

Information and Communication Technology (ICTs) in Education: The Contribution of Communities of Practice

A Brief Review

Kassimu A. Nihuka

Institute of Continuing Education
The Open University of Tanzania

kassim.nihuka@out.ac.tz

Abstract: *This article discusses the available literature related to the contribution of communities of practice to professional development of teachers on Information and Communication Technologies (ICTs) integration in education. A systematic retrieval of literature was conducted in order to identify characteristics of communities of practice that contribute to effective teacher learning. Among other things, findings reveal that communities of practice have the potential in promoting teacher competence on ICT integration. Unlike the traditional workshops and seminars, teachers in community of practice learn about technology integration in teaching processes, pedagogy and instructional design, and curriculum (re)design. In terms of characteristics, the review established that communities of practice are effective if characterized by (i) school-based training of teachers about innovation blended with workshops or seminars and (ii) allows collaboration among teachers. It is concluded that professional development programs that consider communities of practice and characterized by school-based training, blended with workshops or seminars and allow virtual or physical collaboration among teachers have the potential in contributing to teacher learning on ICT integration in education.*

Keywords: Collaborative Learning, Communities of Practice, Design Teams, Information & Communication Technology, Professional Development and Teacher Learning.

INTRODUCTION

Technology integration in education in Tanzania's context is an inevitable endeavor which poses great challenge on the existing curriculum and teachers' professional competence. This is because technology integration in education exerts more pressure on curriculum (re)design at different levels of education and on teachers' pedagogical-content-knowledge and skills (PCK & S). In this case teacher learning through appropriate professional development program is necessary to

make teachers effective enough in integrating technology in their teaching and learning.

Traditionally, teacher learning takes place through workshops and seminars after which teachers return to their institutions (Voogt, Almekinders, Van den Akker, & Moonen, 2005). This situation which is also true in the context of Tanzania have shown to be ineffective in promoting teacher learning because most teachers may or may not use what they have learned during workshop or seminar in their real situations. It is argued that such workshops and seminars lack follow up by coaching, peer visits and collaborations with colleagues or experts (Joyce & Showers, 1995). Moreover, workshops and seminars are not promising approaches because they do not combine aspects of curriculum (re)design, innovation (e.g. technology) integration, teacher learning and the necessary workplace-based support. According to Nieveen, Handelzits and Van den Akker (2005) and Wentworth and Earle (2004) professional development programs that integrate aspects of collaboration through communities of practice are effective in contributing to teacher learning about technology integration in teaching and learning. The collaboration can be from within a locality (Fairbanks, Freedman & Kahn, 2000; Peacock & Rawson, 2001) or virtually through networking (De Moor & Weigand, 2005; Hezemans & Ritzen, 2004; Johnson, 2001; Lieberman, 2000).

This article discusses the available literature related to the contribution of communities of practice to professional development of teachers on information and communication technology integration in the teaching and learning. This topic is relevant for Tanzania's education system because the findings are likely to inform on how to organize effective in-service arrangements for professional development of teachers so as to improve their competences on technology integration in education.

The following main question was formulated in order to guide retrieve of relevant literatures to adequately address the purpose of the study: what characteristics of communities of practice contribute to effective teacher professional learning about ICT integration in education? The following specific sub-questions were used:

- How are communities of practice conceived?
- How are communities of practice normally organized?
- What do teachers actually learn in communities of practice?
- What are the implications of the study to teachers' professional development in Tanzania's context?

METHODOLOGY OF LITERATURE SEARCH

The study involved retrieving of literature from education databases including; Eric, piCarta, Scopus, PsychoINFO, Google, Google scholar, Web of science and Science Direct. Keywords such as design teams, communities of designers, teacher learning, collaborative learning, professional development, in-service, peer collaboration, communities of practice and learning communities were used in searching for literatures. Reference lists of the articles were also used to identify more relevant literatures which could be retrieved from search engines to add to the literatures. It was found that the topic is widely researched especially in areas of professional development and teacher learning, communities of practice and professional learning, and professional development and school development. Despite the fact that most of the studies are reported from developed countries, they still provide useful lessons for developing countries such as Tanzania.

FINDINGS

The Concept of Communities of Practice

The first question aimed at determining how communities of practice are conceived by various authors in the existing literature. The literature portrays mixed feelings on the conception of communities of practice. For example - on one hand - West (2007) conceives communities of practice as being fussy and ill-defined. According to West, the current definitions lack theoretical underpinnings. On the other hand, other scholars provide very vigorous definitions of communities of practice (e.g. Barab & Duffy, 2000; Barab, MaKinster & Swcheckler, 2004; Lave & Wenger, 1991; Looi, Lim & Chen, 2008). They describe communities of practice as groups of professionals who share a concern, a set of problems, or passion about a topic, and who deepen their knowledge and expertise in their academic areas by interacting on an ongoing basis (Wenger, McDermott & Snyder, 2002). Such communities may have different characteristics depending on whether such communities are educational or non-educational.

Another definition is suggested by Barab and Squire (2004). These scholars conceive a community of practice as a persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and experiences focused on a common practice and / or mutual enterprise. It is a practice that binds the individuals (education professionals) into a collective whole, rendering a community its character, activities and even its idiosyncrasies (Looi et al., 2008). Moreover, Looi et al contend that, members in a community of practice share stories problematize work-

related issues and actively construct knowledge on how to improve their own professional practices.

Generally, central to all surveyed definitions is learning and collaboration since professionals learn and share knowledge and skills about their specializations (i.e. subject matter) and the methods or procedures (such as pedagogy for teachers) related their professions. Additionally, communities of practice advocate a whole-person developmental approach in a social environment and interact with colleagues and support each other continuously to improve their educational practices in the institution.

The Drive for Teacher Professional Learning

The need to integrate technology in education is a critical drive behind the need for effective teacher professional development programs. It is important to appreciate that technology has become part of practices in education in the developed world and quite recently in the developing world as well.

There are several reasons which explain why universities need to integrate technologies (Fisser, 2001), which include government and policy, demographic changes, market forces, knowledge economy, internationalization of higher education and lifelong learning. In terms of government and policy, it is established in the literature (e.g. Gornitzka & Maassen, 2000 cited in Fisser, 2001) that the role of governments in supporting universities is decreasing. Consequently universities tend to move towards integrating technologies so that they deliver competent service to the market and thus responding to the needs of clients.

The second reason for technology integration is the desire by universities to respond to demographic changes of students. It is argued in Collis and Moonen (2001) that demographic changes of students have an influence on both the increasing demand for higher education and on the composition of students' population. This makes universities invest a lot in technology in order to make education more flexible to a wider range of varied students' characteristics.

The issue of market is a third critical reason. According to Meek and Wood (1998) higher education should be relevant to the labor market and needs of future students. It is argued by Fisser (2001) that students of the future will be learners that are more mature and can relate their learning to professional and life experiences. Response to the knowledge economy is a fourth reason that influences universities to integrate technologies. This means that since economies depend on the

development and application of new knowledge, then education and technology are needed to obtain the necessary knowledge. According to Gibbons, Limoges, Nowotny, Schwartzman, Scott and Trow (1994) students acquire appropriate skills for the knowledge economy context which need to be reflected in higher education curriculum, in its content, structure, length and mode of delivery.

The fifth reason is internationalization of higher education where education becomes a cross-border activity in which the use of technology then plays an increasing important role. For this reason universities find themselves integrating technologies in their operations including delivery of courses and programs. The last but not least reason for integrating technologies in higher education is a response towards lifelong learning (Fisser, 2001). To realize lifelong education, the use of some forms of information and communication technologies is necessary.

Based on the highlighted reasons, studies reveal that many universities in the developed world have made a move towards ICT integration in education delivery (e.g. De Boer, 2004; Fisser, 2001; 2006). Similar initiatives are also reported in some universities in developing world (e.g. Aguti & Fraser, 2007; Nihuka, 2011; Nnafie, 2002; Sife, Lwoga & Sanga, 2007; Siritongthaworn, Krairit, Dimmitt & Paul, 2006). However challenges of knowledge and skills of teachers and students, management perceptions, ICT infrastructure, institutional conditions, supports structures for teachers and students and many others remains quite important for successful integration of technologies in education.

Organization of Communities of Practice

The second question sought to understand how communities of practice are normally organized. It was found from literature that communities of practice are organized differently (DeVries & Pieters, 2007; Harvey, 1999; Mishra, Koehler & Zhao, 2007; Nieveen, Handelzalts, Van den Akker & Homminga, 2005; Thijs & Van den Berg, 2002; Voogt, Almekinders, Van den Akker & Moonen, 2005). Such arrangements include (i) in-service and (ii) teacher design teams.

In-Service

The use of in-service arrangements for professional development of teachers is widely reported in the literature (e.g. Thijs & Van den Berg, 2002; Kitta 2004; Mafumiko, 2006; Voogt et al., 2005). In-service arrangements provide opportunities for teachers to learn through collaboration and practice of the profession in their workplaces. Considering in-service which is reported by Voogt et al. (2005), the

arrangement was a professional development strategy that was developed so that teachers can learn how to integrate technology in their teaching through collaboration. It involved alteration of short workshops with periods in schools during which the participating teachers could communicate with each other and exchange materials.

The activities and routines during in-service arrangement reported by Voogt et al., (2005) involved (i) familiarization of basic technology skills so that every teacher has the same level of technology proficiency and (ii) practicing integration of technology in their classroom and reflect on their experiences. The said in-service arrangement was effective in terms of contributing to teacher learning because it provided collaboration during workshops and also during real-time teaching in classrooms. A similar situation is shared in several other previous studies (McLaughlin & Talbert, 1993; Nieveen, Handelzalts & Van den Akker, 2005; Wentworth & Earle, 2004).

It is concluded therefore that collaboration (a feature of communities of practice) enhances effectiveness of in-service arrangements which in turn helps teachers acquire competence in innovation (e.g. technology) integration in education. Therefore, in addition to workshops, effective in-service must consider both, collaboration (through communities of practice) and workplace-based support for teachers. Also, concrete activities must be identified for in-service arrangement (preferably quite in advance) for teachers to practice and learn from.

Teacher Design Teams

Communities of practice can also be organized through teacher design teams. Teacher design teams (Nieveen et al., 2005) or communities of designers (Mishra, Koehler & Zhao, 2007) are groups of teachers of adjacent subjects who cooperate in order to renew and redesign their curriculum for technology integration and develop themselves professionally.

Design teams may have a quite varied number of participants with two as minimum. Design teams are organized in order to allow teacher collaboration which helps them integrate technologies in education. Design teams may have a coach as an expert (in pedagogical content knowledge and curriculum) as facilitator and resource person (Nieveen et al., 2005). The couch is also responsible for overall facilitation and coordination of the teams. Couches of each team could meet regularly in order to exchange ideas, discuss problems and needs and to serve as platform to come to some convergence in the innovation.

The major activities in design teams include re-examining joint domain curriculum and work together to redesign, test and implement the renewed common curriculum of their domain. It should be noted that teacher design teams are quite effective in helping teachers integrate curriculum development, teacher development and school development towards technology integration in education.

In both cases (in-service arrangements and teacher design teams), four types of collaborations are obvious, namely: storytelling, helping each other, sharing of ideas and experiences and joint working (Little (1997). According to Little, educational institutions that aim at technology integration need teachers who work together on innovation through in-service arrangements and / or teacher design teams where they have opportunity to reflect on and learn from their experiences.

Teacher Learning in Communities of Practice

The third question aimed to gather evidence from literature that demonstrates what teachers actually learn as a result of participation in communities of practice (i.e. participation in in-service arrangements and teacher design teams). It has been found that the common skills and knowledge that teachers learn in a community of practice include technology integration in teaching processes, pedagogy and instruction design, and curriculum (re)design (Desimone et al, 2002; Garet et al, 1999; Jonathan & Herbert, 2000; Mafumiko, 2006; Mishra et al., 2007; Kitta 2004; Tilya, 2003; Thijs & Van den Berg 2002; Voogt et al., 2005).

In terms of helping teachers to integrate technology in their teaching processes, Voogt et al., (2005) reported that in-service arrangement that include workshops and real-time teaching in classrooms are effective at impacting teacher learning. Specifically, Voogt et al demonstrated that teachers learned how and when to integrate technology in their teaching. Similar results are also confirmed in a study by Mishra et al. (2007) who reported that as a result of collaborations in teacher design teams, teachers in their teams produced products that were subsequently used in teacher education programs which are a good indication of technology integration and teacher education.

The opportunities to collaborations (through communities of practice and in-service arrangement) and real-time teaching in classrooms are effective at improving teachers learning in terms of pedagogy and instruction design. Based on the activities in design teams teachers acquire new subject- and pedagogy-related insights (Nieveen et al., 2005). Moreover, Nieveen et al found that teachers can make explicit

lesson plans which integrate technology and discuss them with colleagues for improvements.

In terms of improving instructional strategies among teachers, Jonathan and Herbert (2000) confirmed that the amount of participation in professional development (i.e. in-service arrangement and communities of practice) were statistically associated with both greater teacher use of innovative teaching. Specifically they found that on average, teachers with no professional development. Same conclusions are shared with Borko (2004); Desimone et al (2002) and Garet et al., (1999).

Teachers perceive the pedagogical aspects related to the integration of technology as an important learning outcome (Voogt et al., 2005). Interactions in communities of practice improve teachers' skills and knowledge on curriculum (re)design for technology integration. According to Nieveen et al. (2005) teachers in in-service arrangements and in design teams make joint efforts to formulate a tentative curriculum based on reflection, exchange and deliberations.

IMPLICATIONS FOR TEACHERS' PROFESSIONAL DEVELOPMENT IN TANZANIA

Based on the findings discussed in this article and own experience on Tanzania's educational context, the following are the implications of the findings for teacher education and professional development arrangement in Tanzania: First, in order to have a significant impact on teacher learning, there is need to abandon the one-time workshop and seminar-based professional development arrangements which are highly criticized for their ineffectiveness. Such arrangements need to be systematically complemented with the concept of communities of practice which have the potential in allowing teachers' collaboration at the level of department, faculty or institution. Literature has shown that communities of practice are powerful approaches towards effective technology integration in education. Coupled with appropriate technical support for teachers, the approach reduces the inertia for technology adoption among teachers.

The other implication is about the importance of organizing professional development programmes in a real setting of teachers and education (situated learning). Education institutions need to invest into professional development programmes through in-service arrangements and teacher design teams. This way, teachers collaborate and help each other towards adoption of specific technologies to enhance education delivery. Moreover, collaboration in in-service arrangements and design teams allows meaningful teacher learning and provides opportunity to

relate own experiences and context to the learning process. Consequently, teacher learning in terms of technology integration, pedagogy and instruction and curriculum design get improved.

The question of culture and how they relate to characteristics of communities of practice and their effectiveness is another critical implication. Communities of practice often need be characterized by shared vision, sense of belonging to the community, shared practice and readily access to each other (West, 2007). However, effective interaction and collaboration among members of a community can somehow be impaired by cultural believes of members. For example the issue of readily access to each other can be greatly hampered between young and old teachers who participate in the same in-service program or design team. The question of gender stereotypes and gender relations can also have an influence in terms of practices in communities of practice. In this case male participants can dominate a community of practice more than their female colleagues. This can result to different learning outcomes among teachers. Hierarchical power difference between members of a community is another cultural difference that need be considered. For example a head of department and an ordinary teacher participating in a design team may not collaborate fruitfully in a community of practice. It is suggested therefore that such cultural orientations need be harmonized and considered accordingly so that they merge the differences for fruitful teacher learning. This will result to the realization of effectiveness of professional development arrangement through communities of practice.

DISCUSSION AND CONCLUSION

This article has presented the contribution of communities of practice on teacher learning about technology integration in teaching and learning. In this article the concept of communities of practice have been used to refer to groups of teachers who share a concern, a set of problems, or passion about a topic, and who deepen their knowledge and expertise in their academic areas by interacting on an ongoing basis. Communities of practice must include workshops or seminar that aim at (i) introducing teachers to the kinds of technologies they are expected to integrate in education and (ii) the holistic view of implementation strategies. Members in a community of practice are expected to share emotional feelings, mental and functional responsibilities. Principally, communities of practice can be used to enhance the effectiveness of in-service arrangements and teacher design teams by allowing collaborations and interactions.

Central to in-service and design teams is collaboration, peer coaching and team working towards technology integration. As a result, teachers learn different things in a community of practice which include technology integration in teaching processes, pedagogy and instruction and curriculum design.

The following are some of the characteristics of communities of practice which contribute to effective teacher learning:

- First, communities of practice are characterized by workplace-based training of teachers about technology integration. This way, teachers find easy to relate new pedagogical-content-knowledge they learn in the training to real setting. This kind of situated learning can quite easily transform teachers to new ways of teaching using technologies.
- The second characteristic is that, for workplace-based training to be effective, they need to be blended with workshops and / or seminars. In this case, the idea of formulating communities of practice becomes critical. This ensures teachers a continuous support from an experienced teacher or expert. Additionally, teachers get opportunity to practice what they have learned in an in-service training into real educational settings.
- The third characteristic is that members in a community of practice need to communicate and collaborate with each other through the use of technology or in a traditional way. This allows teachers (members of a community of practice in this case) to share, reflect, and collaborate with colleagues easily regardless of geographical location.

It is concluded therefore that professional development programs that are organized around communities of practice and are characterized by school-based training, blended with workshops or seminars and allow virtual or physical communication among teachers (members) have the potential in contributing to teacher learning in terms of technology integration, improvement of pedagogy and instruction designing, and curriculum designing. Communities of practice are not hype.

References

- Aguti, J. N., & Fraser, W. J. (2006). Integration of information communication technologies (ICTs) in the distance education Bachelor of Education Programme, Makerere University, Uganda, *Turkish Online Journal of Distance Education*, 7(3), 89-104.
- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, 13(1), 1-14.

- Borko, H. (2004). Professional development and teacher learning; Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Routledge.
- Coppola, Christopher D. (2005) "Will open source unlock the potential of e-learning?", *Campus Technology*. (Retrieved on February 11, 2008 from <http://www.campus-technology.com/print.asp?ID=10299>).
- Clement, M., & Vandenberghe, R. (1999). Teachers professional development; Solitary or collegial (ad)venture? *Teaching and Teacher Education*, 16 (2000), 81-101.
- De Vries, B., & Pieters, J. M (2007). Exploring the Role of Communities in Education. *European Educational Research Journal*, 6(4),382-392
- De Boer, W. (2004). Flexibility support for a changing university, Doctoral Thesis at University of Twente, Enschede.
- De Moor, A & Weigand, H. (2005). Communication Pattern Analysis in Communities of Practice. *The Language Action Perspective on Communication Modelling*, 23 - 29
- Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birmanand, B. F. (2004). Effects of Professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis*, 24(2), 81-112.
- Fisser, P. (2001). Using ICT in higher education. A Process of change in higher education, Doctoral Thesis at University of Twente, Enschede.
- Garet, M. S., Birman, B. F., Porter, A. C., Desimone, L., & Herman, R. (1999). Designing effective professional development: Lessons from the Eisenhower program (and) technical appendices. US department of education.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P. & Trow, M. (1994) *The New Production of Knowledge: the dynamics of science and research in contemporary societies*. London: Sage.
- Gornitzka, A., & Maassen, P.A.M. (2000). Hybrid steering approaches with respect to higher education, *Higher Education Policy*, 12(1), 267-285.
- Gustafson, C. B. (2004). Building Professional Learning Communities. Retrieved on 21 November, 2007 from <http://www.nsd.org/standards/learningcommunities.cfm>
- Harvey, S (1999). The impact of coaching in South African primary science InSET. *Int. J. of Educational Development*. 19 (1999) 191-205
- Hargreaves, A. (2003). *Teaching in the knowledge society. Education in the age of insecurity*. New York: Teacher College Press.
- Hezemans, M., & Ritzen, M (2004). Communities of practice in higher education

- Hord, S. (2004). *Professional learning communities: Communities of continuous inquiry and improvement*. Austin, Tx: Southwest Educational Development Laboratory
- Joyce, B., & Showers, B. (1995). *Student achievement through staff development: Fundamentals of school renewal* (2nd ed.). White Plains, NY: Longman.
- Jonathan A. S & Herbert M. T. (2000). The Effects of Professional Development on Science Teaching Practices and Classroom Culture. *Journal of Research in Science Teaching*, 37(9), 963-980.
- Johnson, C. M. (2001). A survey of current research on online communities of practice. *Internet and Higher Education* 4 (2001) 45-60
- Kitta, S. (2004). *Enhancing mathematics teachers' pedagogical content knowledge and skills in Tanzania*. Doctoral thesis, Twente University. The Netherlands
- Krecic, M. J., & Grmek, M. I. (2007). Cooperative learning and team culture in schools: Conditions for teachers' professional development. *Teaching and Teacher Education*, 24 (2008) 59-68.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press
- Lieberman, A., & Miller, J. (2004). *Teacher Leadership*. Jossey-Bass
- Little, J. W. (1990). The persistence of privacy: Autonomy and initiative in teachers' professional relations. *Teachers College Record*, 91, 509-536.
- Lieberman, A (2000). Networks as Learning Communities: Shaping the Future of Teacher Development. *Journal of Teacher Education* 2000; 51; 221
- Looi, C., Lim, W., & Chen, W. (2008). Communities of practice for continuing professional development in the twentieth-first century. In J. Voogt and G. Knezek (eds.). *International Handbook of Information Technology in Primary and Secondary Education*, 489-506.
- Mafumiko, F. (2006). *Micro-scale experimentation as a catalyst for improving the chemistry curriculum in Tanzania*. Doctoral thesis, Twente University. The Netherlands
- Meek V.L., & Wood, F.Q. (1998). Higher education governance and management: Australia. *Higher Education Policy*, 11(2/3), 165-181.
- McLaughlin, M., & Talbert, J. E. (1993). *Contexts that matter for teaching and learning: Strategic opportunities for meeting the nation's educational goals*. Stanford, CA: Center for Research on the Context of Secondary School Teaching, Stanford University.
- Mishra, P., Koehler, M. J., & Zhao, Y. (2007). Communities of designers; A brief history and introduction, 1-19

- Nieveen, N., Handelzalts, A., Van den Akker, J., & Homminga, S. (2005). Teacher design teams: A scenario for school-based curriculum innovation. Paper presented at the ECER 2005, Dublin, Ireland
- Nihuka, K. A. (2011). Collaborative course design to support implementation of e-learning by instructors. Doctoral thesis, University of Twente, Enschede - The Netherlands.
- Nnafie, I. (2002). Internet cafés in Dar es Salaam: Problems and opportunities. Master of Science Thesis, Eindhoven University of Technology.
- Paul, C. (2002). Literature Review; The impact of ICT on learning and teaching.
- Putnam, R. P., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning?. *Educational Researcher*, 29(1), 1-15.
- Peacock, A., & Rawson, B. (2001). Helping teachers to develop competence criteria for evaluating their professional development, *International Journal of Educational Development*, 21 (2001) 79-92
- Sife, A. S., Lwoga, E.T., & Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International Journal of Education and Development using Information and Communication Technology*, 3(20), 57-67.
- Siritongthaworn, S., Krairit, D., Dimmitt, N. J., & Paul, H. (2006). The study of e-learning technology implementation: A preliminary investigation of universities in Thailand, *Educational Information Technology*, 11(2006), 137-160
- Schlanger, M., & Fusco, J. (2004). Teacher professional development, technology, and communities of practice: Are we putting the cart before the horse? In S. Barab, R Kling, and J. H. Gray (eds.), *Designing for virtual communities in the service of learning*, New York: Cambridge University Press, 120-153.
- Smart, K. L., & Cappel, J. J. (2006). Students' perceptions of online learning: A comparative study. *Journal of Information Technology Education*, 5(2006), 201-219.
- Tilya, F. (2003). Teacher support for the use of MBL in activity-based physics teaching in Tanzania. Doctoral thesis, Twente University. The Netherlands.
- Thijs, A., & Van den Berg, A (2002). Peer coaching as part of a professional development program for science teachers in Botswana. *International Journal of Educational Development*, 22 (2002) 55-68

- Voogt, J., Almekinders, M., Van den Akker, J., & Moonen, B. (2005). A blended in-service arrangement for classroom technology integration: impacts on teachers and students. *Computers in Human Behavior*, 21 (2005) 523-539
- West, R. E. (2007). A Framework for defining and researching the boundaries of learning communities. Paper presented at the 2007 conference of the Association for Educational Communications and Technology in Anaheim, CA.
- Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice*. Boston, MA: Harvard Business School Press