



# OVERVIEW OF RESEARCH ON THE INTEGRATION OF ICT IN INITIAL TEACHER EDUCATION

ITELAB DELIVERABLE 2.1

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# INTRODUCTION

This presentation is the outcome of the ITELab project task 2.1 to:

*”Provide a summary of published reports and case studies which document:*

- 1. How training in the pedagogical use of ICT is currently covered within ITE curricula in Europe*
- 2. Evidence of how student teachers are currently trained in using ICT.”*

The purpose of the review of the reports and studies is to apply research evidence to ITELab activities, to use it to inform the design thinking and recommendations on innovating ITE curricula/pedagogy, and in the development of the course modules and student MOOC (massive open online course). It is not intended to be an exhaustive academic literature review study.

The literature review was carried out in the period January to February 2017. Over 70 studies were identified as potentially relevant, from research databases (ERIC, EBSCO, journal archives) supplemented by suggestions from partners. A few could not be accessed as they were behind paywalls.

The studies were read and key points extracted based on their contribution to the two research questions.



# SUMMARY FINDINGS



# 1: TRAINING IN THE PEDAGOGICAL USE OF ICT IN ITE CURRICULA

1. Few studies focus on ICT in the ITE curriculum
2. Those that do may be out of date and provide few details on how training in the pedagogical use of ICT is reflected in ICT curricula
3. Some countries do have ICT in ITE policies
  - Leading to certification: AT: EPICT, FR C2i, UK-E online professional skills test
  - Other countries (e.g. NO) include digital competence as a core competence
4. Even so, there is often no follow-through from government policy to implementation in ITE
5. ICT is often implicit within a broader ambition, e.g. digital competence for all citizens, teacher as researcher and innovator (FI)
6. In some countries ITE providers (usually universities) set their own curricula for ITE (e.g. NL)
  - Difficult / impossible to access
7. Where ICT is mentioned in curricula it tends to be vaguely worded and aspirational
8. In the absence of ICT in the curriculum ICT use develops on an ad hoc basis
  - e.g. collaborative networks, isolated enthusiasm, teachers expected to pick up digital skills in addition the prescribed curriculum, in their own time



## 2: TRAINING STUDENT TEACHERS IN ICT USE

### 1. Student teachers' digital competence

Little training in general, little on new technologies, little integration into teaching

Student teachers' own competences and beliefs important

Important to see ICT use modelled and then learn by doing

Digital judgment and more discerning ICT use should be encouraged

Agency: importance of self-responsibility

### 2. Teacher educators

Lack knowledge in ICT use

Are digital role models

### 3. Tools

Video, for observing, conferencing and recording

Interactive Whiteboard

Virtual classrooms

Subject-specific tools, e.g. mathematics



## 2: TRAINING STUDENT TEACHERS IN ICT USE (CONT.)

### 4. Pedagogy

Inclusion (few studies): few opportunities to use and reflect on ICT for all

Rethinking learning spaces

Collaborative learning

Communities of enquiry

Deeper learning: critical thinking, problem-solving, collaboration, self-directed learning

Hybrid solutions

Horizontal model of learning based on collaborative processes

### 5. A framework for ITELab – TPACK? (well documented in studies)

A basis for an ICT in teaching programme

Technological knowledge, pedagogical knowledge, content knowledge predict TPACK (= technological, pedagogical and content knowledge)

Design-based process



# DETAILED FINDINGS

- 1: ICT IN ITE CURRICULA
- 2: HOW ICT IS COVERED IN ITE



# 1: HOW IS TRAINING IN THE PEDAGOGICAL USE OF ICT CURRENTLY COVERED WITHIN ITE CURRICULA IN EUROPE?

RECENT LITERATURE REVIEW SEARCH





# POLICIES - GENERAL

- [Shaping career-long perspectives on teaching: A guide on policies to improve Initial Teacher Education](#), European Commission, 2015

Nothing on ICT in ITE curricula, but ICT features in case studies and recommendations. Emphasis on collaboration and competences:

*“New teaching graduates can [...] be an asset to schools as they bring fresh knowledge, often including skills, such as integrating ICT and new media and different perspectives on existing routines and cultures.”*

*“Collaborative learning networks are usually self-organised and are run on the basis of being open and willing to share information and materials. They are usually based on a common aim and equal and inclusive principles and, with the support of ICT, are the natural environments for collaboration. Networking between members of the teaching profession (teachers, teacher educators and school heads) or student teachers may mean levelling the terrain for collaboration“ [e.g. ES, EE] p48*

CY: *“projects to promote networking and collaboration amongst teaching professionals. [...] linked to integrating ICT in learning, as well as Internet safety. “ p49*

- [ICT and Initial Teacher Education: National Policies. OECD Education Working Papers, Number 61](#) (2011)

*There is sometimes a mismatch between curricular reforms and what is going on in initial teacher education. Government requirements regarding curriculum reform implementation have not always been complemented by dialogue and collaboration with teacher education institutions (although, of course, there are exceptions, e.g. Finland). P40*

- Review of National Curricula and Assessing Digital Competence for Students and Teachers: Findings from 7 Countries (EUN, 2010)

*“The description of competence targets for student teachers remains in most cases on a general level. Moreover, the distinction between knowledge, skills and attitude targets is not always clearly made.”*



# POLICIES - NATIONAL

OECD Country reports (2010)

## Austria

*European Pedagogical ICT Licence [...]: obligatory modules focus on understanding the pedagogical role of ICT in teaching, acquiring basic ICT skills, searching and communicating with internet tools, creating and sharing content, and understanding the requirements of bringing innovation to schools*

## Finland

*No detailed “curriculum of subject teacher education” covering all universities in Finland can be presented. P20*

*Close integration of the use of ICT in teaching with basic and further education of teachers. Encouraging institutions to implement new, innovative learning styles and methods (2006 Information Society Programme 2006-2015). P15*

*Too little co-ordination and harmony among different types of national and local level strategies [...] The adopted top-down approach to strategy implementation may be problematic P16*

*Student teachers should learn to use versatile teaching methods and ICT in the teaching of their subject. P17*

*Objective of a teacher as a researcher and developer of his/her own work P21*

## France

*ICT is not integrated in initial teacher education subject curricula. It's an additional competence to be acquired independently from subject learning. P36*

*Since 2006, teacher education institutions (IUFMs) are expected to train student teachers leading to a C2i (ICT and internet certificate) specifically for teachers. P44*



# POLICIES – NATIONAL (CONT.)

*OECD 2010 unless otherwise stated*

## Netherlands

*Technology is not compulsory in teacher training P7*

*Initial teacher training institutes themselves formulate the curriculum P8*

## Norway

*The recent reform in education, the Knowledge Promotion reform, puts digital competence on an equal footing with other basic skills (along with ability to express oneself verbally, reading, writing and mathematics). This has generally generated a stronger focus at teacher training institutions on preparing student teachers to make use of ICT in their teaching, as expressed through strategic documents and plans at teacher training institutions. P25*

- [Professional digital competence in teacher education](#) Ottestad G., et al (2014),

*Commenting on three recent Norwegian studies on ICT in ITE programmes, Tømte, Kårstein and Olsen (2013) found that the development of professional digital competence is weakly instituted at the management level of teacher education programmes, and that most programmes lack a comprehensive approach to the development of such skills. Furthermore, they found that teacher education institutions' academic profiles on the topic are poorly developed, and that the expertise of the academic staff is highly variable. The fostering of professional digital competence of student teachers in many teacher education programmes depends on enthusiasts among academic staff.*



# POLICIES – NATIONAL (CONT.)

*OECD 2010 unless otherwise stated*

## Sweden

*The System of Qualification from HSV mentions ICT in initial teacher education in only one sentence: “To obtain a teacher’s degree, the student teacher has to show the ability to use information technology in teaching and the pedagogical development and realize the role of mass media in this respect” P14*

*Focus has mostly been on integrating ICT in the three-semester program in general teacher competence (AUO) and also on the use of LMS but less on how technology can be integrated into subject teaching. P36*

## Case studies from England

*Out of 33 ‘standards’ which have to be met in order to pass the course, four relate to ICT. They must:*

*Have passed the online professional skills test in ICT*

*Know how to use skills in ICT to support their teaching and wider professional activities*

*Be able to design opportunities for learners to develop their ICT skills*

*Be able to teach lessons and sequences of lessons across the age and ability range for which they are trained and in which they use a range of teaching strategies and resources, including e-learning P7*



## An *intention*, not in place

### [Advancing Educational Technology in Teacher Preparation: Policy Brief](#) US Department of Education (2016)

*Guiding principle #1: Promote the active use of technology.*

*What does this look like in the classroom? Teachers guide students to publish blogs or create videos. They arrange for students to talk with experts in real time on topics they're studying. Examples of what you don't want to see: Students simply consuming media or filling out digitized worksheets.*

*Bottom line: Teacher prep faculty need practice using educational technology in order to model its use for teacher candidates. At Vanderbilt University's Center for Teaching, faculty get one-on-one support for technology integration and can attend a regular lecture series called "Conversations on Digital Pedagogy," that will help them develop a plan to integrate technology into their curriculum.*

*Guiding principle #2: Provide faculty with ongoing tech training.*

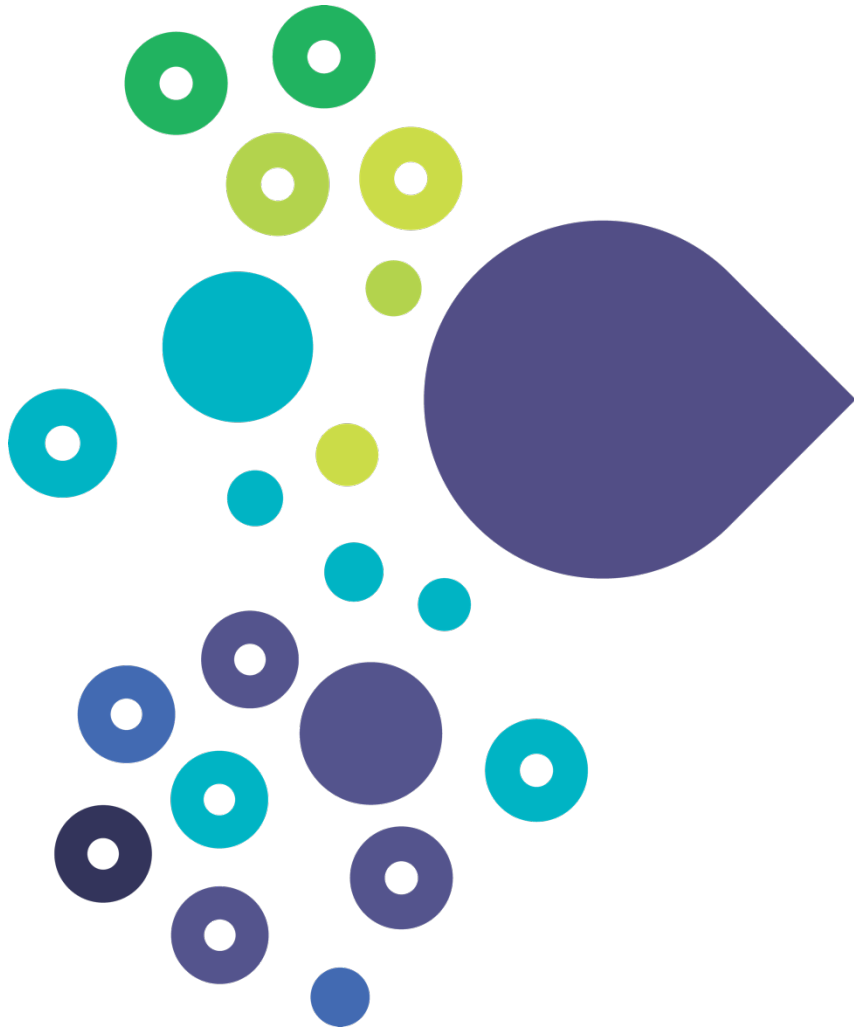
*Faculty who don't feel comfortable using technology in their own lessons won't be of much use to candidates who'll have to be comfortable incorporating technology into lesson plans by graduation. So education schools must make sure professors have access to training that will make them good model users of technology for their teacher candidates.*

*Guiding principle #3: Integrate technology across the curriculum.*

*Future teachers need more than a single course in educational technology. Education schools should move toward a model where candidates are using technology in all their classes. Future science teachers, for instance, might learn how to build lessons that allow students to use probes or sensors to collect real-time data. All future teachers might learn to build classroom websites as a tool to increase communication with parents.*

*Guiding principle #4: Align efforts with research-based standards.*

*The teaching field should unite around a common set of standards that will ensure candidates, whatever program they choose, will have training in using digital tools to support student learning.*



## 2: EVIDENCE OF HOW STUDENT TEACHERS ARE CURRENTLY TRAINED IN USING ICT

LITERATURE REVIEW

NOTE: **TEXT IN RED** = KEY POINTS FOR ITELAB WORK



# STATE OF THE ART IN ICT IN ITE

- [OECD CERI - ICT and Initial Teacher Training](#) Enochsson, A. and C. Rizza (2009), “[ICT in Initial Teacher Training: Research Review](#)”, OECD Education Working Papers, No. 38, OECD Publishing. <http://dx.doi.org/10.1787/220502872611>

Research review (covers 2002-2008, 61 studies analysed)

*The research is unanimous, even if it is not comprehensive, and it shows that **ICT is not used regularly or systematically** in the countries reviewed. There are good examples, carried out by enthusiastic teacher trainers, but only a minority of the student teachers benefit from this. Very **few articles report innovative use of recent technology. Most of the research reports on the use of computers and traditional computer software.** Overall, **student teachers do not integrate technology into their teaching.** A number of reasons for this are identified. The overall picture is that implementation is necessary at all levels (macro, meso, micro) for a successful outcome, but research also gives examples of how problems can be overcome at a micro-level, which is the level of the actors’ pedagogical practice. P3*

*“Isolated workshops and courses do not have a lasting impact on practice, and **there is support for combined approaches.** It is **important that student teachers have the possibility to see and experience pedagogical integration of ICT in the classroom during internship,** both looking at good examples and being able to learn by doing themselves. The **students’ personal level of computer competence, but also the value placed on ICT, matters.** A number of obstacles prevent successful implementation such as lack of time, lack of access to adequate technology, and faculty members’ and **mentors’ technological skills.**” P3*



# STUDENT TEACHERS' DIGITAL COMPETENCE

- [Educating Teachers for the new Millennium](#) Tømte C. (2013)

*[In Norway]: Digital literacy can be defined as a set of knowledge, skills and attitudes. These are required as a prerequisite for being able to use digital tools, media and resources appropriate and prudent to solve practical problems, communicate, gather and process information and create digital products. **Developing digital judgment by acquiring knowledge and good strategies for online use is an important part of digital competence***

***Students report expecting more substance related to ICT in teaching and learning than they are actually are obtaining.** Moreover, both institutions reported lack of organizational support, insufficient technological equipment; insufficient ICT competence and outdated perspectives on how to use ICT in teaching*

*The [Norwegian] national curriculum for compulsory education and teacher education has been renewed, including notions regarding the ICT issue as it relates to digital competence. Teacher-training institutions are required to integrate digital competences into their teacher training*

- [Teacher educators' digital competence](#), Krumsvik (2014)

*There is a **need to develop both theoretical foundations and models for a more in-depth understanding of digital competence in teacher education.** P 272*

Model dimensions: Self-awareness (Adoption, Adaptation, Appropriation, Innovation) and Practical proficiency (Basic digital skills, Didactic ICT competence, Learning strategies) P 274

- [Developing a validated instrument to measure preservice teachers' ICT competencies: Meeting the demands of the 21st century](#) Tondeur J., et al (2015)

*ICT competencies: (1) competencies to support pupils for ICT use in class and (2) competencies to use ICT for instructional design*

- [How and Why Do Student Teachers Use ICT?](#) Hammond, M. et al (2011)

*Nearly all teachers were receptive to using ICT - more so than their in-service counterparts. New teachers need to be supported in developing a **more discerning use** as they begin their teaching careers*

*Routine users focused mostly on the use of the Interactive Whiteboard for whole class teaching; extended users gave greater opportunities for pupils to use ICT for themselves; innovative student teachers used ICT in a greater range of contexts and made more effort to overcome barriers such as access.*





# STUDENT TEACHERS' DIGITAL COMPETENCE (CONT.)

- [Student teachers' first reflections on information and communications technology and classroom learning: implications for initial teacher education](#) Sime, D., Priestley, M (2005)

*Students associated the use of ICT with changes in the nature of classroom relations, as well as a reshaping of learning and teaching.*

*A sound foundation of generic IT skills (i.e. training on basic and commonly used computing packages) is thus a useful addition to the early stages of an ITE programme, and one that will facilitate the development of a capacity to teach using ICT P140*

- [Why do some student teachers make very good use of ICT?](#) An exploratory case study Hammond et al (2009)

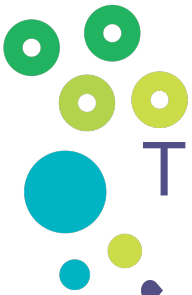
*Access, support for, and **modelling of, ICT use in the classroom** were key issues in developing this very good use of ICT.*

*Equally important seemed to be the belief that ICT could make a positive difference to teaching and learning and a **willingness to 'learn by doing'**.*



# AGENCY

- [External reform initiatives and teachers' efforts to reconstruct their practice: The mediating role of teachers' zones of enactment](#), Spillane, J. (1999): Journal of Curriculum Studies, 31:2, 143-175  
*Teachers' zones of enactment play a crucial role in their implementation of instructional reform*
- [Teacher Agency in Curriculum Making: Agents of Change and Spaces for Manoeuvre](#). Priestley et al (2012) in Curriculum Enquiry 42:2, Wiley, UK.  
*The extent to which teachers are able to achieve agency varies from context to context based upon certain environmental conditions of possibility and constraint P2*  
*An important factor in this lies in the beliefs, values and attributes that teachers mobilise in relation to particular situations P2*  
*Agency can be seen validly as **agency in opposition to policy** P36*  
*Educational policy, especially when it requires changes to the social practices of teaching, needs to be designed to be more flexible, taking more account of teacher agency, and especially teachers' proactive and projective engagement with the policy in question P37*
- [The role of beliefs in teacher agency](#) Biesta, G. et al (2015) Teachers and Teaching: theory and practice, 21:6, 624-640  
*Some see teacher agency as a weakness within the operation of schools and seek to replace it with evidence-based and data-driven approaches, whereas others argue that because of the complexities of situated educational practices, **teacher agency is an indispensable element of good and meaningful education.***
- [Pedagogical Knowledge and the Changing Nature of the Teaching Profession](#) OECD (2017)  
*Targeting the improvement of teacher learning, with a special focus on strengthening the links between the agents of teacher learning, is an approach that has potential to facilitate the dynamics of teachers' knowledge. P13*  
*Teachers' "**self-responsibility**" as a motivational construct to understand how teachers perceive their professional responsibilities. P14*



# TEACHER EDUCATORS

- Preparing Future Teachers to Teach with ICT, Fredrik Mørk Røkenes, doctoral thesis, Norwegian University of Science and Technology Faculty of Social Sciences and Technology Management Programme for Teacher Education, 2016 (unpublished)

*Although English as a Second Language student teachers might be confident in elementary and basic digital skills, they seem to **lack knowledge and awareness of how to use ICT didactically** to support pupils' learning in the subject discipline, and how to develop pupils' digital learning strategies and digital Bildung.*

*ESL teacher educators most frequently use two strategies, namely modeling didactical ICT integration and scaffolding student teachers' learning experiences with ICT. These stand out as means of promoting student teachers' integration of ICT in their own teaching.*

*Teacher educators are digital role models and need to reflect on the ways they use ICT in teacher education*

- [Prepared to teach ESL with ICT? A study of digital competence in Norwegian teacher education](#), Fredrik Mørk Røkenes\*, Rune Johan Krumsvik, in Computers & Education 97, (2016), 97, 1-20

*The importance of systematic and reflexive thinking around how ICT integration is conducted in teacher education*

*The **importance of modeling ICT-integration in teaching by the teacher educator** and mentor teachers*

*If teacher education programs want to prepare ESL student teachers to teach ESL in innovative ways with ICT, then teacher educators and mentor teachers need to reflect on how they use these digital tools in their own teaching practice*



# SPECIFIC TOOLS

- [Becta: what the research says about ICT and ITT \(2003\)](#)

*Video conferencing may improve communication between students on teaching practice in schools and university staff (Falconer & Benjamin 2002)*

*Computer conferencing allows the establishment of communities of practice among student teachers (Clarke 2002)*

*Using digital video to record observations of exemplary teaching can enhance the ability of students to identify, interpret and analyse effective practice (Beck et al. 2002)*

- [Transition in pedagogical orchestration using the interactive whiteboard](#) Beauchamp, G., Kennewell, S. (2013)

*Both the teacher and pupils use the affordances of IWB for orchestration of activity rather than merely using a set of unrelated tools predominantly used by the teacher*

- [Student teachers go online; the need for a focus on human agency and pedagogy in learning about 'e-learning' in initial teacher education](#) Turvey, K. (2008)

*Student teachers' developing pedagogical approaches achieve expression within the virtual classroom in much the same way as they would in the 'real' classroom; that is to say through language as the primary tool of mediation*

*Student teachers need opportunities to engage in authentic online dialogue with children as they endeavour to find their online pedagogical voice*



# STEM TOOLS

- [Using the Internet in science teaching? Issues and challenges for initial teacher education](#) Childs, A., et al (2011)

*There are many similarities in the use of the Internet with other ICT or science activities, including pedagogical issues around how to organise group work, the role of the teacher and even the geography of the teaching environment.*

*However, there were some key differences, particularly using the Internet as a resource for research activities in science which raised issues for teachers and pupils in **selecting appropriate websites** from such a wealth of information.*

- [Encouraging the Use of Technology in Problem-Solving: Some Examples from an Initial Teacher Education Programme](#) Lopez-Real, F., Man-Sang Lee, A. (2006)

*Student teachers are encouraged to produce alternative solutions to the problems they tackle and, in particular, to consider whether ICT can help [using **Dynamic Geometry Software (DGS)**].*

*Distinct functions of DGS in problem solving: (i) DGS opening up new perspectives, (ii) DGS as explanation and insight, (iii) DGS highlighting the nature of exact and approximate methods, (iv) DGS as illustration and generalisation.*

*Underlying these different functions there is an important common feature, namely the re-formulation of problems in an ICT environment.*



# VIDEO OBSERVATION AND COACHING

- [The Best Foot Forward Project - Substituting Teacher-Collected Video for In-Person Classroom Observations, First year implementation report.](#) Kane, T., et al (2013)

[About teachers, not student teachers]

*The opportunity to **watch their own lessons** resulted in treatment teachers being more self-critical. P3*

*Teachers in the treatment group perceived their supervisors to be more supportive and their observations to be fairer. They reported fewer disagreements on the ratings they received and were more likely to describe a specific change in their practice resulting from their post-observation conference. Likewise, treatment administrators reported that their post-observation conferences with teachers were less defensive. P3*

*Giving teachers control of the video collection and submission process improved several dimensions of the classroom observation process. It boosted teachers' perception of fairness, reduced teacher defensiveness during post-observation conferences, led to greater self-criticism by teachers and allowed administrators to shift observation duties to quieter times of the day or week. P4*

- Innovation in Teaching and Learning research report Part 1: [The impact of using a video-based platform for developing communities of practice](#) Preston, C. (undated)

*Impressive results were observed by teachers themselves in the following key areas: a sense efficacy; confidence; professional collaboration; sharing; developing professional capital through communities of practice. Most importantly, the teachers were expressing, almost unanimously, pride in taking ownership of their own learning agenda.*

- [Using In-ear coaching to support colleagues](#)

*"I was watching a lesson when I witnessed one of our pupils behave in an inappropriate way towards my colleague. I spoke to the pupil after the lesson and they were of course denying anything had happened, until I brought up the recording of the lesson and reviewed their behaviour with them. It allowed me to discuss my disappointment and then to ensure the pupil reflected on their behaviour and put it right." Mark Allen, Vice Principal at The Dearne ALC in Barnsley, UK*

- [Collaborating with schools over distance](#)

*"IRIS Connect provided the best solution to **enable teachers to see models of effective teaching, to reflect on their own teaching and to practice and receive immediate feedback.**" Dr. Shawn Edmondson, Director of Strategic Initiatives, Washington STEM, USA*



# INCLUSION

- ▶ [Student teachers' attitudes and beliefs towards using ICT within inclusive education and practice](#) (2014)

*Student teachers' attitudes towards using ICT for teaching and learning were strongly positive, and were also strongly positive towards inclusive education*

*Student teachers **rarely experience the opportunity to use and reflect on using ICT within e-inclusive pedagogies** as part of their school placements*

*It is important that student teachers view **ICT as more than just a cognitive educational tool, but as an integral part of learners' identity***



# PEDAGOGY

[Get Active: Reimagining Learning Spaces for Student Success](#) Basye, D., et al (2015)

[Not specific to initial teacher education]

*As schools invest in modernizing their systems, they have to look more holistically in regard to **how they design learning environments** (both the physical and the blended), where they spend their money, and how they focus on increasing student engagement and achievement P1*

*A well-designed physical space can inspire teachers to be creative and design learning experiences that take full advantage of **active learning opportunities**. P91*

*How learners engage with each other, with ideas, and with the resources associated with learning is shaped and influenced by the environment in which those interactions occur. P117*

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# PEDAGOGY (CONT.)

[The first decade of the community of inquiry framework: A retrospective](#), D.R. Garrison, D. et al (2010) Internet and Higher Education 13 (2010) 5–9  
*Three elements or “presences” within the **Community of Inquiry framework** :*

*Cognitive presence is operationalized through the Practical Inquiry (PI) model based on the more elaborate phases of Dewey's notion of reflective thought*

*Social presence from a multi-dimensional perspective that [has] overlap with the other presences*

*Teaching presence is seen “as a significant determinant of student satisfaction, perceived learning, and sense of community” (Garrison & Arbaugh, 2007, p. 163) P6-7*

- [NMC Horizon Report: 2017 Higher Education Edition](#), Adams Becker, S. et al (2017) Austin, Texas: The New Media Consortium.]

*Deeper learning approaches: mastery of content that engages students in **critical thinking, problem-solving, collaboration, and self-directed learning**. To remain motivated, students need to be able to make clear connections between their coursework and the real world, and how the new knowledge and skills will impact them. Project-based learning, challenge-based learning, inquiry-based learning, and similar methods are fostering more active learning experiences. P8*

- [The Effectiveness of Hybrid Solutions in Higher Education: A Call for Hybrid-Teaching Instructional Design](#), Guglielmo Trentin G., and Bocconi S. (2014)

*In order for **hybrid solutions** to encourage innovative educational practices and meaningful learning, these should be designed to support collaborative, learner-centered instruction, as well as embedded assessment for learning. P3*

*In onsite-individual and onsite-collaborative dimensions, Network and Mobile Technologies mainly serve as a generic “information and communication space” that amplifies knowledge sharing, while the learning process still takes place inside the physical space, at individual and/or at group level. Accordingly, in online-individual and online-collaborative components, NMTs provide the “learning space” where the learning process actually takes place. P7*

*If teachers are prepared to undertake the design, development and running of hybrid-type teaching activities, there will be greater improvement in the quality standard of the corresponding learning/teaching processes. P15*

*In order to integrate HSs into their teaching practices, **teachers must change their attitude to teaching, shifting from a vertical model of knowledge transmission to a more horizontal one, based on collaborative processes as well as individual study** P15*



# TPACK (1)

- [Facilitating preservice teachers' development of technological, pedagogical, and content knowledge \(TPACK\)](#) Chai, C. S., Koh, J. H. L., Tsai, C.-C. (2010).

*This paper examines the perceived development of preservice teachers in terms of their technological knowledge, pedagogical knowledge, content knowledge and the synthesis of such knowledge, i.e., the technological, pedagogical, and content knowledge (TPACK)*

*Technological knowledge, pedagogical knowledge and content knowledge are all significant predictors of preservice teachers' TPACK, with pedagogical knowledge having the largest impact*

*A course entitled "ICT for Meaningful Learning" was designed to prepare Singapore preservice teachers for technology integration. The course comprises 12 two-hour sessions, and its components provided preservice teachers with three TPACK knowledge sources [= TK, PK, TPACK] P65*

*ICT courses should give priority to developing a strong pedagogical foundation before instruction in technological tools P70*

*Teacher educators may still need to debate about what constitutes a good ICT program P71*

- [A review of Technological Pedagogical Content Knowledge](#) Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2013). Education Technology and Society, 16(2), 31-51.

*TPACK is the type of integrative and transformative knowledge teachers need for effective use of ICT in classrooms.*

*As a framework for the design of teacher education programs, the TPACK framework addresses the problem arising from over-emphasis on technological knowledge in many ICT courses that are conducted in isolation from teachers' subject matter learning and pedagogical training.*

*Studies have yielded positive results in enhancing teachers' capability to integrate ICT for instructional practice.*

*We suggest more development and research of technological environments based on TPACK; study of students' learning conception with technology; and cross fertilization of TPACK with other theoretical frameworks related to the study of technology integration*

*In the context of creating TPACK lessons, teachers have to assume the epistemic agency and appropriate "design literacy", which characterized by flexibility and creativity (Kereluik et al., 2011). Most of the time, however, teachers are more acquainted with being the authority in the classrooms who deals with verified knowledge. P46*



# TPACK (2)

- [Understanding the Theoretical Framework of Technological Pedagogical Content Knowledge: A collaborative self-study to understand teaching practice and aspects of knowledge](#) Fransson, G., Holmberg, J. (2012)

*A self-study research project that focused on our experiences when planning, teaching, and evaluating a course in initial teacher education. The theoretical framework of technological pedagogical content knowledge (TPACK) was used as a conceptual structure for the self-study. As a result, the focus, content, form of distribution, teaching, and assessment of the course went beyond what is common in initial teacher training in Sweden.*

*The focus of the course was the pedagogical use of ICT (specifically web 2.0 resources) to support learning in preschool and school P194*

*Resources used included software/online applications for the following: making presentations (e.g., PowerPoint, Prezi), video, audio, and image editing (e.g., PhotoFiltre, Picasa), creating slideshows and cartoons (e.g., Animoto, Tondoo), making Screencasts (e.g., Screencast-o-matic, Screenr), finding OERs with Creative Commons licenses (e.g. Flickr), sharing and organizing digital content (e.g., Google Reader, Diigo) P195*

*Purposeful use of ICT for learning cannot effectively be taught as a separate skill, but must be learnt actively by practicing in a context in which the dynamic relationship among ICT, content, and pedagogy is recognized P198*

*Students were asked to use curriculum and syllabi objectives as starting points and then design their own learning processes by exploring ICT (in particular web 2.0 tools) and learn how to use the tools while considering their relationship with and suitability for content and pedagogy. P198*

*Written instructions alone would be insufficient. We therefore supplied the students with an **interactive and multimedia-rich website that offered visual and/or audio examples of possible digital resources to use, ideas about how to use some of these resources from a pedagogical perspective and links to, or short explanatory texts about, how to learn how to use them** P199*

*Self-study research is a powerful tool for professional development P203*



# TPACK (3)

- [Teaching Teachers for the Future Project: Building TPACK Confidence and Capabilities for Elearning](#) Finger, G. et al (2013)

*The TTF Project, funded by the Australian Government's ICT Innovation Fund aimed to develop the ICT capabilities of future teachers. Central was the use of the Technological Pedagogical Content Knowledge (TPACK) conceptualisation for teacher educators to build pre-service teachers' TPACK confidence and capabilities to enhance eLearning approaches with their students.*

*The TPACK conceptualisation and the Australian Institute for Teaching and School Leadership's "[ICT Elaborations for Graduate Teacher Standards](#)" can inform the design of ITE programs in preparing future teachers for using ICT to support teaching and to support student learning.*

- [The technological pedagogical content knowledge framework for teachers and teacher educators](#). ICT integrated teacher education: A resource book Koehler, M. J., Mishra, P., Akcaoglu, M., Rosenberg, J. (2013)

*Teachers should be considered “designers” of curricula, and with regards to teacher educators, we identify “learning technology by design” and activity types as two key methods for the development of TPACK.*

*An emphasis upon **how teachers integrate technology in their practice** is more important than the emphasis upon what teachers integrate in their practice P5 teachers **first formulate goals for student learning** (Mishra & Koehler, 2009). Then, they choose activity types appropriate for the specified goals. Finally, they **select specific technologies based upon their choice of activity types**. Research indicates that activity types help teachers to make careful, strategic decisions around the integration of technology in their teaching (Harris & Hofer, 2011). P5*

*Through the act of designing, students and faculty constructed both online classes (which were later taught by the faculty) as well as an awareness of technology's role in reaching instructional goals for specific content. In this approach, students are not recipients of instruction, but undertake a “cognitive apprenticeship” with instructors (Mishra & Koehler, 2006). This **design-based process is an authentic context for learning about educational technology that recognizes that design-based activities take on meaning** and occur iteratively over time. P6*



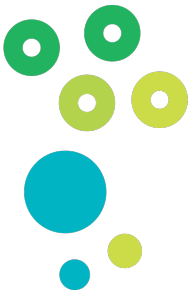
# TPACK (4)

- [The Development of an Instrument to Assess Preservice Teacher's Technological Pedagogical Content Knowledge](#). Lux, N. J., Bangert, A. W., & Whittier, D. B. (2011). *Journal of Educational Computing Research*, 45(4), 415-431.

*The purpose of this study was to develop and validate the Pre-service Teacher- Technological Pedagogical Content Knowledge Survey (PT-TPACK) instrument.*

*Data analysis yielded six interpretable factors: pedagogical knowledge (PK), technological knowledge (TK), content knowledge (CK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK).*

*Results from this study suggest that the PT-TPACK survey holds promise as a useful evaluation tool for assessing preservice teachers' knowledge and use of technology to increase the effectiveness of their instructional efforts.*



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