) are not the same. Current methods of professional development for faculty in technology are usually workshops that teach one software or web tool through demonstration, PowerPoint and/or lecture. Many colleges offer websites with tutorials on using specific web tools. Providing workshops and websites may improve skills but do not assist faculty in integration (Figg & Jamani, 2013, Ellis, Hugs, et.al., 2009). One of the more effective methods for learning tools and integrating them is peer sharing (Fulford et.al., 2008; Kukulska-Hulme, 2012) in which faculty members informally and formally meet and share new digital teaching methods.

Effective integration of technology by faculty requires a focus on increasing self-efficacy, examining pedagogical practices, using technology as a teaching tool, and basing integration on learning outcomes and giving ongoing support (Rogers; Sammons, Murandu & Strickland, 2002).

Hooper and Reiber (1995) posited a model of technology adoption that included the concepts, *familiarization*, *utilization*, *integration*, *reorientation*, and *evolution*. The ***familiarization*** phase often occurs during workshops which cover how to use a technology and which often is the extent of the teacher's involvement. ***Utilization*** involves trying out a technology and often abandoning it due to difficulties in understanding and applying the technology. ***Integration*** involves the incorporation of the technology into the curriculum where it becomes a necessary part of the lesson plan. Hooper and Reiber see this as a beginning in true integration. ***Reorientation*** is characterized by a review of the pedagogy used by the teacher. The teacher sees herself not as an instructor, but as the creator of a learning environment focused on the student and their learning. ***Evolution*** requires the teacher to be open to change and to adapt their pedagogy as they learn new technologies.

Best practices that have proven successful and recommendations for faculty integration from the research literature include:

1. Conducting surveys to determine faculty needs (Browne, 2011; Venkatesh, et. Al. 2003)
2. Providing multiple methods of building competency including, mentors, small group training, websites, ongoing instructional support, and sabbaticals to enable faculty to integrate technology (Moser, 2007)

3. Modeling for faculty and providing training on the use of equipment in the classroom (Sammans, Murandu, and Strickland 2002)
4. Peer mentors and small group sessions for disciplines centered around integration to meet specific instructional outcomes (Rogers, 2000, Schmid, et.al., 2009)
5. Focus on course development and learning outcomes rather than faculty development by administration (Agee, Scrivener & Holisky, 2000)
6. Providing project-based training and workshops that incorporate both training on digital tools and the implementation of the tools in specific courses, along with hands-on experience with the tools (Antonacci, 2002; Juniu, 2004)
7. Mini-grants for technology integration for faculty (Judge & O'Bannon, 2004)

Technology is in our classrooms. But can we use it? And, more important, can we use it to increase learning and to more effectively meet our learning outcomes?

Collin College: Model for Technology Integration

Concerns:

Collin College has been at the forefront of innovation in establishing a technology convergence program, a nationally acclaimed nursing program, and many other programs that have received awards. The college has provided state of the art libraries, and equipment for many of its programs. But it has been behind in the integration of technology in the classroom.

1. The Instructional Technology Council of the American Association of Community Colleges survey found 77% of the community college faculty surveyed use tablets for course instruction or preparation (Mullins & Weinfurter, 2013). However, the use by faculty at Collin of tablets in the classroom with students is extremely

limited due to the lack of technical support and provision of equipment, even when they bring their own devices.

2. Collin College has 1200 full and part-time faculty on five campuses. Yet it has only 3 instructional designers that work with faculty on BlackBoard, website creation, and problems and issues with using technology to grade and other utilitarian needs. They do not have time or ability to meet faculty needs for technology integration instruction. While they are making valiant efforts to incorporate assistance for faculty in this area, it is not possible that they can adequately meet needs. In contrast Frisco ISD has a technology integration specialist on each campus that works with faculty to integrate technology into lesson plans and in the classroom. They work with approximately 100 teachers per technology specialist as opposed to Collin whose instructional technology specialists have a ratio of 1/400. There is a clear need for additional assistance if we are to adequately meet faculty needs.
3. Collin has academic technology specialists on each campus and assistants to serve the media needs of all instructors. But they are under the technology department that serves the entire technology infrastructure and technology needs for the college. The roles of media services, ELC, the technology committee and their responsibilities need to be examined and explained to better coordinate meeting instructional needs.

Collin has been a leader in many areas of technology. Assisting faculty in technology integration will show innovative faculty development that will further promote Collin's status.

An Integration Model for Collin College could include:

1. **Faculty mentors**: Hiring additional staff is often problematic. The research indicates faculty will be better able to integrate technology by meeting in small cohorts within their discipline or division (Baylor & Ritchie, 2002; Juniu, 2004). One or two faculty members who demonstrate ability in technology integration could be identified for each division and receive a stipend to support faculty technology integration. Their responsibilities could include;
    a. Surveying the division to identify faculty needs in regard to technology
    b. Small group sessions in which they offer informal training or access to online training on how to integrate a specific technology tool based on identified needs. The Child Development and Education Department recently trained faculty members on the use of the new technology we had received. Most of this training involved identifying digital activities and assessments that would meet the learning outcomes of specific courses.
    c. Encouraging faculty to share best practices they have identified for technology integration within their discipline.
    d. Maintaining a webpage of resources on the eLC website or providing discipline-specific resources to the eLC for faculty on that would provide web links and ideas

    These faculty members could work under the direction of the eLC instructional designers. However, since their duties are already

overwhelming, a faculty member could receive a course release to oversee the program and report to the eLC administrator.

2. **Workshops and web resources**: Offered by instructional designers or experts focusing on integrating technology based on learning outcomes in individual disciplines
3. **Online video training on technology use and integration:** While there are some videos on online training offered by the eLC for faculty, they are primarily to assist in the use of BlackBoard. Videos or simple explanations in the use of web tools that can enhance instruction could be created and maintained on the eLC website. Faculty could be encouraged to submit their own tools and ideas on how technology could be integrated to promote learning.
4. **Innovative use of technology by faculty could be encouraged:** Faculty members currently go before the Technology Committee when they want to introduce new technology into the classroom. But the process to get approval is not easily identified for faculty. A form on the eLC website that faculty could fill out to make a request would allow more innovation in the classroom.
5. **Support the use by faculty of tablets in the classroom for instruction:** When the great majority of community college faculty are using tablets for instruction in some form, there is a need for college support of such equipment. Wireless setups could allow faculty to project from their tablet to the front of the classroom, which allows faculty to walk around, interact and dialog with students while teaching. Such setup would also assist faculty in using apps that

can address specific learning outcomes within the classroom. Offering mobile carts for checkout with tablet devices would be another way of encouraging technology integration in the classroom.

6. **Support for attendance at conferences and online courses that focus on technology integration**: There are several conferences around technology integration. The International Society for Technology in Education is the largest and offers a national as well as a large state conference in which practical applications of technology for the classroom are presented. In addition, many disciplines now offer conferences, which focus on technology use. There are also an abundance of online training courses, web conferences, etc. in which faculty could receive reimbursement above and beyond a discipline specific conference which they can attend yearly.
7. **Study and evaluation of the roles of those involved in technology in the college**: We have three instructional designers and two instructional technologists to serve 1200 full and part-time faculty members. These specialists job descriptions include online course development and maintenance, multimedia development, faculty website development and maintenance, ongoing BlackBoard support, web 2.0 training, creating presentations, training faculty, evaluating commercial software for faculty, inform and train them on Web 2.0 tools. While media services takes care of maintenance of equipment used in the classroom, no one is actually mandated to provide training on existing equipment for faculty. The technology committee has the mandate to review any new technology instructors would

like to introduce and an online form could help in identifying for faculty and the committee items that require their approval.

Summary

Technology integration has been identified as a critical need for higher education faculty. The ability to not only use technology but to integrate it as a tool to promote learning and assist students in successfully addressing student outcomes in courses is critical. Faculty are interested in technology but often lack the time and ability to be successful in its use. Collin College could address this issue by providing multiple support strategies for its faculty. Faculty who understand how to incorporate technology into their learning outcomes and how to promote higher level thinking, reflection and application of information through the use of technology will best meet student needs.

References

Agbatogun. (2013). Interactive digital technologies' use in Southwest Nigerian universities. *Education Tech Research Dev*, *61*, 333–357.

Agee, A., & Holisky, D. (2000). Technology Across the Curriculum at George Mason University. *Educause Quarterly*, *4*, 6–12. Retrieved from https://net.educause.edu/ir/library/pdf/EQM0041.pdf

Ajjan, H., & Hartshorne, R. (2008). Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests. *The Internet and Higher Education*, *11*(2), 71–80. doi:10.1016/j.iheduc.2008.05.002

Antonacci, D. (2002). *Integrating Technology into Instruction in Higher Education* (pp. 1–24). Retrieved from http://associations.missouristate.edu/assets/mohighedweb/IS-TechnologyIntegrationinHigherEducation.pdf

Arnold, N.(2006). Technology-Mediated Learning 10 Years Later: Emphasizing Pedagogical or Utilitarian Applications? *Foreign Language Annals*, *40*(1), 161–181. Retrieved from http://eric.ed.gov/?id=EJ766776

Baylor, A. L., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms? *Computers & Education*, *39*(4), 395–414. doi:10.1016/S0360-1315(02)00075-1

Bowen, J. A. (2012). *Teaching Naked: How Moving Technology Out of Your College Classroom Will Improve Student Learning* (1st ed.). Jossey Bass.

Browne, J. (2011). An IRT Analysis of Preservice Teacher Self-efficacy in Technology Integration. *Journal of Technology and Teacher Education, 19*(2), 123–140. Retrieved from http://www.editlib.org/p/32366/

Bryan, J. (2008). Integration of Web-Enhanced Teaching in Higher Education: Challenged Beliefs. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2008, pp. 3388–3393). Retrieved from http://www.editlib.org/p/28853/

Clift, R. T., Mullen, L., Levin, J., & Larson, A. (2001). Technologies in contexts: *Teaching and Teacher Education*, *17*(1), 33–50. doi:10.1016/S0742-051X(00)00037-8

Collis, B. (2003). E-Learning: What can the Corporate Sector and Higher Ed Learn from Each Other? In *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (Vol. 2003, pp. 1286–1293). Retrieved from http://www.editlib.org/p/12125/

Ellis, R. A., Hughes, J., Weyers, M., & Riding, P. (2009). University teacher approaches to design and teaching and concepts of learning technologies. *Teaching and Teacher Education*, *25*(1), 109–117. doi:10.1016/j.tate.2008.06.010

Figg, C., & Jimani, K. (2013). Transforming Classroom Practice: Technology Professional Development that Works! Retrieved September 11, 2014, from http://brock.scholarsportal.info/journals/teachingandlearning/home/article/viewFile/431/384

Fulford, C., Main-Anakalea, C., & Boulay, R. (2008). Sabbaticals for Technology Integration. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2008, pp. 660–669). Retrieved from http://www.editlib.org/p/28462/

Georgina, D. A., & Hosford, C. C. (2009). Higher education faculty perceptions on technology integration and training. *Teaching and Teacher Education, 25*(5), 690–696. doi:10.1016/j.tate.2008.11.004

Georgina, D. A., & Olson, M. R. (2008). Integration of technology in higher education: A review of faculty self-perceptions. *The Internet and Higher Education*, *11*(1), 1–8. doi:10.1016/j.iheduc.2007.11.002

Grosseck, G. (2009). To use or not to use web 2.0 in higher education? *Procedia - Social and Behavioral Sciences*, *1*(1), 478–482. doi:10.1016/j.sbspro.2009.01.087

Hoogveld, A. W. M., Paas, F., & Jochems, W. M. G. (2005). Training higher education teachers for instructional design of competency-based education: Product-oriented versus process-oriented worked examples. *Teaching and Teacher Education, 21*(3), 287–297. doi:10.1016/j.tate.2005.01.002

Hooper, Simon, and Loyd Reiber. (1995) Teaching with technology. in *Teaching: Theory into Practice*, edited by A. Ornstein. Needham Heights, MA: Allyn and Bacon. Pages 154-170. Retrieved September 26, 2014 (http://www.nowhereroad.com/twt/).

Inan, F. A., Lowther, D. L., Ross, S. M., & Strahl, D. (2010). Pattern of classroom activities during students' use of computers: Relations between instructional strategies and

computer applications. *Teaching and Teacher Education*, *26*(3), 540–546. doi:10.1016/j.tate.2009.06.017

Judge, S., & O'Bannon, B. (2004). Infusing Technology Use in Higher Education Through Faculty Mini-Grants. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2004, pp. 3103–3105). Retrieved from http://www.editlib.org/p/12461/

Juniu, S. (2004). Digital Democracy in Higher Education. In *Society for Information Technology & Teacher Education International Conference* (Vol. 2004, pp. 820–825). Retrieved from http://www.editlib.org/p/13575/

Kukulska-Hulme, A. (2012). How should the higher education workforce adapt to advancements in technology for teaching and learning? *The Internet and Higher Education*, *15*(4), 247–254. doi:10.1016/j.iheduc.2011.12.002

Lambert, C., Erickson, L., Alhramelah, A., Rhoton, D., Lindbeck, R., & Sammons, D. (2014). Technology and Adult Students In Higher Education: A Review of the Literature. *Issues and Trends in Educational Technology*, *2*(1). Retrieved from http://www.editlib.org/p/148280/

Landrey, J. (2014). *19% of all Higher Education IT Purchases Are Made Outside of Central IT;* Alexandria. Retrieved from http://www.meritalk.com/pdfs/cloud-campus/Meritalk_VMware_Carahsoft_Cloud_Campus_Press_Release.pdf

Lee, C. (2000). A Paradigm Shift in the Technology Era in Higher Education. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2000, pp. 575–580). Retrieved from http://www.editlib.org/p/16128/

Maloney, E. J. (2007). What Web 2.0 Can Teach Us about Learning. *Chronicle of Higher Education*, *53*(18). Retrieved from http://eric.ed.gov/?id=EJ756805

Meyer, K. A., & Xu, Y. J. (2007). A Bayesian analysis of the institutional and individual factors influencing faculty technology use. *The Internet and Higher Education*, *10*(3), 184–195. doi:10.1016/j.iheduc.2007.06.001

Moran, M., Seaman, J., & Tinti-Kane, H. (2011). *Teaching, Learning, and Sharing: How Today's Higher Education Faculty Use Social Media*. Boston: Babson Survey Research Group. Babson College, 231 Forest Street, Babson Park, MA 02457. Tel: 909-278-7389; Web site: http://www.babson.edu/Academics/centers/blank-center/global-research/Pages/babson-survey-research-group.aspx. Retrieved from http://eric.ed.gov/?id=ED535130

Moser, F. Z. (2007). Faculty Adoption of Educational Technology. *Educause Quarterly*, 66–69. Retrieved from https://net.educause.edu/ir/library/pdf/EQM07111.pdf

Mullins, Christine, and Amy Weinfurter. 2013. Tracking the use of tablets in community colleges. Retrieved September 26, 2014 (http://www.itcnetwork.org/resources/itc-newsletter/769-tracking-the-use-of-tablets-in-community-colleges.html).

National Forum on Education Statistics: Technology in Schools Task Force (2002). *Technology in Schools*. Washington, D.C. Retrieved September 26, 2014 (http://nces.ed.gov/pubs2003/2003313.pdf).

Purcell, K., Buchanan. J., and Friedrich, L. (2013). *The Impact of Digital Tools on Student Writing and How Writing Is Taught in Schools | Pew Research Center's Internet & American Life Project*. Retrieved September 26, 2014 (http://www.pewinternet.org/2013/07/16/the-impact-of-digital-tools-on-student-writing-and-how-writing-is-taught-in-schools/).

Ringstaff, C.; Kelley, L.(2002). "The Learning Return on Our Educational Technology Investment." Retrieved September 26, 2014 (http://dmps.typepad.com/tac/learning_return.pdf).

Rogers, D. L. (2000). A Paradigm Shift: Technology Integration for Higher Education in the New Millennium. *AACE Journal*, *1*(13), 19–33. Retrieved from http://www.editlib.org/p/8058/

Sammons, D., Murandu, M., & Strickland, J. (2002). Utilizing SmartBoards to Enhance Technology Integration in University Classrooms. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2002, pp. 1713–1714). Retrieved from http://www.editlib.org/p/10217/

Schmid, R., Lowerison, G., Abrami, P., & Dehler, C. (2009). Using Technology for Learning in Higher Education: What is Important? In *Society for Information Technology & Teacher*

Education International Conference (Vol. 2009, pp. 1090–1096). Retrieved from http://www.editlib.org/p/30749/

Sturgeon. (2011). Faculty perceptions of the factors enabling and facilitating their integration of instructional technology in teaching. University of Tennessee-Knoxville. Retrieved from http://trace.tennessee.edu/cgi/viewcontent.cgi?article=2055&context=utk_graddiss

Transforming American education: Learning powered by technology (National Technology Education Plan 2010). (2010). Retrieved from Retrieved from http://www.ed.gov/sites/default/files/netp2010.pdf

Ulrich, J., & Karvonen, M. (2011). Faculty instructional attitudes, interest, and intention: Predictors of Web 2.0 use in online courses. *The Internet and Higher Education*, *14*(4), 207–216. doi:10.1016/j.iheduc.2011.07.001

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478.

Weathersbee, J. (2008) Impact of technology integration on academic performance of Texas school children. Applied Research Projects, Texas State University-San Marcos. Paper 272.http://ecommons.txstate.edu/arp/272

Whipp, J., Schweizer, H., & Dooley, N. (2001). Helping Higher Education Faculty Model Use and Integration of Technology in Teaching. In *Society for Information Technology & Teacher Education International Conference* (Vol. 2001, pp. 2161–2164). Retrieved from http://www.editlib.org/p/17135/

Winton, H. (2014). Helping Faculty Members Use Technology Is Top Concern in Computing Survey. The Chronicle of Higher Education. Retrieved September 19, 2014, from http://chronicle.com/article/Helping-Faculty-Members-Use/142377/

Annotated Research Bibliography

Research	Findings	Implications for Collin
(Agbatogun, 2013) 492 faculty members from six Nigerian universities surveyed using the Faculty Members Technology Use Scale	Faculty use of technology is influenced by gender, academic qualifications, academic status, comfort with technology, use of conventional teaching strategies, and too much to cover in curriculum	Faculty need support in developing comfort with technology, and in integrating technology into the curriculum using easy to implement technology tools that allow maximum curricular coverage
(Agee Scrivener & Holisky, 2000). Project provided grants to faculty for $500 to $4000 of support tech integration. Their proposals indicated type of integration as well as assessment methods	Focus on use of tech in course development rather than faculty development provided more positive results	Faculty training that focuses on the use of technology within the course for learning rather than general training on a web tool or delivering learning materials and information would be most beneficial
(Ajjan & Hartshorne, 2008) Survey of 136 faculty at large university; assessed faculty's use and awareness of the benefits of Web 2.0	Blogs and wikis seen as increasing learning and writing ability, social interaction and satisfaction, but many do not use. Focus on enhancing faculty efficacy and perceived control of web 2.0 use through introduction of easy tools compatible with current teaching methodology	Faculty can develop skills in use of technology through learning about Web 2.0 tools that are compatible with their teaching methodology. A webpage outlining different methodologies and web tools to use along with video tutorials could be considered
(Antonacci, 2002) Literature review on use of technology in higher education instruction Identified major barriers to tech integration for faculty	Successful strategies include providing project-based training that incorporates both training on digital tools and the implementation of these tools within specific courses.	Faculty Development should include not only basic training on tech tools, but training on integration in specific courses
(Arnold, 2006) Results of on-line survey of 173 college foreign language teachers	Most use computer technology in instruction but for utilitarian purposes as opposed to learning purposes	Focus in faculty development should include an understanding of the methodology for including technology as part of pedagogy
(Baylor & Ritchie, 2002)	Faculty who were open to change more	A system in which faculty in the same

Quantitative study of 94 classrooms in 4 states looked at factors impacting school technology use	likely to adopt technology for more than just "drill and practice" and informational uses. Technology activities with other teachers was predictive of more technology integration in the classroom	department and division worked together would more likely encourage the use of technology as a learning methodology
(Bowen, 2012) Book focused on the use of technology in higher education outside of the classroom to increase student learning	Bowen supports use of technology to increase preparation and engagement between classes to create more time for in-class dialogue. Suggests the creation of games, online communities in the classroom and interactive online assignments that are done outside of the class to increase critical thinking and dialogue inside the classroom	Bowen would be a good speaker for a learning conference for faculty. Training needed on the development of games that meet course content needs as well as how to develop meaningful online learning communities
(Browne, 2011) The study examines the use of The Technology Integration Confidence Scale (TICS) to identify the ability of student teachers to integrate technology into their classroom.	Self-efficacy identified as critical factor in integration. The use of a scale to identify issues and efficacy of teachers assisted in planning for curricular development	Asking faculty to complete an integration confidence scale or other assessment of understanding and implementation of technology integration would provide administrators with better understanding of faculty needs for technology integration support.
(Bryan, 2008) Qualitative study examining challenges to teaching beliefs for faculty when web-enhanced teaching is implemented	Undergraduate students who may be considered digital natives often are not competent in the use of digital tools for learning. Teachers need to focus not just on the use and provision of online materials but on the use of technology in the classroom to support learning	While the use of BlackBoard has been embraced by most of the faculty for providing materials and grades, there is a need for faculty to learn to use technology as a teaching methodology as well.
(Clift, Mullen, Levin, & Larson, 2001) Data from a series of studies on technology integration into teacher education programs and proposal of a model for integration	Students need technology integrated not just in some courses but in courses all across the college; support is needed from peers for faculty; informal and formal teaching is needed to support technology integration	An informal support system in which peers model and assist in the development of technology integration skills could be very effective

(Collis, 2003) Article examining corporate use of e-learning and what higher education can learn from this	Corporate culture exhibits concern for clients, concrete and shared objectives, integration of formal and informal learning, quality multimedia learning tools. Focus in higher ed is more on success in a job or project rather than preparing for a job or project, which is more outcome based.	The development of concrete, competency based objectives for the ELC's work in increasing faculty integration would strengthen their mission and produce better outcomes
(Ellis, Hughes, Weyers, & Riding, 2009) Qualitative study of university professors	Many see technology as a tool to deal with access and course design issues for students and faulty including access, distance and time issues, but not as tools to encourage learning and applied understanding. Faculty support for course design with emphasis on the use of learning technologies is recommended	Workshops or training focused on technology tools to promote applied understanding and learning rather than just a utilitarian focus, such as posting announcements and how to do grades in BlackBoard would assist faculty in integrating technology as a learning tool
(Figg & Jimani, 2013) Article examines a professional learning design model (PLDM) using TPACK (Technological Pedagogical and Content Knowledge) as basis	Literature review indicates that traditional professional development workshops teaching technical skills will not develop teaching competence with technology. Focusing on a tech enhanced learning activity that features the pedagogy of using it and how to adapt it for different teaching contexts and tools is most effective	Workshops that focus on instructional pedagogy and how the technology can support the teaching in the classroom would allow faculty to develop a more solid basis for tech use in the classroom to enhance learning.
(Fulford, Main-Anakalea, & Boulay, 2008) Study on a program to provide faculty who mentored others in infusing technology into the curriculum with a sabbatical to develop their knowledge and skills to integrate technology	Findings indicated that allowing time fo Development of strategies and tools for better technology integration resulted in positives outcomes for students and those being mentored	Providing course releases or stipends would Provide faculty mentors who have received additional training in the use of technology
(Georgina & Hosford, 2009;	70% of faculty felt it was the college's	Surveys can be conducted to identify faculty

Georgina & Olson, 2008) Examined how faculty technology literacy and training impact integrating technology into pedagogical practice in 15 universities	responsibility to train faculty in the use of technology. The majority felt the best venue for learning was in small group faculty forums with trainers (56%) and asking colleagues (52%), however the quality of trainers was critical as well as the need for individualized instruction. Faculty input into training from surveys and interest groups can help reduce negativity regarding pedagogical changes	needs. The use of faculty mentors that can provide small group training within curricular areas would provide pedagogical integration support
(Grosseck, 2009) Article on theoretical aspects of Web 2.0 technologies in higher ed, models of integration and benefits and barriers to the use of Web 2.0	Web 2.0 tools allow students and faculty to be collaborative, creative and to learn and express in reflective, analytical ways but faculty must apply the tools appropriately as part of good pedagogical integration	Provide faculty with more understanding of the difference between the random use of Web 2.0 tools and the integration of it into teaching and competency-based learning and assessment
(Inan, Lowther, Ross, & Strahl, 2010) Study involved direct observation of 143 integration lessons in classrooms	Teachers must become familiar with technology and training should center on how the use of technology enhances student-centered learning, such as collaborative learning, higher-order questioning	Technology tools focused on collaborative learning, higher-order questioning and encouraging student independence as well as coaching can be identified for general pedagogical use as well as tools specific to disciplines and shared with faculty
(Judge & O'Bannon, 2004) An implementation project in which mini-grants for technology integration are given to faculty through a proposal process and where mentors are provided to assist	100% of faculty receiving grants revised syllabi to include tech-based learning activities and many received external funding for additional tech equipment as well as publishing their experiences	Small stipends based on proposals submitted in which faculty outline how they will infuse technology and a mentor program could assist in faculty development
(Juniu, 2004) Examines the need for a democratic approach to the use of technology and training for its use in higher education	The focus should be on hand-on experience with technology and workshops focused not on software features but on how software can enhance critical thinking to help the learning process. Workshops should offer real-life	Design workshops to deal not with specific software but specific teaching strategies such as discussion, teamwork, analysis and demonstration.

	problem solving.	
(Kukulska-Hulme, 2012) Examines different approaches to professional development for faculty in integration	Some higher ed institutions are using a community-focused approach by establishing learning communities, which concentrate on one or two digital tools at a time. The researcher developed a collection of resources focused on mobile learning experiences which provided explanation of the tool, specific learning that could result and specific examples of how to implement them; they also provided a fair in which faculty to try out different forms of technology and talk to people who have implemented these tools in their classrooms	Learning communities built around departments or divisions could develop materials that focus on the use of specific tools for specific learning activities. A faculty development day in which different forms of technology and tech tools are displayed and where faculty could examine the technology while someone who has used it in their classroom can explain application. This could be done as part of All-College Day before and after our session
(Lambert et al., 2014) Literature review focusing on he use of technology in higher education in relation to nontraditional adult students	Adult learners often respond better to teaching methods that encourage critical thinking and reflection on experience. Focus should be not on content-driven courses but on course development that considers technology, pedagogy and content equally . There is a need for s systematic model of intentional tech integration into instruction	A model and process for faculty technology incorporation and integration is needed that has a focus on blending pedagogy, technology and content in courses
(Lee, 2000) Article examining obstacles to shifting from teaching-centered to learning-centered strategies in integrating technology in higher education	Use of technology should focus on active learning. Successful implementation of technology involves understanding of pedagogical strategies, implementation and assessment of strategy and continuing to work with and improve strategy. Competency-based objectives necessary for effective implementation	Competency-based objectives and assessment should be linked to technology tools that do not promote static learning, but dynamic, active learning. These tools should be learning-centered, focusing on student learning rather that instructor teaching
(Maloney, 2007) Article on web 2.0 and learning	"Course-management systems were not created to enhance learning, but to make it easier for a faculty member to deliver	While the focus on BlackBoard is important, it is also important to help faculty learn to use Web 2.0 tools that promote learning

	materials to students. Even though most of the systems now include basic tools that allow students to turn in assignments, take exams and surveys, and communicate with each other through discussion boards and chat programs, those tools tend to be limited in functionality, generic in form, and based on relatively old technology (pp.1-2) "	
(Meyer & Xu, 2007) Bayesian network analysis of variables related to faculty technology use in National Study of Postsecondary Faculty: 2004 (NSOPF:04) sample of 16,914 faculty	The use of technology in the classroom is consistently influenced by instructional load and student responsibilities. Recommendations include focusing on how faculty uses technology now in instruction to move focus from information to increasing learning.	Assessing how faculty currently use technology would be helpful as well as being sure the student and instructional loads are appropriate
(Moran, Seaman, & Tinti-Kane, 2011) Report on the use of social media in higher education. Survey examining both personal and profession use by faculty	Faculty concerned with privacy issues and integrity of submissions in use of social media but recognize value when used appropriately. 40% of faculty had assigned student use of social media as assignment; 80% reported use in a course--online videos most prevalent.	Training could be provided on the use of social media to enhance leanring including commenting and analyzing on sites such as Twitter and Facebook.
(Moser, 2007) Qualitative Analysis of MIT, Tufts, and Northeastern faculty and IT departments	Strategy for technology adoption and integration with higher education faculty critical and college needs multiple methods of assisting faculty in adoption	Faculty need not only e-learning support and support in learning specific tools but also course preparation support, including course design and teaching with technology. Faculty also need opportunities for reflection and assistance in assessment of their technology integration. A regular needs analysis could be done
(Rogers, 2000) Article examines the need for technology competencies in higher	Students in courses using multimedia complete courses quicker and exhibit higher competency levels than in traditional	Provision of technology that is easily accessible to faculty needed. Encourage faculty to explore and expand course design

education similar to the technology competencies for K-12 schools and need to shift emphasis from "teaching to learning" in order to train appropriately.	instruction; training for faculty should inspire faculty to create, must be experience based, respond to faculty interests, be engaging, properly funded and considerate of faculty anxieties and fears, provide technology faculty can take home, encourage collaboration with colleagues	by providing clear paths to receiving approval when faculty would like to use innovative technology
(Sammons, Murandu, & Strickland, 2002) Study examining the integration of SmartBoards into university classrooms	Study indicated that few were able to use the SmartBoards without training on use in classroom	Whenever new technology is introduced training is needed not just in how to use equipment, but in how to integrate it into current teaching methods
(Schmid, Lowerison, Abrami, & Dehler, 2009) 4000 students over six year period surveyed to examine relationship between technology use, active learning, and perceived course effectiveness	When focus is on learner knowledge construction as opposed to passive reception of information, technology is perceived as important learning tool. Factor analysis indicated the most important is use of technology to specifically address instructional outcome through active and meaningful activities	Encourage the use of technology for active learning based on needed competencies, not just for reviewing and receiving information
(Sturgeon, 2011) Survey of 427 faculty from 22 institutions of higher learning to identify factors that facilitate university faculty integration of technology	Findings indicate that most faculty needed to know that technology would enhance student learning	Provide exemplars of faculty who successfully use technology to meet course competencies
(Venkatesh, Morris, Davis, & Davis, 2003) The article describes the development and testing of a theory, The Unified Theory of Acceptance and Use of Technology (UTAUT), to explain various	The UTAUT model was evaluated and tested and found to explain technology acceptance significantly more than individual models on which it is based. The use of the model is encouraged to identify specific methods of meeting faculty needs	A uniform approach to technology integration based on established models would allow Collin to more effectively assist faculty and influence student learning outcomes.

aspects of technology acceptance in faculty by integrating several models of acceptance determinants,		
(Whipp, Schweizer, & Dooley, 2001) Faculty development project on integration of technology for teaching and learning	The project provided a website of resources for faculty integration; faculty consultants, as well as short notice assistance, workshops and mini-grants on tech integration	Collin offers some of this model and should consider adding additional components to the current assistance that is offered faculty
(Winton, 2014) 451 two- and four-year, public and private colleges across the United States CIOs and IT Administrators surveyed	80% stated that helping faculty integrate technology into their teaching was biggest concern for the next couple of years. 86% said planning for tablets critical, and 82% said planning for smartphones critical as well. Only 62% said laptops were any concern.	Colleges today are focusing on technology integration in the classroom including student and faculty use of tablets and smartphones. There is a need for more focus on the integration of technology as a teaching tool for Collin

APPENDIX B

Effective Technology Integration in Early Childhood Education: An Application Model

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

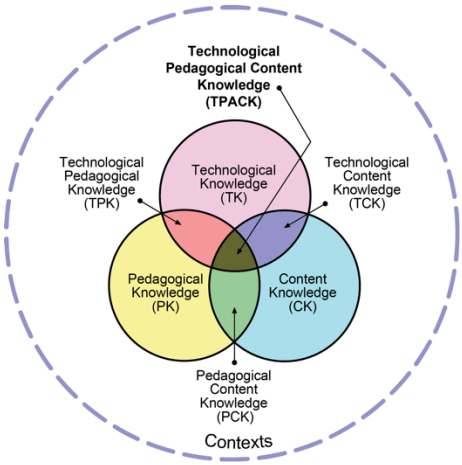
Effective Technology Integration in Early Childhood Education: An Application Model

The National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center developed a position statement in 2012 on the use of technology with young children. The statement provided clarity and structure in the appropriate use of technology with children under the age of eight. The statement provides an extensive overview of principles, standards, dispositions, attitudes, and skills necessary to effectively and intentionally integrate technology in early childhood education.

The depth of this statement can at times limit its application by early childhood educators who are often looking for concise, visual models to better understand the knowledge, skills and attitudes that are needed to effectively integrate technology.

Current Models for Technology Integration

There are several models in the K-12 education community to assist and explain technology integration. Two, in particular, provide a simplified method of understanding how to effectively integrate technology in classrooms: the TPACK and SAMR models. Both address knowledge, skills and attitudes needed by teachers.



TPACK

The TPACK model (Mishra & Koehler 2006) identifies the types of knowledge required to effectively integrate technology in the K-12 classroom. TPACK recognizes 3 necessary types of knowledge: technological, pedagogical, and content. Combining any 2 of the knowledge dimensions provides movement toward technology integration, but effective classroom integration involves having and using all three types of knowledge in ways that combine and integrate the knowledge.

SAMR

The SAMR model (Puentedura 2012) correlates technology use with student and teacher learning and growth. SAMR identifies a continuum of growth:

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

1. **Substitution** in which students and teachers use technology as a substitute for common learning tools, such as using an app instead of a worksheet to teach letter sounds.
2. **Augmentation**, a form of substitution in which the learning experience is enhanced or changed in some basic way by a digital tool. A student uses an app that not only repeats the letter sounds but also records the child saying the sound.
3. **Modification** involves using different tools to add to and change the learning for students. The child uses the app to record sounds and then saves it in a file of sounds recorded by the child
4. **Redefinition** occurs when the teacher or child uses technology to create, synthesize and/or evaluate information. The child creates an interactive book in which he includes the letter, a picture he created in a graphics app representing the letter and the recording he made of each sound.

These models provide K-12 teachers with practical applications to analyze their own technology use and move toward better classroom integration. Best practices research and training in K-12 often use these models as a basis for professional development. TPACK is used extensively. Koehler and his colleagues have a website, http://www.tpack.org/ with a variety of applications of the model and conferences devoted exclusively to the understanding and use of the model. The SAMR model has likewise provided resources for application of the model (http://hippasus.com/blog/)

A Model for Effective Technology Integration in Early Childhood Education

There are pedagogical differences in the teaching and knowledge background that early childhood professionals and elementary and high school educators are expected to understand and utilize. Early childhood educators focus not on the intellectual development of a student, but on physical, emotional, social, and cognitive development equally. Early childhood educators follow Developmentally Appropriate Practices (DAP) principles and guidelines developed by the National Association for the Education of Young Children (Copple & Bredekamp 2009).

Public schools focus on cognitive growth and address other areas of development only in relation to achievement and academic learning. While public education may encourage physical growth through P.E. and recess, for example, the purpose of this growth is to enhance ability to achieve academic goals. Integration of technology in the early childhood classroom has to take into account the uniqueness of the philosophy and goals of working with young children.

The TPACK framework, provides a basis for teacher development in public school, but does not incorporate critical knowledge areas needed in early childhood education. A broader model is needed focused on early childhood. *Pedagogical,*

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Early Childhood Developmentally Appropriate Practice, Technology, & Content Knowledge Dimensions for Effective Technology Integration (PECT), incorporates the core considerations for developmentally appropriate practices in early childhood education (2009) and identifies four types of knowledge necessary for effective technology integration in early learning classrooms:

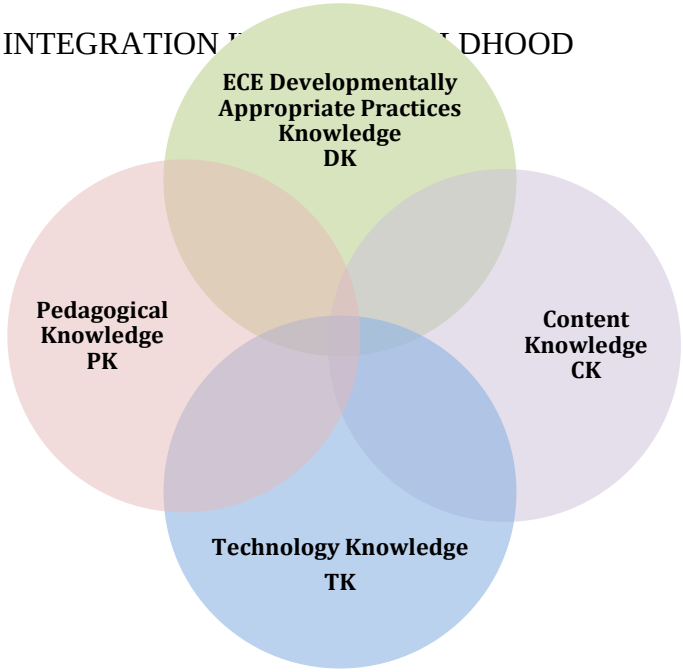
1. **Developmentally Appropriate Practice Knowledge**: At the core of all teaching and guiding of young children should be a knowledge of how children grow, development and learn and how they are affected by their environment, relationships and teachers' pedagogical practices. The three core considerations of DAP include:
    a. Knowing about child development and learning in children
    b. Knowing what is individually important for each child
    c. Knowing what is culturally important
2. **Technology Knowledge:** Teachers need a fundamental knowledge of the technology tools available to them and how they can be used in classrooms with and for children and families.
3. **Content Knowledge:** Content knowledge is basic to any effective teaching. Knowledge of content and the learning outcomes associated with that content provides a framework for the use of technology.
4. **Pedagogical Knowledge:** Pedagogy in early childhood revolves around the following types of knowledge and abilities as identified in NAEYC's Position Statement (2009), *Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8*.
    a. Creating a caring community of learners
    b. Teaching to enhance development and learning
    c. Planning curriculum to achieve important goals
    d. Assessing children's development and learning
    e. Establishing reciprocal relationships with families

    While the pedagogical knowledge described is important for any teacher, the emphasis on addressing development as well as learning, family partnerships and a focus on the emotional development of learners creates a unique perspective important for those working with young children.

Any two or three dimensions of knowledge may impact the integration of technology in the classroom. Combining two or three dimensions of knowledge provides a greater opportunity for impact, creating additional dimensions. When knowledge from all four dimensions is integrated into classroom practice, synergy creates a classroom where technology integration is dynamic and developmentally appropriate.

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

TECHNOLOGY INTEGRATION I[illegible]DHOOD



PECT for ECE Technology Integration

Pedagogical, Early Childhood Developmentally Appropriate Practice, Technology, & Content Knowledge for Effective Technology Integration

(A modification of the TPACK model for Technological Pedagogical Content Knowledge, Mishra & Koehler 2006 re-designed by Sharon Hirschy/Collin College)

What is Technology Integration?

The process of incorporating technology as a tool for both teacher and child in the classroom in such as way that it becomes part of the fabric of classroom experiences, no different than any other.

It is the use of technology as learning and teaching tools in the same way that crayons, blocks and puzzles are tools. Technology integration involves not a stand-alone center experience, but the use of technology in any center or activity when appropriate. The digital camera is available to any child who wants to take a picture of his Lego tower, the iPad is next to the block center (where there are toy farm animals and implements) and showing on a loop a video clip of a farm while children create their own farms. The teacher sees a child master cutting and takes a short video clip to be shared with parents and placed in an electronic portfolio.

Teachers use technology to learn more about child growth and development and DAP, to interact with other professionals and to gain knowledge about technology.

Effective technology integration makes the lives and learning experiences of children and their teachers richer as it becomes assimilated into teaching and learning methodology.

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Knowledge, Skills, Attitudes and Dispositions for ECE Technology Integration

Identifying and developing knowledge is the beginning of integration of technology with current practices in the early childhood classroom. The next step is applying this knowledge. Early childhood educators are finding themselves in a variety of roles as they apply technology to their classrooms, becoming curators, facilitators, modeling, and using technology (Rand, 2014).

Fulfilling such roles requires the identification of methods to gain the knowledge, and the skill needed to apply the knowledge. While teachers use technology for basic word processing and communication, they often are not able to truly integrate its use in their work with young children.

A continuum of knowledge, skills, attitudes and dispositions that incorporate the dimensions of knowledge referenced in the PECT framework provides a blueprint for continued learning and development. The SAMR model (Puentedura 2012), provides a continuum for K-12 educators in their use of technology in the classroom that focuses on the student use as well as teacher use of technology.

Early childhood educators need a similar guide focusing on the development of specific skills that will allow them to develop knowledge and ability to integrate technology. The **PECT** model with added skills, attitudes and dispositions provides a more complete understanding of how to fully integrate technology in the classroom. This added continuum includes four stages of development: *Recognition, Application, Integration, and Equilibration.*

Recognition: An early childhood educator first reads and recognizes basic tenets in the research on technology and early childhood and the NAEYC Position Statement on Technology, as well as what constitutes Developmentally Appropriate Practice in the classroom. They also identify basic technology tools that can be used in their program.

Application: The teacher uses technology on a basic level in her classroom and in her communication with families and professionals. Abilities such as word-processing to create newsletters, abilities to communicate with families and colleagues electronically, and the ability to use technology resources to develop curriculum and assess children are developed.

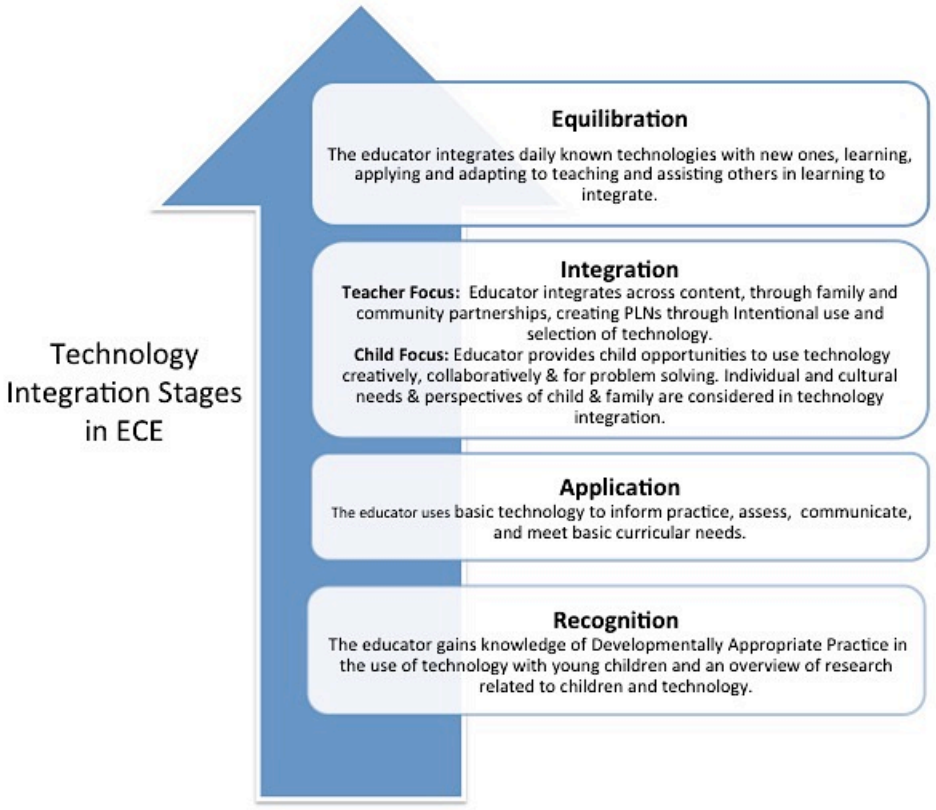
Integration: The teacher uses technology in a variety of ways to enhance curriculum, family partnerships and professional development. She provides learning opportunities for children to use technology in developmentally appropriate ways.

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Equilibration:
The early childhood educator not only integrates technology and incorporates it effectively in all areas of her teaching and professional development, but shares her knowledge with fellow educators. The teacher is able to balance the use of technology and learning of new technology with other classroom tools and other professional development.

An educator begins at any point in the continuum, identifies skills needed, and moves toward equilibration. Many educators will be content with a lower level of integration; however, the more skills and knowledge gained, the more complete the integration of technology into teacher practices.

This model can provide early childhood educators with an understanding of the types of knowledge that are important to integration, and a continuum of development toward integration. The appendix includes core knowledge, skills and attitudes for integration as well as a checklist and resources for teachers to guide their development.



©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

References

Copple, C., & S. Bredekamp, eds. 2009. *Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth Through Age 8.* 3rd ed. Washington, DC: NAEYC.

Daugherty, L., Dossani, R., Johnson, E., & Wright, C. (2014). Getting early childhood educators up and running. (Research Report RR-673/4-PNC). Retrieved from http://www.rand.org/pubs/research_reports/RR673z4.html

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: a framework for teacher knowledge. *Teachers College Record*. Retrieved from http://www.sharonzspace.com/wp-content/uploads/2011/12/mishra-koehler-tcr2006.pdf

NAEYC & Fred Rogers Center for Early Learning and Children's Media. 2012. Technology and interactive media as tools in early childhood programs serving children from birth through age 8. Joint position statement. Washington, DC: NAEYC; Latrobe, PA: Fred Rogers Center for Early Learning at Saint Vincent College. www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf.

Puentedura, R. (2012). Thinking About Change in Learning and Technology. Presentation given September 25, 2012 at the 1st Global Mobile Learning Conference, Al Ain, UAE. Retrieved from http://www.hippasus.com/rrpweblog/archives/2012/04/10/iPad_Intro.pdf.

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Core Knowledge, Skills, Attitudes and Resources for Technology Integration by Early Childhood Educators

Stages of Technology Integration for Early Childhood Educators Checklist and Resources

Materials associated with this model were developed by Sharon Hirschy through the support of Collin College. Use this information in any way you choose and make changes as long as you include in your materials "Reproduced by permission of the publisher, © 2015 Sharon Hirschy/Collin College" (or a similar type of statement).

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Core Knowledge, Skills, Attitudes and Resources for Technology Integration by Early Childhood Educators

This chart was developed in part from information from NAEYC & Fred Rogers Center for Early Learning and Children's Media. 2012. *Technology and interactive media as tools in early childhood programs serving children from birth through age 8.*

Knowledge	Skills	Resources	Attitudes /Behaviors
Recognition: Developing a basic knowledge of Developmentally Appropriate Practice and technology			
1) Developmentally Appropriate Practice i) Child Growth & Development ii) Guidance iii) Learning Environments iv) Family Partnerships v) Diversity 2) Sites that can inform DAP and provide information 3) Technology & Children a) NAEYC Position Statement on Technology and DAP	• Ability to identify and apply basic concepts of DAP • Can identify core principles of NAEYC & Fred Rogers Position Statement on Technology and Young Children	**DAP** • http://www.naeyc.org/DAP • http://www.naeyc.org/yc/files/yc/file/201209/Cluster_Resources_0912.pdf • http://www.researchconnections.org/content/childcare/find/ http://www.naeyc.org/content/technology-and-young-children • http://www.highscope.org/file/NewsandInformation/Extensions/ExtVol28No1_low.pdf •	Teacher is open-minded, willing to learn, interested, self-aware,
4) Latest research on children and technology use	• Recognizes: o The latest research on technology and children o Examples of appropriate technology use in classrooms	**Research** • http://www.techandyoungchildren.org/research.html • http://www.isbe.net/earlychi/preschool/preschool_tech.htm • **Video examples:** http://teccenter.erikson.edu/category/show-me-videos/ and https://www.youtube.com/user/eriksonteccenter • http://www.naeyc.org/content/technology-and-young-children/resources	
5) Basic technology tools a) Basic Hardware	• Identifies appropriate digital tools for the classroom	Technology Tools http://fg.ed.pacificu.edu/cldc/bestpractices.html	

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

b) Internet Navigation c) Basic web tools, software for teacher use	• Uses basic hardware for the classroom including computers, digital cameras, and internet. • Uses the internet and searches for information • Saves and organizes and information • Does basic word processing • Uses image tools for basic editing and saving of pictures	• http://www.educatorstechnology.com/p/teacher-guides.html	
Application: Using basic technology in the classroom			
1) Basic Communication Tools a) Email b) Newsletters c) Website/blog d) Word Processing e) Social Media	• Uses simple word processing tools for curricular, communication, and professional development activities o Ability to use email, create simple newsletters, blogs and/or websites for communicating with parents and other professionals	**Skills all teachers need and links to resources:** http://thejournal.com/Articles/2005/06/01/20-Technology-Skills-Every-Educator-Should-Have.aspx?p=1 http://www.educatorstechnology.com/2012/06/33-digital-skills-every-21st-century.html	Teacher exhibits perseverance, enthusiasm, patience, problem-solving

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

2) Use of technology for curricular development a) Tools for curriculum development and organization i) Sites for curricular ideas ii) Software, apps, websites, and we tools	• Accesses and utilizes digital tools to develop curriculum and assess children's development o Finds sites that offer developmentally appropriate ideas for creating lesson plans and teaching o Identifies and uses software, apps, and web tools that provide developmentally appropriate activities for children	• http://www.educationworld.com/a_earlychildhood/archives/activity.shtml • http://iws.collin.edu/shirschy/Teacherlinks.html • • Pinterest (https://www.pinterest.com/) search "Early Childhood Curriculum" and Early Childhood Assessment **Assessment** http://www.naeyc.org/files/naeyc/file/positions/CAPEexpand.pdf • http://www.k12.wa.us/earlylearning/pubdocs/assessment_print.pdf • http://technologyinearlychildhood.com/2013/06/06/using-digital-tools-to-create-a-portfolio-for-your-students/ • https://www.youtube.com/watch?v=Th-5I-QKJK4	
3) Appropriate apps, web tools and sites for children	• Locates checklists and websites that assist in evaluating what is developmentally appropriate • Uses checklists and reviews to evaluate children's apps and sites before use	• http://www.fredrogerscenter.org/media/resources/Tech_Integration_Checklist_-_Final.pdf • http://www.naeyc.org/yc/article/finding-education-in-educational-technology	
4) Assessment of children and self-assessment 5) Assessment tools a. Sites for information on assessment	• Conducts assessments of children and self using technology o Ability to locate and understand information on developing and using		

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

b. Databases c. Checklists d. Portfolios e. Online evaluations f. Digital assessment products	assessment o Awareness and ability to use digital tools for assessment including o Databases o Checklists o Portfolios o Online evaluation o Digital assessment o Products		
Integration: Using technology as one of many tools teachers and children use daily to enhance learning			
1) Teacher focus a) Integrate technology i) Curricula ii) Learning Environment iii) Communicating with families iv) Cross-curricular activities and information b) Select and evaluate technology for children c) Share d) Problem solve basic issues with technology e) Develop a Personal Learning Network (PLN)	**Teacher focus** o Integrates technology for curricula development, learning environment, assessment and family communication, o Integrates technology into practice as one of many tools used o Shares with others new to technology and shares information on new technologies and integration with colleagues o Uses internet searches and other professionals to find solutions to basic hardware and software issues o Identifies and uses digital tools to develop a personal learning network for professional development	**Family Communication:** • http://www.educate.ece.govt.nz/learning/exploringPractice/ICT/LinksToFamiliesAndICT.aspx **Integration:** • https://ecetechshowcase.wikispaces.com/TechToolsNAEYC13 • http://www.naeyc.org/yc/files/yc/file/201205/McManis_YC0512.pdf • http://www.fredrogerscenter.org/media/resources/Tech_Integration_Checklist_-_Final.pdf **PLN** • http://www.educatorstechnology.com/2012/11/teacher-tutorial-on-creating-personal.html **Essential Reading in technology and early childhood** http://teccenter.erikson.edu/wp-content/uploads/2014/09/Essential-Readings-on-Tech-in-the-Early-Years.pdf	Teacher is risk-taking, creative, demonstrates leadership, sensitive to diversity, communicates well

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

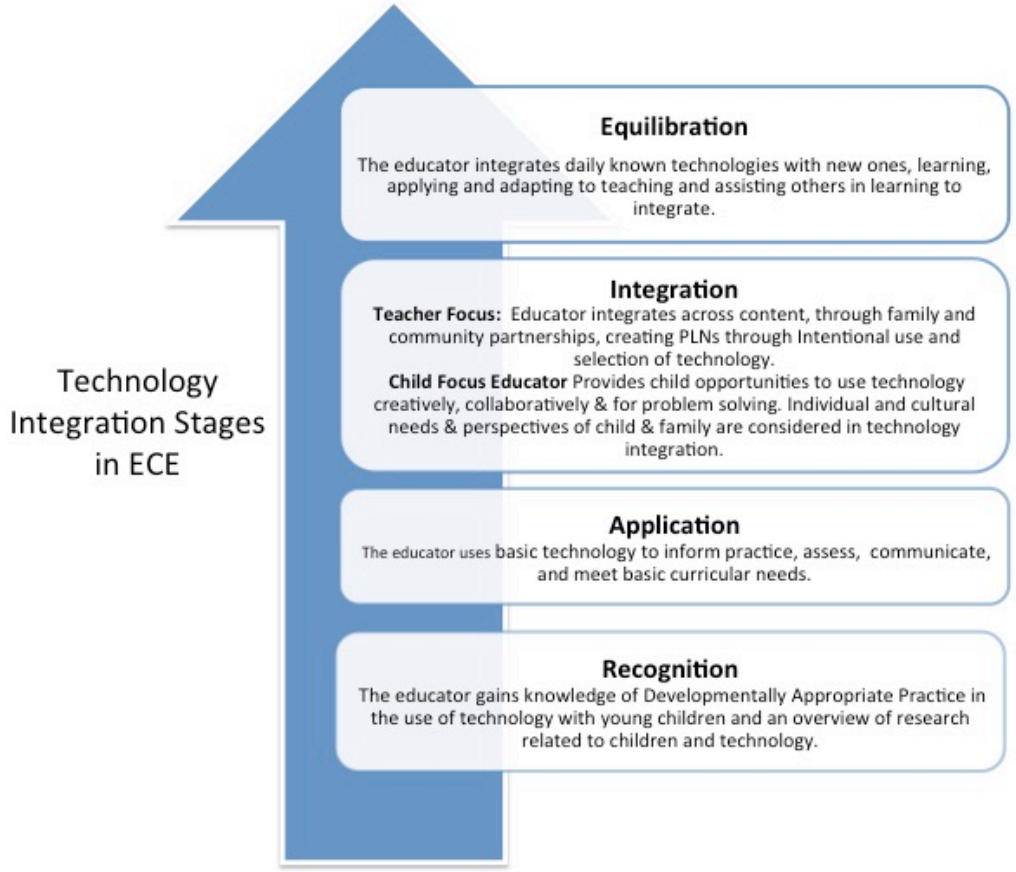
2) Child Focus a) Developing open-ended, creative and collaborative activities for children involving technology b) Use of digital activities for problem-solving, creativity and social skill development rather than just drill and practice c) Individual and cultural needs and perspectives of individual child and family in relation to technology use	**Child Focus** • Selects, evaluates and uses appropriate technology for children in classroom • Develops open-ended, creative and collaborative activities for children involving technology • Plans digital activities for children that involve problem-solving, creativity, and skill development • Provides appropriate differentiation and communication in regard to technology in the classroom for children and families • Locates sites and digital informatic to understand and assist children i an appreciation of diversity • Locates sites and digital information to provide appropriate differentiation for children and families • Provides opportunities for children to learn about digital citizenship	http://childrenstech.com/ https://www.commonsensemedia.org/ http://www.edutopia.org/blog/coding-for-kindergarteners-sam-patterson http://www.cec.sped.org/~/media/Files/Professional%20Development/ParetteBlum.pdf

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Equilibration: Balancing the learning and integration of new and old technologies			
1) Advanced methods of employing technology in the classroom with children and families and for curricular and professional development 2) Where to locate and access new information on technology, teaching methodologies and how to integrate into current practice 3) Professional development opportunities for technology in early childhood 4) How to mentor and share information with other teachers and serve as role model 5) How to conduct action research in classrooms to measure children's needs and abilities for technology and to use information to plan curriculum	• Incorporates technology into classroom teaching in multi-dimensional ways using a variety of hardware, software, internet and web tools • Teacher has a system to routinely locate and access information on the use and integration of technology in the early childhood classroom • Teacher frequently takes advantage of professional development opportunities to learn more about technology and integration • Learning is shared with colleagues in formal and informal settings • Acts as mentor to other teachers in use of technology • Action research is used to evaluate the effectiveness of new digital media in the classroom and to plan and modify	**Media Research** http://cmch.tv/ **Technology Integration:** https://globalearlyed.wordpress.com/ http://cooltoolsforschools.wikispaces.com/ **Professional Development:** http://www.iste.org/ http://www.eetcconference.org/ http://www.ecetech.net/techspirations/ecetechchat-on-twitter/ http://www.fredrogerscenter.org/blog/ http://edublogs.org/blog-directory/directoryteched/ **Action Research:** https://mindmaps.wikispaces.com/Action+Research+and+Technology **Mentoring:** http://earlylearningtexas.org/media/23607/0_final_texas_mentoring_7-8-13.pdf	Teacher is flexible, an explorer, leader demonstrates self-efficacy, global awareness, tolerance, pragmatic, respectful of children, family and colleagues, motivated,

Stages of Technology Integration for Early Childhood Educators
Checklist and Resources

This checklist provides educators with a method of evaluating current abilities and needs regarding technology integration. It is to be used as a guide for improvement and understanding but is not an all-inclusive list of the knowledge necessary for complete understanding and implementation of technology integration.



ECE Teacher Checklist for Classroom Technology Integration

Recognition Stage				
Beginner	**Advanced Beginner**	**Intermediate**	**I can do it!**	**Expert**
I can identify and apply basic concepts of DAP				
I am familiar with the basic principles of NAEYC & Fred Rogers Position Statement on Technology and Young Children				
I am aware of basic research on the effects of children's use of technology				
Examples of appropriate technology use in classrooms				
I can identify some appropriate digital tools for the classroom				
I use basic hardware for the classroom including computers, digital cameras, Internet.				
I use the internet to search for information				
I can save and organize information				
I am familiar with basic word processing				
I can use simple image tools to edit and save pictures				
I can locate checklists and websites to help me evaluate which technology is developmentally appropriate				
I use checklists and reviews to evaluate children's apps and sites before use				

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Application Stage					
	Beginner	**Advanced Beginner**	**Intermediate**	**I can do it!**	**Expert**
I use word processing tools for communication, curriculum and professional development activities					
I can use email with families and create simple newsletters					
I can create blogs and/or websites for communicating with parents and other professionals					
I can access and use digital tools to develop curriculum and assess children's development					
I regularly search sites that offer developmentally appropriate ideas for creating lesson plans and teaching					
I use software, apps, and web tools that provide developmentally appropriate activities for children					
I conduct assessments of children using technology					
I can locate information on developing and using appropriate assessments					
I use digital tools for assessment including databases, checklists, portfolios, and online evaluations					

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Integration Stage: Teacher focus	Beginner	Advanced Beginner	Intermediate	I can do it!	Expert
I can integrate technology for curricula development, learning environment, assessment and family communication by using a variety of digital tools,					
I integrate technology into my classroom practices as one of many teaching tools used					
I help others new to technology and share information on new technologies and integration with colleagues					
I use internet searches and other professionals to find solutions to basic hardware and software issues					
I know and use digital tools to develop a personal learning network for professional development					

Integration Stage: Child Focus	Beginner	Advanced Beginner	Intermediate	I can do it!	Expert
I select, evaluate and use appropriate technology for children in my classroom					
I provide open-ended, creative and collaborative activities for children involving technology					
I plan digital activities for children that involve problem-solving, creativity, and skill development					
I provide appropriate differentiation and communication in regard to technology in the classroom for children and families					
I can locate sites and digital information to understand and assist children in an appreciation					

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

of diversity
I can locate sites and digital information to provide appropriate differentiation for children and families
I provide opportunities for children to learn about digital citizenship

Equilibration Stage					
	Beginner	**Advanced Beginner**	**Intermediate**	**I can do it!**	**Expert**
I incorporate technology into classroom teaching in multi-dimensional ways using a variety of hardware, software, internet and web tools					
I have a system to routinely locate and access information on the use and integration of technology in the early childhood classroom					
I frequently take advantage of professional development opportunities to learn more about technology and integration					
I share learning about technology with colleagues in formal and informal settings					
I act as mentor to other teachers in use of technology					
I use action research is used to evaluate the effectiveness of new digital media in the classroom and to plan and modify my curricula					

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

ECE Technology Integration Stages Web Resources

Resources for Recognition Stage Skills Development

http://www.naeyc.org/DAP
http://www.naeyc.org/yc/files/yc/file/201209/Cluster_Resources_0912.pdf
http://www.researchconnections.org/content/childcare/find/
http://www.naeyc.org/content/technology-and-young-children
http://www.highscope.org/file/NewsandInformation/Extensions/ExtVol28No1_low.pdf

Research
http://www.techandyoungchildren.org/research.html
http://www.isbe.net/earlychi/preschool/preschool_tech.htm

Video examples
http://teccenter.erikson.edu/category/show-me-videos/ https://www.youtube.com/user/eriksonteccenter
http://www.naeyc.org/content/technology-and-young-children/resources

Technology Tools
http://fg.ed.pacificu.edu/cldc/bestpractices.html
http://www.educatorstechnology.com/p/teacher-guides.html
http://www.fredrogerscenter.org/media/resources/Tech_Integration_Checklist_-_Final.pdf
http://www.naeyc.org/yc/article/finding-education-in-educational-technology

Resources for Application Stage Skills Development

http://thejournal.com/Articles/2005/06/01/20-Technology-Skills-Every-Educator-Should-Have.aspx?p=1
http://www.educatorstechnology.com/2012/06/33-digital-skills-every-21st-century.html
http://www.educationworld.com/a_earlychildhood/archives/activity.shtml
http://iws.collin.edu/shirschy/Teacherlinks.html
Pinterest (https://www.pinterest.com/) search "Early Childhood Curriculum ", "Early Childhood Assessment", and "Early Childhood and Technology"

Assessment
http://www.naeyc.org/files/naeyc/file/positions/CAPEexpand.pdf
http://www.k12.wa.us/earlylearning/pubdocs/assessment_print.pdf
http://technologyinearlychildhood.com/2013/06/06/using-digital-tools-to-create-a-portfolio-for-your-students/
https://www.youtube.com/watch?v=Th-5I-QKJK4

Resources for Integration Stage Skills Development

Family Communication
http://www.educate.ece.govt.nz/learning/exploringPractice/ICT/LinksToFamiliesAndICT.aspx
https://www.naeyc.org/files/yc/file/200909/Ten%20Tips%20for%20Involving%20Families.pdf
http://www.pbs.org/parents/childrenandmedia/article-when-introduce-child-smartphone-tablet.html

Integration
https://ecetechshowcase.wikispaces.com/TechToolsNAEYC13
http://www.naeyc.org/yc/files/yc/file/201205/McManis_YC0512.pdf
http://www.fredrogerscenter.org/media/resources/Tech_Integration_Checklist_-_Final.pdf

PLN (Personal Learning Networks)
http://www.educatorstechnology.com/2012/11/teacher-tutorial-on-creating-personal.html

Essential Reading in Technology and Early Childhood
http://teccenter.erikson.edu/wp-content/uploads/2014/09/Essential-Readings-on-Tech-in-the-Early-Years.pdf

Child Focus
http://childrenstech.com/
https://www.commonsensemedia.org/
http://www.edutopia.org/blog/coding-for-kindergarteners-sam-patterson
http://www.cec.sped.org/~/media/Files/Professional%20Development/ParetteBlum.pdf

Resources for Equilibration Stage Skills Development

Media Research

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

http://cmch.tv/

Technology Integration
https://globalearlyed.wordpress.com/
http://cooltoolsforschools.wikispaces.com/

Professional Development
http://www.iste.org/
http://www.eetcconference.org/
http://www.ecetech.net/techspirations/ecetechchat-on-twitter/
http://www.fredrogerscenter.org/blog/
http://edublogs.org/blog-directory/directoryteched/

Action Research
https://mindmaps.wikispaces.com/Action+Research+and+Technology

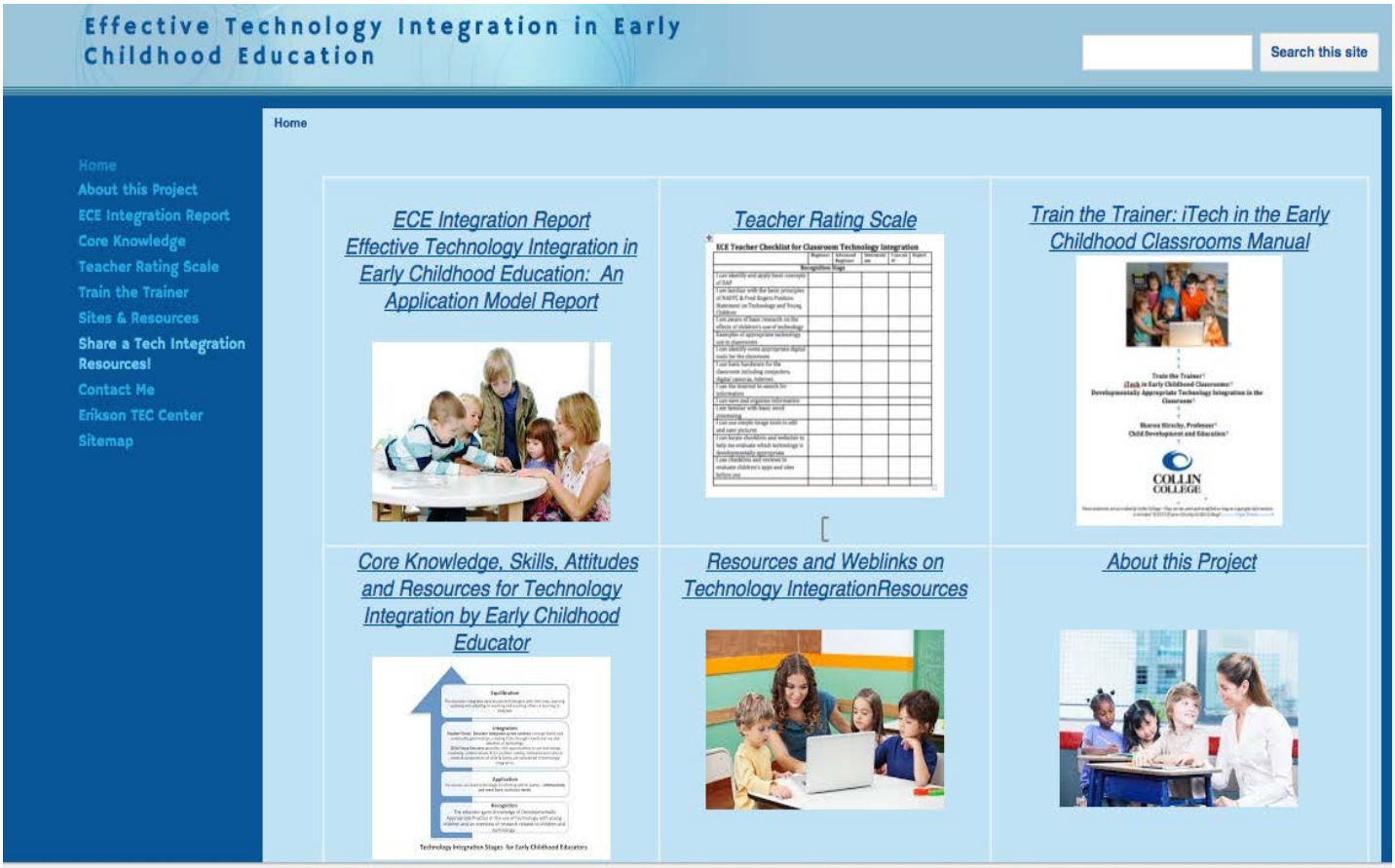
Mentoring
http://earlylearningtexas.org/media/23607/0_final_texas_mentoring_7-8-13.pdf

An online form of this checklist is available at:
https://docs.google.com/forms/d/1EK_JpdrJMaPR5VuxzdDAtgdltX9YCbg2BhDePoRGoYQ/viewform?usp=send_form

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Website with Train-the Trainer and other Materials Developed during the Sabbatical for Early Childhood Education

https://sites.google.com/site/ecetechintegration/



©2015 Sharon Hirschy/Collin College.

Appendix C

Sabbatical Summary Presented to the Technology Committee

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

Technology as a Teaching Methodology in Higher Education: Utilization Versus Integration
Sabbatical Summary: Sharon Hirschy

Technology increases higher education faculty productivity, grading accuracy, and communication. However, utilization of technology is not the same as integration. Integration of technology involves incorporating it as part of teaching methodology and philosophy.

Best practices for Higher Ed integration of technology in classrooms from the research literature:

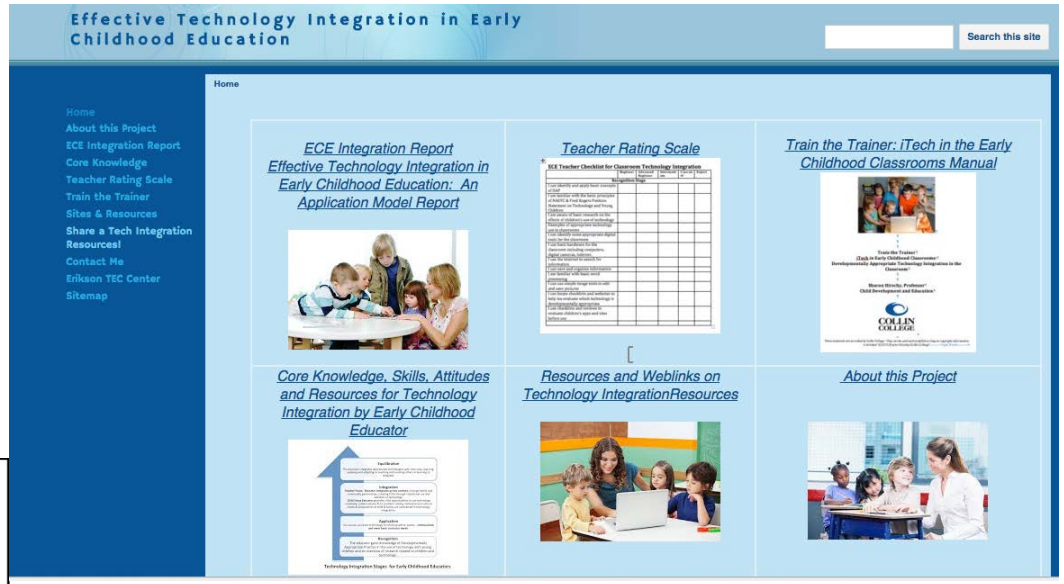
1. Conducting surveys to determine faculty needs (Browne, 2011; Venkatesh, et. Al. 2003)
2. Providing multiple methods competency building: mentors, small group training, websites, ongoing instructional support, and sabbaticals to enable faculty to integrate technology
3. Modeling by faculty and providing training on the use of equipment in the classroom
4. Peer mentors and small group sessions on technology integration that are division/discipline-specific and that meet specific instructional outcomes
6. Focus on course development and learning outcomes rather than faculty development
7. Project-based training and workshops that incorporate both training on digital tools and the implementation of the tools in specific courses, along with hands-on experience with the tools
8. Mini-grants/Sabbaticals focused on technology

Recommendations:

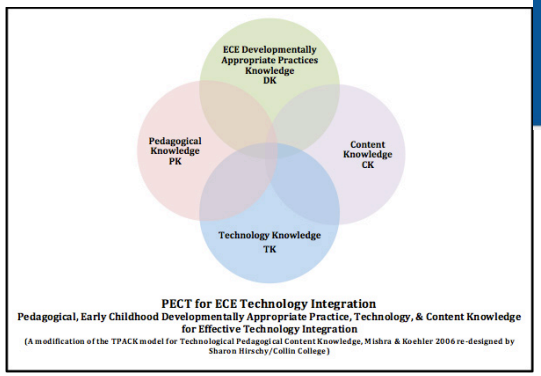
1. **Faculty mentors**: One or two faculty members who demonstrate ability/interest in technology integration could be identified for each division and receive a stipend to support faculty technology integration. Their responsibilities could include;
    a. Needs assessment of the division faculty , small group informal training or access to online training on how to integrate a specific technology tool based on identified needs, encouraging faculty to share best practices through social media and/or digital resources, developing a webpage of web 2.0 tools, tutorials and digital resources . These faculty members could work under the direction of the eLC instructional designers. However, since their duties are already overwhelming, a faculty member could receive a course release to oversee the program and report to the eLC administrator. The Social Science Division is currently considering a proposal to create a pilot project to address this.

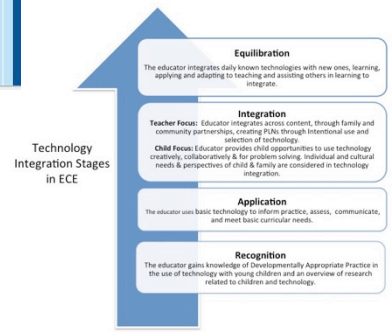
©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/

2. **Workshops and web resources**: Offered by instructional designers or experts focusing on integrating technology based on learning outcomes. EdCamps in which faculty informally meet in a workshop setting to train each other in the use of specific digital tools .
3. **Online video training on technology use and integration:** While there are some videos on online training offered by the eLC for faculty, they are primarily to assist in the use of BlackBoard. Videos or simple explanations in the use of web tools that can enhance instruction could be created and maintained on the eLC website. Faculty could be encouraged to submit their own tools and ideas on how technology could be integrated to promote learning.
4. **Innovative use of technology by faculty could be encouraged:** Faculty members currently go before the Technology Committee when they want to introduce new technology into the classroom. But the process to get approval is not easily identified for faculty. A form on the eLC website that faculty could fill out to make a request would allow more innovation in the classroom.
5. **Support the use by faculty of tablets in the classroom for instruction:** 77% of community college faculty members are using tablets for instruction and/or preparation,. Wireless reconfiguration could allow faculty to project from their tablet to the front of the classroom, to interact and dialog with students while teaching. Offering mobile carts for checkout with tablet devices would be another way of encouraging technology integration in the classroom.
6. **Support for attendance at conferences and online courses that focus on technology integration**: There are several conferences around technology integration. There are also an abundance of online training courses, web conferences, etc. in which faculty could receive reimbursement above and beyond a discipline specific conference which they can attend yearly.
7. **Study and evaluation of the college technology systems and infrastructure to identify the most effective methods of serving faculty needs, including processes for requesting new technology and assistance.**



https://sites.google.com/site/ecetechintegration/





- The website and materials have received national recognition from the Fred Rogers' Center and has been featured by the Erikson Technology Integration Center on their website
- An article has been accepted for publication this summer by the Texas Child Care Quarterly
- Presentations have been or are scheduled to be made this summer at the Texas Computer Educators Association, Technology for Tots Conference, and the National Association for the Education of Young Children Professional Development Conference, and the Texas Association of Administrators and Supervisors of Programs for Young Children on the materials

©2015 Sharon Hirschy/Collin College. https://sites.google.com/site/ecetechintegration/