TWG8: Pedagogical reasoning and reflective practice: a framework for teaching in a digital age

Group co-leaders: Mike Phillips (Monash University, Australia), Alona Forkosh-Baruch (Tel Aviv University & Levinsky College of Education, Israel)

Group members: Anneke Smits (Windesheim University, The Netherlands), Aurelio Vibar (University of the Philippines Cebu, Philippines), Christine Bescherer (University of Education Ludwigsburg, Germany), Joan Hughes (University of Texas at Austin, USA), José Miguel Garrido-Miranda (Pontificia Universidad Católica de Valparaíso, Chile), Takahisa Furuta (University of Gunma, Japan), Yousra Chtouki (Alakhawayn University in Ifrane, Morocco), Sergey Grigoriev (Moscow City University, Russia), Vadim Grinshkun (Moscow City University, Russia); Christine Hamel (Laval University, Quebec, Canada), Denys Lamontagne (Cursus, Quebec, Canada).

Discussion Paper

Objectives:

1. To review recent research, policy developments and teacher practices highlighting the role of knowledge and PR&A related to technology integration education. The outcome of which will be the identification of key issues and trends in research, policy and practice.

2. To identify and pinpoint the role of technology in PR&A, in teaching, learning and decision-making.

3. To examine the potential for further development and innovation in teachers' knowledge and PR&A to enhance technology integration in education.

4. To discuss implications and make recommendations for policy, practice and research.

Introduction

Teachers' professional knowledge has been researched and discussed at length by educators, researchers and policy makers for many decades. The extensive body of literature reporting findings from research describes differing forms of teacher knowledge as either theoretical knowledge or practical knowledge, or in Fenstermacher's (1994) terms Formal knowledge – "one's knowledge claims must be justified in such a manner that they range beyond the immediate context, situation, or slice of time" (p. 28) - and Practical knowledge – "to claim to know something practically is to claim to know something about an action, event, or situation in this particular instance" (p.28).

Loughran (2019) suggests that, while these differences are important from an academic perspective, from the perspective of practicing teachers it is reasonable to suggest that "in their daily practice, teachers do not necessarily think of their teaching and the underlying influences on what they know and are able to do, by differentiating between knowledge in the ways used in the literature" (p. 4). Loughran (2019) argues that the pragmatic nature of teaching positions teachers to see their knowledge in relation to their practice or "what they do and how they do it" (p. 4).

To better understand the 'what' and 'how' of teachers' work, many have argued that exploring why teachers make certain decisions is important (for example see: Niess, 2019; Forkosh-Baruch & Avidov Ungar, 2019; Ball, 1998). Making sense of the 'why', however, comes with its own challenges because much of that thinking – the pedagogical reasoning – underpinning practice has long been recognised as tacit in nature (Polanyi, 1966).

The connection between teachers' knowledge and their actions is evidenced in Shulman's (1987) work outlining a knowledge base for teaching and a model of Pedagogical Reasoning and Action (PR&A). Shulman's (1987) conceptualisation of PR&A involved six non-linear decision-making steps which can be considered "as a starting point for unpacking the unseen aspects of practice" (Loughran, Keast, & Cooper, 2016, p. 388) and as a way to allow teachers to demonstrate their capacities as an expert pedagogue (Berliner, 1986).

Knowledge and action in digitally rich educational contexts

While teaching has long been considered as an "outrageously complex activity" (Shulman, 1987, p. 11), contemporary education contexts have been made arguably more complex with the increasing ubiquity of educational technologies. Building on Shulman's "starting point" (Loughran, Keast, & Cooper, 2016, p. 388) of a knowledge base for teaching and PR&A, subsequent research has considered whether the rise in the availability of educational technologies has altered teachers' knowledge, beliefs and their PR&A (Heinonen et al., 2019; Tondeur, Van Braak, Ertmer, & Ottenbreit-Leftwich, 2017; Heitink, et al., 2016; Holmberg, Fransson, & Fors, 2018).

Further developing Shulman's (1987) conceptualisation of pedagogical content knowledge (PCK), Mishra and Koehler (2006) introduced the technological, pedagogical and content knowledge (TPACK) framework in recognition of the growing influence of educational technologies. The interdependent relationships between technological, pedagogical and content knowledge have been widely accepted and have subsequently been the basis for more than 3,200 publications (Kessler & Phillips, 2019).

Some have argued that the introduction of educational technologies has not only redefined the forms of knowledge required by effective educators in contemporary classrooms but that digital hardware and software has also changes teachers' PR&A. As outlined by Harris and Phillips (2018), the results from four research teams (Feng and Hew, 2005; Niess & Gillow-Wiles, 2018; Smart, Sim and Finger, 2015; Starkey, 2010) "have been interpreted to assert that technological pedagogical reasoning and action are sufficiently different from Shulman's original PR&A to warrant an amended model" (p. 2053).

Harris and Phillips (2018) make an argument against the notion of technological, pedagogical reasoning and action (TPR&A) suggesting that technologies offer many more options for 'what' and 'how' teachers work in classrooms but the *processes* underpinning 'why' they do what they do remain unchanged by the technologies. In making such an argument, Harris and Phillips (2018) recognise the absence of empirical evidence in the research literature:

> Given the past decade-plus of active research about teachers' TPCK/TPACK, and the comparative dearth of extant research about teachers' planning and decision-making with educational technologies (Richardson, 2009), we still have much to discover about how and why teachers' TPACK—as one important part of a comprehensive knowledge base for teachers—is applied and expanded within the processes that comprise teachers' PR&A. (p. 2059)

Further investigations into the impact of educational technologies on teachers' PR&A is only one line of future inquiry. Questions regarding the increasingly complex ethical decisions teachers need to make, whether PR&A can be taught and what future impacts educational technologies may have on policy practice and research around PR&A have all emerged in recent years.

Ethical decision-making based on PR&A

Educational technologies open up both opportunities and challenges for teachers. These not only require teachers to develop greater forms of technological literacy but also to consider the potential impacts of technological affordances as part of their PR&A in technology rich contexts. One increasingly important issue that needs educators' attention is the assessment of information accuracy and credibility (Burbules & Callister, 2018). This may, for example, have impact on which platforms and websites teachers use for teaching specific content (for example, due to censorship), or which applications may be useful to effectively present contents of different nature and type (for example, platforms which that prefer commercial rather than pedagogical considerations). Establishing the validity of content provided to or accessed by students presents teachers with a renewed opportunity to examine their own content knowledge in light of pedagogical affordances offered by educational technologies.

Copyright is another ethical challenge which has the potential to impact on teachers' PR&A in digital rich contexts. One only needs to explore the growth of the Creative Commons Licensing of many educational materials for an indicative illustration of the potential impact of copyright implications. This issue can be divided into two aspects: first, using materials protected by copyrights, and second, preserving one's own copyright - both for students and teachers (de Zwart, Henderson, Lindsay, & Phillips, 2011). In addition to copyright protection considerations, teachers in many contemporary classrooms are now also considering students' privacy as part of their PR&A.

The issue of student privacy is challenging when one considers the vast array of digital footprints students leave in school learning management systems. Students leave footprints in every step they make, and in many cases teachers have access to this information; its usage may be justified by the need for reasoning regarding best practices for specific students, but it may also be misleading and even misused, if teachers do not know how to use this information for pedagogical reasoning (de Zwart, Henderson, Lindsay, & Phillips, 2011). Furthermore, teachers themselves are exposed to potential surveillance, either by video-recording of lessons or by monitoring their every step when assessing technological devices (Selwyn Nemorin & Jonson, 2017). While there are potential benefits that may be derived from additional data associated with teachers' PR&A in technologically bound contexts, the very same data is open to misinterpretation either by the teachers themselves or by their superiors and may ultimately obstruct development of their PR&A.

Pedagogical reasoning and action of pre-service and in-service teacher training

One substantial and often overlooked questions regarding PR&A is whether it is an innate skill or whether PR&A can be taught. Recommendations from the research literature suggest that this question is better considered from the perspective of whether PR&A can be taught to pre-service teachers in contrast to the question of whether it can be taught to in-service teachers (Lloyd, 2019). The earlier delineation of 'what teachers do' and 'how they do it' dominates both pre-service and in-service discussions about teachers' work; however, given the often, vast experience of many in-service teachers, the 'why' underpinning the 'what' and

'how' is arguably more accessible than in a pre-service teacher with limited 'what' and 'how' experiences'.

Loughran, Keast and Cooper (2016) highlight the importance of teaching PR&A as part of initial teacher education programs to pre-service teachers; yet, echoing other research publications (for example, see: Martin, 2018), they do not provide explicit methods by which this may be possible in a range of settings. Training usually presents pre-service teachers with strategies regarding how to teach in new ways, but they rarely learn how to reason about these new ways of teaching; however, recent developments have demonstrated new and thoughtful approaches to potential educational technology integration into the practices and PR&A of pre-service teachers (Smits, Voogt, & van Velze, 2018)

Similarly, Niess (2019) offers new insights through her discussions of the importance of PR&A for in-service teachers and outlines a broader, more systemic approach, which may be utilized as a means of facilitating socio-metacognitive-constructivist learning experiences. Niess and Gillow-Wiles (2017) also provide discussion regarding ways to engage teachers within a community to share classroom experiences and reflections about teaching and learning with technologies. This may serve all participants in their goal to improve their practice in light of 21st century settings.

Immersive technological systems may be an effective means for supporting PR&A. For example, annotation, video reality or methods such as Epistemic Network Analysis (Shaffer, Collier, & Ruis, 2016) may promote reflection regarding TPACK practices (see for example Zhang, Liu, & Cai, 2019). Technology in this sense had a double role: empowering teachers' informed educational practices directly, and empowering teachers PR&A by reflective practices, either in retrospect or by simulation of educational practices.

Another issue to contemplate is the balance between a more theoretical approach to training teachers for enhancing PR&A and a more practical approach, depending on which emphasis is more effective. Hence, the timing of the reflection phases is of utmost important: as much theory as is necessary to build an experience that is compatible with what the teacher already knows, if teachers are unfamiliar with the relevant theories, practice will not be effective. The best option for experienced teachers would be to start with a more practical approach, and for pre-service teachers – from theory to practice.

Implications and recommendations for policy, practice and research

The need for PR&A requires action in relation to policy, practice and research.

Policy recommendations include, first and foremost, the notion that PR&A must be an individual consideration, rather than a systemic endeavour. In fact, much of the high-level reasoning is performed in a top-down manner, usually by supervisors or coordinators, either federal ministries of education, or from state or district authorities. This reasoning is usually inaccessible to principals, school technology coordinators or teachers; it definitely does not reach students. Hence, it does not impact users' practice and does not develop their own PR&A. The empowerment of teachers' utilization of educational technologies must be addressed through policy initiatives. These should focus on ways to improve teachers' PR&A via professional development initiatives, related to TPACK (Koh, Chai, Benjamin, & Hong, 2015). Special attention should be allocated to teachers' pedagogical beliefs, thereby connecting between them and PR&A.

Practice recommendations should be divided into four major layers: teacher educators, in-service professional development, pre-service teacher education, and students. The major focus should be on pre-service education, in which future teachers are prepared for teaching in the context of the digital era. Hence, they need assistance in pedagogical reasoning regarding technology-supported teaching and learning in the subject matter they specialize in their training. These future teachers can lead processes of PR&A regarding innovative practices in their schools, and consequently become educational leaders. However, in-service teachers should be a part of this process as well: professional development centres as well as colleges of education can plan sessions for empowering their PR&A, in meetings outside schools, but also in video-recording of lessons within schools, which may serve as learning materials (Chai, Hwee Ling Koh, & Teo, 2019). These lessons can be analysed by groups of teachers from the same subject matter or of different specialization areas. Learning from best practices as well as from failures within school staff and possibly also across schools – by homogeneous subject matter groups of teachers – will raise teachers' awareness regarding educational technology implementation considerations. Students should also be encouraged to make informed decisions regarding their technology utilization, since the choice of technological interfaces, applications or platforms should be at least to a certain extent left for their choice; this is relevant for content-based as well as for generic software. Students, being usually more technology-proficient than their teachers, must be taken one step further, thereby connecting between their technology skills and learning processes. As for teacher educators, they need to experience the same PR&A processes regarding digital technology implementation; however, they can accompany their practice with research.

Henceforth, research recommendations focus on the need to further examine factors involved in educators' PR&A, in order to fully understand educational decision-making with regards to ICT implementation. Factors should include contextual components, e.g., the TPACK model, as well as variables such as teachers' beliefs (Lai, & Lin, 2018) and digital technology proficiency, and students' age, interests, talents etc. Ethical aspects need to also be addressed to a greater extent, as technology is developing rapidly and penetrating our lives altogether, and our professional lives in particular. This may cause restrictions regarding technology utilization, therefore requires examination of its consequences.

To sum, while digital technologies are becoming more common in schools and in teacher education, PR&A regarding educational technology utilization is becoming more complicated and requires training of teachers, teacher educators and even students. Technology is developing rapidly (Abdel-Basset, Manogaran, Mohamed & Rushdy, 2019), therefore, more considerations need to be addressed.

References

Abdel-Basset, M., Manogaran, G., Mohamed, M., & Rushdy, E. (2019). Internet of things in smart education environment: Supportive framework in the decision-making process. *Concurrency and Computation: Practice and Experience, 31*(10), 4515-4527.

Ball, D. L. (1988). *Knowledge and reasoning in mathematical pedagogy: Examining what prospective teachers bring to teacher education* (Vol. 1). Michigan State University. Department of Teacher Education.

Berliner, D. C. (1986). In pursuit of the expert pedagogue. Educational Researcher, 15 (7), 5–13.

Burbules, N. C., & Callister, T. A. (2018). Dilemmas of Access and Credibility: Access for Whom? Access to What? In, N. C., Burbules (Ed.), *Watch IT: The risks and promises of information technologies for education* (pp. 19-40). New York: Routledge.

Chai, C. S., Hwee Ling Koh, J., & Teo, Y. H. (2019). Enhancing and modeling teachers' design beliefs and efficacy of technological pedagogical content knowledge for 21st century quality learning. Journal of Educational Computing Research, 57(2), 360-384.

de Zwart, M., Henderson, M., Lindsay, D.F, & Phillips, M. (2011) Teenagers, Legal Risks and Social Networking Sites. Monash University, Melbourne.

Fenstermacher, G. D. (1994). The knower and the known: The nature of knowledge in research on teaching. In L. Darling-Hammond (Ed.), Review of research in education (Vol. 20, pp. 3–56). Washington D.C.: American Educational Research Association.

Forkosh-Baruch, A., & Avidov-Ungar, O. (2019). ICT Implementation in Colleges of Education: A Framework for Teacher Educators. *Journal of Information Technology Education, 18*, 207-229.

Harris, J., & Phillips, M. (2018, March). If There's TPACK, is There Technological Pedagogical Reasoning and Action? In *Society for Information Technology & Teacher Education International Conference* (pp. 2051-2061). Association for the Advancement of Computing in Education (AACE).

Heinonen, K., Jääskelä, P., Häkkinen, P., Isomäki, H., & Hämäläinen, R. (2019). University Teachers as Developers of Technology-Enhanced Teaching—Do Beliefs Matter? *Journal of Research on Technology in Education, 51*(2), 135-151

Heitink, M., Voogt, J., Verplanken, L., Van Braak, J., & Fisser, P. (2016). Teachers' professional reasoning about their pedagogical use of technology. *Computers and Education*, *101*, 70–83.

Holmberg, J., Fransson, G., & Fors, U. (2018). Teachers' pedagogical reasoning and reframing of practice in digital contexts. *The international journal of information and learning technology, 35*(2), 130-142.

Kessler, A. & Phillips, M. (2019). What do published abstracts reveal about the TPACK research community? Let us tell you!. In K. Graziano (Ed.), Proceedings of Society for Information Technology & Teacher Education International Conference (pp. 2459-2462). Las Vegas, NV, United States: Association for the Advancement of Computing in Education (AACE). Retrieved August 6, 2019 from https://www.learntechlib.org/primary/p/207995/.

Koh, J. H. L., Chai, C. S., Benjamin, W., & Hong, H. Y. (2015). Technological Pedagogical Content Knowledge (TPACK) and design thinking: A framework to support ICT lesson design for 21st century learning. *The Asia-Pacific Education Researcher, 24*(3), 535-543.

Lai, T. L., & Lin, H. F. (2018). An investigation of the relationship of beliefs, values and technological pedagogical content knowledge among teachers. *Technology, Pedagogy and Education, 27*(4), 445-458.

Lloyd, C. A. (2019). Exploring the real-world decision-making of novice and experienced teachers. Journal of Further and Higher Education, 43(2), 166-182.

Loughran, J., Keast, S., & Cooper, R. (2016). Pedagogical reasoning in teacher education. In, J. Loughran, & M. L. Hamilton (Eds.), *International handbook of teacher education* (pp. 387-421). Springer, Singapore.

Martin, B. (2018). Faculty technology beliefs and practices in teacher preparation through a TPaCK lens. *Education and Information Technologies, 23*(5), 1775-1788.

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Niess, M. (2019). Supporting Instructors in Redesigning Online Instruction Toward Student-Centered, Problem Based Learning. In, *Society for Information Technology & Teacher Education International Conference* (pp. 250-254). Association for the Advancement of Computing in Education (AACE).

Niess, M. L., & Gillow-Wiles, H. (2017). Expanding teachers' technological pedagogical reasoning with a systems pedagogical approach. *Australasian Journal of Educational Technology, 33*(3), 77-95.

Polanyi, M. (1966). The tacit dimension. Garden City N.Y: Doubleday.

Shaffer, D. W., Collier, W., & Ruis, A. R. (2016). A tutorial on epistemic network analysis: Analyzing the structure of connections in cognitive, social, and interaction data. *Journal of Learning Analytics*, *3*(3), 9-45.

Selwyn, N., Nemorin, S., & Johnson, N. (2017). High-tech, hard work: An investigation of teachers' work in the digital age. *Learning, Media and Technology*, *42*(4), 390-405.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22.

Smits, A., Voogt, J.M., & van Velze, E.M. (2018). The development of technology integration in a graduate course for practicing teachers. In M.L. Nies, C. Angeli and H. Gillow-Wiles (Eds.), *Developing Teachers' Technological Pedagogical Content Knowledge (TPACK) in the Digital Age*. Hershey, PA: IGI Global.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational Technology Research and Development, 65*(3), 555-575.

Zhang, S., Liu, Q., & Cai, Z. (2019). Exploring primary school teachers' technological pedagogical content knowledge (TPACK) in online collaborative discourse: An epistemic network analysis. *British Journal of Educational Technology*. doi:10.1111/bjet.12751

Additional References for consideration

Barker, L., & Hickey, P. (2019). *The beauty of pausability: Approximations of teaching in a virtual reality environment.* Paper presented at the American Educational Research Association annual meeting.

Cheah, Y. H., Chai, C. S, & Toh, Y. (2019). Traversing the context of professional learning communities: Development and implementation of Technological Pedagogical Content

Knowledge of a primary science teacher. *Research in Science & Technological Education, 37*(2), 147-167.

Glowatz, M., & O'Brien, O. (2018). Technology engagement for academics in third level: Utilising the technological, pedagogical and content knowledge framework (TPACK). *Journal of Applied Learning and Teaching, 1*(1), 13-24.

Korthagen, F. (2010). Situated learning theory and the pedagogy of teacher education: Towards an integrative view of teacher behavior and teacher learning. Teaching and Teacher Education, 26, 98-106.

Trond Eiliv Hauge (2014) Uptake and use of technology: bridging design for teaching and learning, *Technology, Pedagogy and Education, 23:3*, 311-323.

Willermark, S. (2018). Technological pedagogical and content knowledge: a review of empirical studies published from 2011 to 2016. *Journal of Educational Computing Research, 56*(3), 315-343.