CATHOLIC EDUCATION
WESTERN AUSTRALIA

IMPLEMENTING NEW TECHNOLOGIES TO ENHANCE PROFESSIONAL LEARNING

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Introduction

The job of a teacher has never been more complex (Bryk, 2015). School curricula have deepened and expanded to encompass academic skills and non-cognitive and social-emotional capabilities. Schools are serving more diverse communities in which more families are struggling. Teachers collaborate with a range of service providers, specialists and coaches to plan and tailor instruction based on rich and increasing student data. Initial teacher preparation and induction programs have evolved, but expectations have grown for practicing teachers to learn more. Kools and Stoll (2016) acknowledge "teachers are not developing the practices and skills required to meet today's learners' diverse needs" and that a collaborative approach should be considered.

In the US, UK, and Australia, average primary schools have 300-500 students, while average secondary schools have 700-900 students (US Department of Education, 2012; Australian Bureau of Statistics, 2013; ONS Annual Abstract of Statistics, 2016). At this scale, the range of expertise needed in today's complex schooling context cannot reasonably be resident in each school. Thus, a collaborative networked approach to professional learning is necessary to scaffold each teacher's continual learning, enabling her to acquire, apply and reflect on a range of effective approaches for all students.

This chapter synthesizes key research-based approaches to building educator capacity in ways that embed professional learning as part of rather than apart from practice by leveraging digital environments for collaborative learning. Topics include digital Communities of Practice, teacher inquiry, and applying analytics to improve learning.

Rationale

Networks of educators who focus on effectiveness and improvement of student outcomes can join together around shared approaches to inquiry with researchers to "learn faster how to improve" (Bryk, 2015, p. 473). New opportunities are available for schools to leverage powerful digital learning environments to become effective learning organizations that have agility in a complex environment.

Organisation for Economic Cooperation and Development (OECD) defines learning organizations as schools that have "the capacity to change and adapt routinely to new environments and circumstances as its members, individually and together, learn their way to realising their vision" (Kools & Stoll, 2016, p.5). A learning organization practices continuous embedded

learning that includes team learning and collaboration among staff in a culture of inquiry, innovation and exploration with and from the external environment. Building, sustaining and scaling a school as a learning organization is only possible using networked professional learning approaches. If it is large enough, a school's specialized programs can be considered as learning organizations within the school. Smaller single stream schools can join in the distributed education community in a school system learning organization, and benefit from virtual professional learning communities (Trust & Horrocks, 2016).

Effective professional learning can significantly improve student learning (Timperley, Wilson, Barrar, & Fung, 2007). Further, for teachers of students with specific needs, increased professional learning in tailoring instruction is found to be positively associated with teacher efficacy which is an important dimension in implementing differentiation (Dixon, Yssel, McConnell, & Hardin, 2014). A fundamental approach in effective professional learning is honing a teacher's skills to continually assess student progress, how teaching can adapt, and implement new practice informed by reflection and inquiry (Timperley, et al., 2007; Cole, 2012; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Cycles of inquiry-based professional learning are more likely to be effective when they are collaborative with peers and include practice-embedded strategies like observing exemplary teaching and leadership, and teacher feedback (Hattie, 2009). What differentiates top performing systems is practices founded in collaboration and feedback, inquiry based teaching, and conversations on pedagogy (Jensen, Hunter, Sonnemann, & Cooper, 2014). A recent review of the key school leader practices that influence student achievement showed that professional learning should focus on creating communities of practice that are job embedded, regularly occurring and include professional dialogue and examination of student work (Hitt & Tucker, 2016).
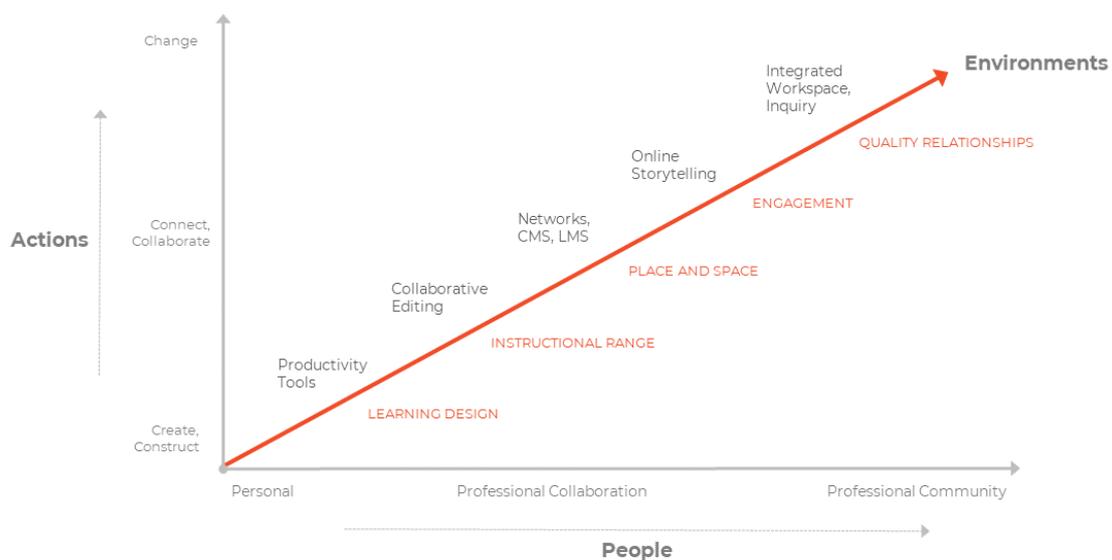
Networked Professional Learning

Collaborative professional learning ranges in scale. Sustained small-scale relationships include peer mentoring, coaching, and inquiry which can deeply influence practice for participants (Dana & Silva, 2009). As schools and systems work to address complexity by speeding and scaling classroom improvement, they are adopting sustained large-sale approaches including Communities of Practice (CoP) (Wenger, White, & Smith, 2009), Professional Learning Communities (PLC) (Hord & Roy, 2014), and Networked Improvement Communities (Bryk, 2015). All of these collaborative approaches are being practiced, enhanced and expanded using technology

(Cavanaugh, 2014). This section will explore promising digital approaches for collaborative professional learning.

The digital professional learning model in Figure 1 shows a continuum of professional learning, expressed on three dimensions. One dimension concerns people and the scope of their interactions, from individual to groups. The People dimension relates to educators and colleagues who may work and learn individually, in collaborative groups or in sustained communities. The second dimension addresses actions and scope of their impact, from creating to changing practices. The Action dimension includes activities beginning with creating teaching resources and experiences and continues to the impacts that educators can individually and collectively enable in schools. The diagonal dimension shows the digital environments that enable and expand the impacts of the people and their actions. The Environments dimension describes virtual tools and spaces where communities can effect varying levels of impacts in schools, This Person-Action-Environment (PAE) model for collaborative professional learning is influenced by current adaptive professional development research (Koellner & Jacobs, 2015) and human resource development perspectives (Manuti, Pastore, Scardigno, Giancaspro, & Morciano, 2015). Common examples of digital environments are provided at each step of the diagonal dimension.

People-Environment-Action Model

Next we explore how three effective collaborative professional learning approaches are enabled in digital environments for educators. We focus at the outer ends of the PEA continua, where Change, Community, and integrated Environments are maximized. Specially, we look at environments that support community inquiry for positive change in classrooms. The professional learning approaches that exemplify educator community inquiry are action research, Communities of Practice (CoP) and Professional Learning Communities (PLC).

Action Research in Digital Environments

Action research is established as a promising professional learning practice in education communities (Tomlinson, 1995). However, action research is often an isolated experience undertaken by individual teachers. In addition, action research has required teachers to organize their own records, artifacts, and reflections without a system designed specifically to support them. Recently, a collaborative digital action research environment has streamlined the process and connected teachers for a more powerful experience.

The five basic steps of an action research inquiry cycle are: identification of a question, description of the context, data collection, analysis, and the creation of findings to guide practice. In a digital collaborative action research community, teachers can connect across school and system boundaries even if local capacity for action research is limited or absent. An example of a digital action research environment is ARTI, Action Research for Technology Integration, developed initially as the central professional learning community within a statewide technology implementation (Dawson, Cavanaugh, & Ritzhaupt, 2012). In recent years, ARTI has grown globally to provide tens thousands of teachers and schools (1) an online scaffold for inquiry into their technology integration practices, (2) a mechanism to synthesize action research information from multiple teachers, and (3) a mechanism to capture evidence of student learning within technology integrated classrooms.

Each step in the ARTI system provides teachers with simple navigation mirroring the action research process, suggested timelines, clear instructions about the information being requested, a location to provide the necessary information, pointers to reading about each step, and an example to serve as a scaffold. Today's version of ARTI enables teachers to share their findings in a central database (Florida Center for Instructional Technology, 2017). Especially for teachers of students with unique learning needs, a scaffolded

approach to inquiry can illuminate the extent to which teaching strategies and resources support students (Trna, 2014).

During the time that the ARTI system has been in use, teachers have reported noticeable or substantial improvements in student performance, in some cases exceeding the teachers' expectations. The majority of teachers reported increases in conditions that support learning: enjoyment, motivation, engagement, on-task behavior, and positive school experience. Teachers commonly reported long-term impacts that the process of inquiry has caused in his or her professional life, including commitments to continue using, investigating, and learning to teach with technology; taking on leadership actions including sharing their successes with colleagues either informally or through presentations and other formal venues; and becoming advocates for technology for students.

Communities of Practice

Communities of Practice offer a powerful strategy for supporting teacher professional learning and educational achievement. "Teachers and schools that engage in better quality collaboration have better achievement gains in math and reading. Moreover, teachers improve at greater rates when they work in schools with better collaboration quality" (Ronfeld, Farmer, McQueen, & Grissom, 2015, p. 475). For educators who work in instructional teams with student achievement as the goal, collaborative communities can accelerate their success. As an organizational structure Communities of Practice share a collective responsibility for the growth and development of all members of the school and the school system. This structure provides a means for bringing together and supporting all educational stakeholders – families, policy makers, administrators, teachers, students, school system and supporting staff members – with the shared goal of increasing effective learning and teaching (Sessums, 2015). Wenger, White and Smith (2009) suggest that a school must be more than a place of instruction – it must also be a place of inquiry that produces as well as shares existing knowledge. Successful Communities of Practice should be designed to help members systematically reflect on and improve their practice. A Community of Practice develops around the ideas and activities that matter most in schools. As a community takes on an identity, its need to document activities, resources, collective knowledge, skills and impacts, emerges.

A successful Community of Practice starts with 1) planning the goal of the community, 2) deciding who should lead and who should be members. Having articulated the focus and membership of a community, it's recommended that

members 3) hold a synchronous meeting or workshop to build relationships and trust among members. During the session, the group should 4) draft an agreement that states the rationale and scope of the group, roles for group members (e.g., facilitator, sponsor), expectations for members including time commitments, expectations for working together, and a description of success criteria.

Given the many tools available to support communities synchronously and asynchronously, the group should nominate 5) tools that will support the community and be accessible to members regardless of organizational affiliation. A successful Community of Practice requires 6) a lead facilitator. The lead facilitator organizes meetings and shared knowledge resources, monitors the success of the community, guides members and serves as the central contact point for the community (Sessums, 2009). For example, a group of educators, who may be sole practitioners in their schools, are able to join together in digital environments including Skype, Microsoft Teams, Slack, social networks like Facebook, Twitter or a learning management system, where they support each other in advancing practice for their students.

Professional Learning Communities

As practice-embedded groups, Professional Learning Communities provide the collaborative experience teachers need to be most effective in their craft. They provide a powerful learning experience and can create a sustainable learning environment (Van der Klink, Kools, Avissar, White & Sakata, 2017; Tondeur, Forkosh-Baruch, Prestridge, Albion & Edirishinghe, 2016; Wells, 2014). Digitally networked Professional Learning Communities connect every teacher to high-impact, personalized and peer facilitated learning in iterative cycles of lesson study, looking at student work, creating content, and inquiry into practice (Dawson, Cavanaugh, & Ritzhaupt, 2012). Professional Learning Communities share a goal of continuous improvement of their practice. They often engage in inquiry, action research, data analysis, planning, implementation, reflection, and evaluation to improve student learning. Professional Learning Communities for K-12 educators must meet teachers' and leaders' immediate needs and provide them career ladders (Hord & Roy, 2014). The education professional learning organization, Learning Forward, developed comprehensive standards for professional learning of teachers, including standards for PLCs (Learning Forward, 2011). Standards relevant to digital networked Professional Learning Communities include use of data to determine student and educator learning needs, evidence to monitor and refine implementation, and evaluation of results.

Thus, a PLC must provide access to meaningful and applicable materials and experiences for the community. It is likely that educators will require each of the community "habitats" that support active and healthy professional ecosystems (Wenger, White, & Smith, 2009): meetings, conversations, projects, content, access to expertise, relationships, individual participation, community cultivation, and serving a context. Therefore, a scalable, sustainable and effective digital networked PLC must integrate the multiple habitats needed by a thriving educator community (Cavanaugh, 2014). Guskey's (2014) case study describes a group of educators engaging in a PLC in Twitter and an online discussion forum in which they identify teaching resources, trial them, share their results, and iterate together.

New Insights

In practice, educators and schools fluidly adopt elements of Action Research, Communities of Practice, and Professional Learning Communities to suit their needs and cultures. Education organizations looking to formalize an integrated approach to professional learning that is designed for today's wicked, complex and unique problems in education are turning to the Networked Improvement Community model that structures inquiry with analytics and measurement systems to tackle specific challenges shared in the community (Gomez, Russell, Bryk, LeMahieu, & Mejia, 2016). These networks have grown up in the digital era and are dependent on digital tools and platforms. Their structure is based on improvement science, which applies "rapid prototyping and testing, tools for detecting and learning from variation, and affordances to learn from widely different contexts," suiting it well for a complex and dynamic education landscape (Lewis, 2015, p. 59). Groups of educators have begun applying the Networked Improvement Community approach with students (Charalampidi, Hammond & Boddison, 2014) and with colleagues for communities of promise (Zyngier, 2017).

Increasingly, digital networked professional learning that focuses on improvement will depend on transforming practice based on advanced analytics rather than access to snapshots of data. Educators and researchers have learned that "No single way of teaching works best with all students. Because students differ in motivation, interests, and abilities, using a wide repertoire of approaches … is essential," (Cuban, n.p. 2015). Among the 138 influences on learning examined by Hattie (2014), positive influences include acceleration, feedback, spaced practice, mastery learning, and time on task. Given that we know each student has unique and ever-changing needs, and we know a great deal about factors that influence learning, how do teachers improve the learning experience for each student? How do schools build

capacity with approaches and content that work well for learning? To what extent can predictive analytics recommend acceleration or an alternative approach for a child?

Educators are building capacity to answer these questions with advanced analytics. Across many countries, teachers and school leaders have access to increasing flows of data and data tools including custom dashboards showing graphical relationships among chosen factors, such as among student measures, class performance, and program placement. These data and reports have positively influenced teaching and learning by providing a clear view of student progress. However, the data tools do not always offer recommendations for improving learning, and they require specialized skills as well as time for best effect. New reports show that while "virtually all teachers (93 percent) regularly use some form of digital tool to guide instruction, more than two-thirds of teachers (67 percent), across a vast range of schools [in the US], say they are not fully satisfied with the effectiveness of the data or the tools for working with data that they have access to on a regular basis," (Bill & Melinda Gates Foundation, p.3, 2015).

Overcoming the challenges to improve learning, apply effective approaches, and advance learning with data requires more than reports on student progress. The data for each student should lead to specific insights about the student's learning progress and should result in actions that will advance learning, including the extent to which a student's expected and measured achievement align. If a student is not achieving to expectations, what predictors or influences can be identified using advanced analytics? Can low achieving high ability students be identified earlier in their schooling, and can analytics recommend supports specific to their gaps? In order for data to drive insight and action, powerful analytics are needed. While many school data systems include analytics, few combine dynamic early indication of student progress with the kind of recommendations that students, teachers, families, and schools can use to best guide learning. Access to advanced analytics that enable prediction and recommendation is decreasing in cost complexity. Advanced analytics in education starts from the pattern of learners' static data (for example, demographics; past attainment) and dynamic data (for example, pattern of online logins; quantity of discussion posts) to classify the trajectory that they are on (e.g., 'at risk'; 'high achiever'; 'social learner'), and hence make more timely interventions (e.g., offering extra social and academic support; presenting more challenging tasks) (Shum, 2012). Comprehensive education analytics is augmenting digital networked professional learning.

The digital networked approaches described in this chapter put educators in learning organizations into the seat of the researcher, closing a gap in the

research-to-practice timeline and empowering educators to make child-centered decisions based on rich data about each child. Rapid cycles of research on practice will require coordinated approaches that connect educators, mentors, and researchers in a networked research community, thus flattening learning research to scale our knowledge base and increase student learning (Cavanaugh, Sessums, & Drexler, 2015). In a flat learning research relationship, teachers are the primary researchers whose inquiry is guided, facilitated, and meta-analyzed by researchers. In this relationship, teachers generate questions, data sources, analysis, and insights with guidance available from researchers. Flattening of research cycles provides opportunities to engage students in inquiry.
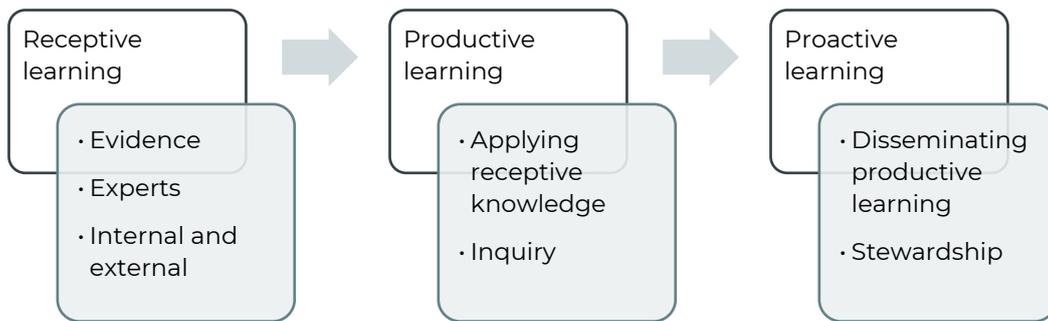
Summary

A school or system that aspires to be a learning organization seeks to embed continuous collaborative networked professional learning that will spur the innovation and exploration needed to transform schools (Kools & Stoll, 2016). Organizations that succeed in transformation adopt a culture of innovation (Cameron & Quinn, 2011) that value exposure to diverse perspectives and ideas in an environment of openness and risk-taking. Thus, learning organizations actively seek to benefit from each other and others so they can rapidly and thoughtfully apply results to improve their outcomes. They are both receptive and productive professional learners.

The collaborative networked approaches to professional learning for educators described here enable receptive and productive professional learning in schools in ways that are designed to improve outcomes for all students. A third imperative of organizational cultures of innovation is proactively giving back by disseminating learning gained after receptive and productive learning in communities of communities as stewards of the discipline (see Figure 2).

Indeed, success factors for innovation in education include program evaluation, sharing of the outcomes of evaluation, and further investment in effective agents of change by purposefully creating conditions for sharing and rewarding ideas (Kruchoski & Martin, 2016).

Today's schools change too quickly, are too complex, and face too many challenges for improvements to come from researchers only or to be locked in the schools where they occur. Educators and leaders must learn collaboratively in networks for the scaled rapid transformation needed by gifted children everywhere.

Receptive learning

- Evidence
- Experts
- Internal and external

Productive learning

- Applying receptive knowledge
- Inquiry

Proactive learning

- Disseminating productive learning
- Stewardship

Resources

Australian Bureau of Statistics. (2013). 4221.0 - Schools, Australia, 2013. Canberra.

Bill & Melinda Gates Foundation. (2015). Teachers know best: Making data work for teachers and students. Seattle: Author.

Bryk, A. (2015). Accelerating how we learn to improve. Educational Researcher, 44(9) 467–477.

Cameron, K. S., & Quinn, R. E. (2011). Diagnosing and changing organizational culture: Based on the competing values framework. San Francisco, CA: Jossey-Bass.

Cavanaugh, C. (2014, June). ePLC: Potential and design of professional learning communities in the cloud. Proceedings of ED-MEDIA: Conference on Educational Multimedia, Hypermedia & Telecommunications. Waynesville, NC: Association for the Advancement of Computing in Education (AACE).

Cavanaugh, C., Sessums, C., & Drexler, W. (2015). A call to action for research in digital learning: Learning without limits of time, place, path, pace...or evidence. Journal of Online Learning Research, 1(1), 9-15.

Charalampidi, M., Hammond, M., & Boddison, A. (2014). Exploring aspects of participation in an international online network for "gifted" students: a research in progress: Edulearn '14 : 6th International Conference on Education and New Learning Technologies, Barcelona, Spain, 7-9 Jul 2014. Published in: EDULEARN14 Proceedings pp. 6250-6259.

Cole, P. (2012). Linking effective professional learning with effective teaching practice. Canberra: Australian Institute for Teaching and School Leadership.

Cuban, L. (2015, September). Guiding principles on teaching, learning and reform. Retrieved from https://larrycuban.wordpress.com/

Dana, N. F., & Silva, D. Y. (2009). The reflective educator's guide to classroom research: Learning to teach and teaching to learn through practitioner inquiry. Thousand Oaks, CA: Corwin Press.

Darling-Hammond, L., Wei, R.C., Andree, L.A., Richardson, N., & Orphanos, S. (2009). Professional learning in the learning profession: A status report on teacher development in the US and abroad. Oxford, OH: National Staff Development Council.

Dawson, K., Cavanaugh, C., & Ritzhaupt, A. D. (2012). ARTI: An online tool to support teacher action research for technology integration. In C. Hartshorne, T. Heafner, & T. Petty (Eds.), Teacher education programs and online learning tools: Innovations in teacher preparation (pp. 375-391). Hershey, PA: IGI Global.

Dixon, F. A., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. Journal for the Education of the Gifted, 37(2), 111-127.

Florida Center for Instructional Technology. (2017). Action research for technology integration (ARTI). Tampa, FL: Author.

Gomez, L., Russell, J., Bryk, A., LeMahieu, P., & Mejia, E. (2016, November). The right network for the right problem. Phi Delta Kappan, 98(3), 8-15.

Guskey, T. R. (2014). Planning professional learning. Educational Leadership, 71(8), 10-16.

Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. Oxford: Routledge.

Hattie, J., & Yates, G. C. R. (2014). Visible learning and the science of how we learn. New York: Routledge.

Hitt, D., & Tucker, P. (2016). Systematic review of key leader practices found to influence student achievement: A unified framework. Review of Educational Research. 86(2) 531 –569.

Hord, S. M., & Roy, P. (2014). Reach the highest standard in professional learning: Learning communities. Thousand Oaks, CA: Corwin Press.

Jensen, B., Hunter, A., Sonnemann, J., & Cooper, S. (2014). Making time for great teaching. Melbourne: Grattan Institute.

Koellner, K., & Jacobs, J. (2015). Distinguishing models of professional development. Journal of Teacher Education, 66(1), 51 – 67.

Kools, M., & Stoll, L. (2016). What makes a school a learning organisation? Education working paper No. 137. Paris: Organisation for Economic Co-operation and Development.

Kruchoski, P., & Martin, N. (2016). Unleashing greatness: Nine plays to spark innovation in education. Geneva: World Economic Forum.

Learning Forward. (2011). Standards for professional learning. Dallas, TX: Author.

Lewis, C. (2015, January/February). What is improvement science? Do we need it in education? Educational Researcher, 44(1), 54-61.

Manuti, A., Pastore, S., Scardigno, A., Giancaspro, M., & Morciano, D. (2015, February). Formal and informal learning in the workplace: A research review. International Journal of Training and Development, 19(1), 1-17.

ONS Annual Abstract of Statistics. (2016). Schools and class sizes in England & UK. London: Office of National Statistics.

Ronfeldt, M., Farmer, S. O., McQueen, K., & Grissom, J. A. (June 01, 2015). Teacher collaboration in instructional teams and student achievement. American Educational Research Journal, 52(3), 475-514.

Sessums, C. D. (2009). The path from insight to action: the case of an online learning community in support of collaborative teacher inquiry. Unpublished dissertation, University of Florida, Gainesville, FL. Available at http://etd.fcla.edu/UF/ UFE0024330/sessums_c.pdf

Sessums, C. (2015). Learning communities and support. Redmond, WA: Microsoft Corporation.

Shum, S.B. (2012). Learning analytics UNESCO IITE policy brief, November 2012. Moscow: UNESCO Institute for Information Technologies in Education.

Timperley, H., Wilson, A., Barrar, H. & Fung, A. (2007). Teacher professional learning and development: Best evidence synthesis iteration (BES). Auckland: New Zealand Ministry of Education.

Timperley, H. (2011). Realizing the power of professional learning. New York: McGraw-Hill.

Tomlinson, C. A. (1995). Action research and practical inquiry: An overview and an invitation to teachers of gifted learners. Journal for the Education of the Gifted, 18(4), 467-484.

Tondeur, J., Forkosh-Baruch, A., Prestridge, S., Albion, P., & Edirishinghe, S. (2016) Responding to challenges in teacher professional development for ICT integration in education. Educational Technology & Society, 19(3), 110-120.

Trna, J. (March 01, 2014). IBSE and gifted students. Science Education International, 25, (1), 19-28.

Trust, T., & Horrocks, B. (August 08, 2016). 'I never feel alone in my classroom': teacher professional growth within a blended community of practice. Professional Development in Education, 43(4), 645-665.

U.S. Department of Education. (2012). Common core of data, public elementary/secondary school universe survey, 1999-2011. Washington: National Center for Education Statistics.

Van der Klink, M., Kools, Q., Avissar, G., White, S. & Sakata, T. (2017). Professional development of teacher educators: what do they do? Findings from an explorative international study. Professional Development in Education, 43(2), 163-178, http://dx.doi.org/10.1080/19415257.2015.1114506

Wells, M. (2014). Elements of effective and sustainable professional learning. Professional Development in Education, 40(3), 488-504. doi:10.1080/19415257.2013.838691

Wenger, E., White, N., & Smith, J. (2009). Digital habitats: Stewarding technology for communities. Portland, OR: CP Square.

Zyngier, D. (2017). How experiential learning in an informal setting promotes class equity and social and economic justice for children from "communities at promise": An Australian perspective. International Review of Education, 63(1), 9-28.