Research in Learning Technology
Vol. 26, 2018

REVIEW ARTICLE

Teacher self-efficacy in online education: a review of the literature

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(Received: 13 December 2017; final version received: 18 September 2018)

Although empirical validation of teacher self-efficacy in face-to-face environments continues, it remains a relatively new construct in online education. This literature review, which was conducted over academic databases and which examined work published in the past 15 years, explores three areas of research about teacher self-efficacy in online education: (1) ease of adopting online teaching, (2) online teaching self-efficacy in comparison to demographic and experience variables and (3) changes in teacher self-efficacy in professional development scenarios where self-efficacy was measured before and after treatment. Research studies demonstrate agreement (or no discernible disagreement) in the importance of system/curriculum quality in the implementation of online learning and the recognition that a measure of self-efficacy in online pedagogy has not yet been empirically derived. Researchers continue to examine the balance of technological and pedagogical knowledge that supports the development of teacher self-efficacy, the role of *learner* self-efficacy in teacher self-efficacy and whether teacher self-efficacy differs fundamentally in online education. In addition, it seems clear that empirical validation of the association of teacher self-efficacy and student success has yet to occur in online education with the rigour seen in face-to-face modes of delivery.

Keywords: online education; online learning; distance education; teacher education; self-efficacy

Introduction

Researchers have suggested that differences in the face-to-face classroom context and the virtual classroom context are profound enough to warrant separate study and comparison of the 'qualities and characteristics of the teaching/learning experience' (Rice 2006, p. 432–433); therefore, an examination of the research pertaining to teacher self-efficacy in online education may be justified. Teacher self-efficacy is a measure of the teacher's belief that he/she can affect student success. In the traditional face-to-face classroom, learning and growth in students has been found to closely correlate with teacher self-efficacy (Goddard, Hoy, and Hoy 2000; Tschannen-Moran, Hoy and Hoy 1998) and, since successful student outcomes are at the heart of every educational system, teacher self-efficacy continues to be of interest to both educators and researchers.

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Citation: Research in Learning Technology 2018, **26**: 2047 - http://dx.doi.org/10.25304/rlt.v26.2047

Teacher self-efficacy is a measure of a person's self-efficacy in the specific context of teaching, and the term 'self-efficacy' was first used by the psychology scholar Albert Bandura (1977). Bandura sought a unifying theoretical framework to describe the effect of psychological procedures, such as therapy, on an individual. He proposed that procedures should be measured by their alterations of a patient's self-efficacy in level, intensity and generality. His experiments suggested that *efficacy expectation* is the mechanism by which changes in self-efficacy can be detected, and efficacy expectation was shown to influence outcomes. Bandura further developed self-efficacy in a 2001 paper where human agency was integrated with self-efficacy. Human agency is an individual's belief that he/she has the ability to act in any given environment. Thus, a teacher's self-efficacy can be described as the measure of a teacher's expectation that he/she has the ability and agency to affect student outcomes (Armor 1976; Tschannen-Moran, Hoy and Hoy 1998).

The first measures of teacher self-efficacy took place with the RAND studies in the 1970s and were based on the work of Rotter (Armor 1976; Rotter 1966; Tschannen-Moran, Hoy and Hoy 1998). RAND is a global non-profit research organisation that studies public policy and outcomes worldwide. Rotter hypothesised a reciprocal relationship between *efficacious behaviour* and outcomes. The RAND research was undertaken to determine the input factors that led to success in student reading outcomes. Teacher efficacy emerged as one of the factors. As Bandura's (1977) construct of self-efficacy became more known, researchers noted a significant difference between the Rotter theories (based on efficacious behaviour) and Bandura theories (based on efficacy expectation), and thus a difference in how efficacy had been measured (Dellinger 2005; Dellinger *et al*. 2008; Leslie 2011; Tschannen-Moran and Hoy 2001; Tschannen-Moran, Hoy and Hoy 1998). Today, many teacher self-efficacy measurement and teacher efficacy measurement scales are in use. Some may be based on instruments that have not sufficiently accounted for differences in theories. Therefore, it is important to understand how the wording in the survey questions can make a profound impact on the way the results are interpreted.

Researchers agree that the contexts of face-to-face and online education differ greatly to warrant a distinct examination, and this may be especially true for teacher self-efficacy. After all, context is central to the meaningful measurement of self-efficacy. According to Bandura (2005):

> One cannot be all things, which would require mastery of every realm of human life. People differ in the areas in which they cultivate their efficacy and in the levels to which they develop it even within their given pursuits. For example, a business executive may have a high sense of organizational efficacy but low parenting efficacy. Thus, the efficacy belief system is not a global trait but a differentiated set of self-beliefs linked to distinct realms of functioning. (p. 307)

In addition to context, environment and task specificity are also central to the meaningful measurement of teacher self-efficacy (Bandura 1997; Dellinger *et al*. 2008; Gosselin 2009; Leslie 2011; Pajares 1992; Tschannen-Moran and Hoy 2001). Most teacher self-efficacy measurement instruments used in online education were based on scales internally validated for teachers using a face-to-face mode of education delivery. Most instruments make no mention of knowledge about *education technology* or knowledge about *technology* in general (Barbour and Reeves 2009; Newby *et al*. 2011). Instead, the instruments were designed to measure general pedagogy or

Citation: Research in Learning Technology 2018, **26**: 2047 - http://dx.doi.org/10.25304/rlt.v26.2047

content-specific pedagogy. In this context, research strongly suggests a link between teacher self-efficacy and technology use in the classroom (Davis 1989; Kopcha and Alger 2011; Mishra and Koehler 2006; Niederhauser and Stoddart 2001; Vannatta and Fordham 2004; Watson 2006). Research that ties teacher self-efficacy and technology integration together may be especially important in online education, where technology is central to both teaching and learning. There has been some effort to internally validate teacher self-efficacy instruments specially modified for online education, but nowhere near the specialisation efforts seen in face-to-face education. As such, the purpose of this literature review is to examine the methods of measuring teacher self-efficacy in the context of online education. Three main areas of research were identified in this review: (1) measuring self-efficacy in a teacher's adoption of online teaching, (2) measuring the association of online teaching self-efficacy and demographic/experience variables and (3) measuring changes in teacher self-efficacy before and after a professional development (PD) treatment, which can indicate possible methods of developing online teacher self-efficacy.

Method

The articles used in this literature review were selected from the JSTOR digital library and Education Source and ERIC (EBSCO), which are education-specific databases. A search criterion to select articles for online education was developed in an attempt to overcome the non-standardised nomenclature in the research domain (Corry and Stella 2012). As such, the first selection criterion was 'online education' OR 'online learning' OR 'virtual school' OR 'cyberschool'. An additional search criterion was added to reflect the dynamic nature of technology and online education; to that end, articles published more than 15 years before were excluded. The last criterion was *self-efficacy*. As may be expected, this search turned up many articles about *learner* self-efficacy, which were discarded in a first pass of the selection set in which the titles of the articles were examined. The original selection criteria showed 441 titles in the solution set for Education Source/ERIC and 361 titles in the solution set for JSTOR (with some overlap of titles).

A second pass of the selection set consisted of a close read of the abstracts of the articles. From the second pass, it was determined that the Technology Acceptance Model (TAM) and the Technological Pedagogical and Content Knowledge framework (TPCK or TPACK) were frequently used to measure teacher self-efficacy (Davis 1989; Mishra and Koehler 2006); therefore, additional searches including 'technology acceptance model', 'TPCK' and 'TPACK' as additional keywords were performed. The final selection favoured articles about empirical studies, but the references sections of research reviews and other writings were scanned to locate articles from additional databases that might have been missed in the initial searches. Document analysis was used to classify the research studies by research area/theme. The data in all of the studies discussed in this literature review were collected by survey and interview. Dissertations were also included (Hart, 2001).

Results and analysis

The purpose of this literature review was to examine the methods of measuring teacher self-efficacy in the context of online education. Three main areas of research

were identified in this review: (1) measuring self-efficacy in a teacher's adoption of online teaching, (2) measuring the association of online teaching self-efficacy and demographic/experience variables and (3) measuring changes in teacher self-efficacy before and after a PD treatment, which can indicate possible methods of developing online teacher self-efficacy.

Measuring ease of adopting online teaching

Many research studies on teacher self-efficacy in online education were undertaken in order to discover whether teachers might adopt online teaching readily. The TAM model was an effort by Davis (1989) to predict technology integration and usage in business environments. The TAM model originated from the recognition that technology has the power to change organisations and productivity, but people often resisted its adoption. If organisations could predict which individuals might more vigorously resist adopting a particular technology, they could offer training and/or counselling prior to implementation and achieve better results (Davis 1989). The TAM model is derived from self-efficacy theory (Bandura 1997, 2001), behavioural decision theory (Beach and Mitchell 1978) and the Channel Disposition Model (Swanson 1987). The TAM, as a survey instrument, queries perceived usefulness of technology and perceived ease of use. The TAM uses the language of human agency in questions about perceived ease of use. For example, one of the questions on the TAM survey is, 'Learning to operate CHART-MASTER will be easy for me' (Davis 1989, p. 340). This question asks a survey participant to quantify the belief that he/she has the ability to act, which was defined by Bandura as the human agency construct of self-efficacy (2001).

The TAM model is often used to understand teacher behaviour in online education. A derived TAM model, the 3-TUM model, was used in a 2007 study (Liaw, Huang, and Chen 2007) to measure the association between teacher self-efficacy and the intention to use e-learning. A total of 30 teachers participated in the study. According to the findings, satisfaction with the quality of the technology influenced teacher self-efficacy, and self-efficacy emerged as a predictor of teacher intent to use e-learning in the classroom. The finding about system satisfaction was supported in later studies of a similar structure using the TAM (Al-Sayyed and Abdalhaq 2016; Waheed 2010). One study of 152 in-service teachers contradicted the TAM model and found that ease of use was a predictor of e-learning adoption, but usefulness of e-learning was not (Yuen and Ma 2008). Student academic outcomes were not measured in any of the studies, and self-efficacy was not defined explicitly as a construct in the reports. Nevertheless, these efforts add to the understanding of teacher behavioural intention and may generalise across primary/secondary and higher education teachers because they examine teachers and not students. The impact of the quality of technology systems and technical support on teacher self-efficacy, as reported in many of the research studies, is notable. As such, administrators must ensure adequate testing/quality of systems and usable technical support when transitioning teachers to online education.

Besides measures of self-efficacy revealed in the use of the TAM, Lin and Zheng (2015) conducted a study of PD for online primary/secondary teachers and their adjustment to teaching in the online environment. The researchers used a survey which queried instructional practice, instructional self-efficacy, technology self-efficacy and PD. Their results showed a correlation between content-related

Citation: Research in Learning Technology 2018, **26**: 2047 - http://dx.doi.org/10.25304/rlt.v26.2047

instruction practices and instructional self-efficacy, which seems logical. In addition, teachers indicated a desire for more *technology* PD about transitioning their courses from face-to-face to online teaching. This study drew a distinction between *instructional* self-efficacy and *technology* self-efficacy, which raises a question about whether there is a best-practice distribution of teacher instructional self-efficacy and teacher technological self-efficacy that translates into student success in the classroom. Additional studies supported the result of a desire for technology-related PD – both in transitioning courses, as in this study, and in the study of online pedagogy in general (Horvitz *et al*. 2015; Lee and Tsai 2010; Robinia and Anderson 2010).

Measuring association of teacher self-efficacy and demographicslexperience

Teacher self-efficacy measurement instruments, which were developed for use in the face-to-face context, were used as the basis for instruments designed for use in online education when measuring self-efficacy in association with teacher demographics/experience. The Michigan Nurse Educators Sense of Efficacy for Online Teaching (MNESEOT) (Robinia and Anderson 2010), which used factor analysis to confirm four factors for self-efficacy, has been used to compare self-efficacy against demographic variables and experience for online teachers in higher education. The MNESEOT was based on the Teacher's Sense of Self-Efficacy Scale (Tschannen-Moran and Hoy 2001), which was modified to better suit the online education environment. The four factors were online student engagement, self-efficacy in online instructional strategies, self-efficacy for online classroom management, and self-efficacy in the use of computers. The results were compared against demographic and experience factors. One study using the MNESEOT showed no significant difference in self-efficacy factors for gender or age (Robinia and Anderson 2010); however, another study using the MNESEOT showed higher self-efficacy in online student engagement for female instructors (Horvitz *et al*. 2015). Both studies found a significant correlation between the number of courses taught online and online teacher self-efficacy, which suggested that experience in online education might impact teacher self-efficacy. Another study using a different instrument supported these findings about teacher experience; the study by Lee and Tsai (2010) used the Technological Pedagogical Content Knowledge-Web (TPCK-W) framework. The results suggested that teachers with more web experience had higher self-efficacy in terms of TPCK-W, but older teachers had lower self-efficacy. The TPCK-W was a modified form of the Technological Pedagogical And Content Knowledge framework questionnaire (TPACK) (Mishra and Koehler 2006), which replaced the technology questions with questions specific to web-based online teaching. The TPACK was an effort to represent the contribution of *technological knowledge* to pedagogical knowledge and content knowledge in teaching (Shulman 1987). The TPACK model combined three domains of expertise – technology, pedagogy and content – to create the following new knowledge domains: technological-pedagogical, pedagogical-content, content-technological and technological-pedagogical-content. A common criticism of this model (and for the underlying pedagogical content knowledge model) is the lack of defining characteristics among the knowledge domains (Burgoyne, Graham, and Sudweeks 2010; Graham 2011); however, many versions of the instrument have been internally confirmed (Smith 2010). Not all TPACK instruments in research studies in online education used the word, 'self-efficacy', though they used the *language of self-efficacy*.

For example, individual survey items in one version of the TPACK began with 'my ability to…', which refers to the human agency component defined by Bandura (2001). Instruments designed to measure the *self-efficacy* of components of the TPACK had varied levels of success, with researchers recommending some changes to the instrument (Burgoyne, Graham, and Sudweeks 2010; Smith 2010). Despite the continued question of internal validity, the TPACK may be of interest to researchers in online education because online education is a *pedagogy immersed in technology*. Participants in the TPCK-W study included 558 primary/secondary online teachers. They did not seem to encounter difficulties in distinguishing knowledge domains as was seen in other studies that attempted to use the TPACK with online teachers; as such, validity and reliability measures were found to be satisfactory for the instrument. In this study, however, the *web-pedagogical* knowledge scale was not maintained, which may indicate that teachers are comfortable with the technology, but not entirely comfortable with the pedagogy of online instruction. In addition, the study results found a correlation between teacher self-efficacy and positive attitudes towards online teaching.

Changes in self-efficacy

Changes in teacher self-efficacy measured by various instruments before and after an online teacher education event have been reported in the literature. The findings may suggest that online teacher education programmes and PD delivered online (or focused on technology in particular) are beneficial in *developing* online teacher self-efficacy (Chai, Koh, and Tsai 2010; Graham, Borup, and Smith, 2012; He 2014; Hernandez *et al*. 2014; Hung *et al*. 2010; Moore-Adams and Jones, 2015; Woodcock, Sisco, and Eady 2015; Wright 2011).

The TPACK model in online education is used to understand teachers who are already involved in e-learning (online teachers) and also to develop ways to increase the TPACK of teachers in order to prepare them to teach in a technology-rich culture. In a 2009 research study of 596 primary/secondary (also known as K-12) online teachers using the TPACK to measure self-efficacy, teachers rated highest their knowledge in pedagogy, content and pedagogical content. Teachers were less sure of their ability to troubleshoot equipment issues with students and to connect leaners with content using technology; however, exceptionally high and exceptionally low correlations of the TPACK components suggested that more research would be needed to determine whether the TPACK model was valid in online education (Archambault and Crippen 2009; Archambault and Oh-Young 2009). A later study used the same data to further examine the results. Outcomes from a factor analysis of the data suggested that the seven domains of the TPACK were not distinguishable in online education (Archambault and Barnett 2010), which called into question its use as a measurement instrument. Given the low correlations in the technology-based components of the TPACK, the following teacher education recommendations were released:

> When considering the application of TPACK to online and blended environments specifically, focus should be centered on technical considerations (technological aspects that impact the extent to which technology facilitates student learning), differences in online pedagogy (the differences in teaching strategies that have to be implemented when adapting curriculum to an online environment, including fostering student interaction, the role of the teacher, and assessment of student

Citation: Research in Learning Technology 2018, **26**: 2047 - http://dx.doi.org/10.25304/rlt.v26.2047

> learning outcomes), and principles of instructional design (sufficiently knowing a particular content to be able to use adopted technology to develop and offer quality online teaching). (Archambault, DeBruler, and Freidhoff 2014, p. 87)

Researchers in a study of pre-service teachers (Chai, Koh, and Tsai 2010) noted a similar difficulty with TPACK knowledge domains wherein participants experienced some difficulty in distinguishing among them. In the study, pre-service teachers completed the TPACK before and after a TPACK-based educational technology course, and the results were compared. Gains in self-efficacy were statistically significant, but some pre-service teachers did not yet have enough pedagogical knowledge to make sense of the technology in an integrated way. Researchers recommended that technology instruction should be integrated with both methodological and content instruction to maximise teacher self-efficacy. Other studies suggested that lack of content knowledge hindered the TPACK development of the self-efficacy of pre-service teachers (Graham, Borup, and Smith 2012) to the extent that one study eliminated it altogether (Kontkanen *et al*. 2016). One successful TPACK-based online teacher certificate programme did not reflect a content integration challenge; however, it was a master level programme (MA) where pedagogical self-efficacy and content self-efficacy may already have been developed (Moore-Adams and Jones 2015). Clearly, the TPACK is a notable contribution to the measure of self-efficacy in online education, especially in the area of evaluating teacher education programmes; however, more research is needed to verify its validity in online education.

The research studies in this review described how measures of teacher self-efficacy might be used in predicting ease of adoption of online education, possible associations of the measures among demographic and experience variables, and the use of teacher self-efficacy as an evaluative measure of online teacher education programmes. Findings converge on areas of agreement among researchers, but many questions about teacher self-efficacy and student success in online education remain.

Discussion

Three main areas of research about online teacher self-efficacy were identified in this review: (1) measuring self-efficacy in a teacher's adoption of online teaching, (2) measuring the association of online teaching self-efficacy and demographic/experience variables and (3) measuring changes in teacher self-efficacy before and after teacher education or PD. Research results show agreement (or no discernible disagreement) in the importance of quality implementation and the recognition that a measure of self-efficacy in online pedagogy has not yet been clearly defined and validated.

Because satisfaction with the quality of online education curriculum and technology was found to be a factor in the ease of adopting online education, adequate testing of an online delivery system and deployment/maintenance of a high-quality technical support system are strongly recommended. In addition, a standardised system of curriculum evaluation, such as Quality Matters (as in Wright 2011), is recommended as a process and framework for continuous evaluation of online curriculum.

Because a measure of *self-efficacy in online pedagogy* was not clearly defined and validated over all three main areas of research, more exploration of the construct is recommended. In the literature about teacher adoption of online education, results from Lin and Zheng (2015) indicated that teachers who transitioned from face-to-face teaching to online teaching desired more PD in the integration of content with

technology and the design of online instruction. Furthermore, findings indicated correlations among instructional self-efficacy, technology self-efficacy and teaching practices. The researchers suggested that online teachers perceived their role as managerial and social, which was related to non-content-related teaching practices. In addition, participants indicated that they changed their pedagogy in the transition to online education; they were more flexible with their time, prepared more thoroughly for synchronous sessions (in order to use the time well) and responded more quickly to student feedback. These findings indicate that a specific pedagogy may be needed to successfully transition from face-to-face education to online education. In the studies about demographics/experience variables, teachers with more experience teaching online had higher measures of self-efficacy (Horvitz *et al*. 2015; Lee and Tsai 2010; Robinia and Anderson 2010); however, attempts to internally validate instruments in the online context suggested that there may exist a measure of *self-efficacy in online instruction*, which is yet not defined and validated (Lee and Tsai 2010). In the area of measuring changes in teacher self-efficacy before and after teacher PD and education programmes, studies again raise the question of whether there is an undefined component, which defines *self-efficacy for online teaching* (Chai, Koh, and Tsai 2010; Hernandez *et al*. 2014; Hung *et al*. 2010; Moore-Adams and Jones, 2015; Woodcock, Sisco, and Eady 2015).

It should be noted that an association between teacher self-efficacy and quantitative student *outcomes* in online education has not been empirically validated over a wide variety of studies with the rigour it has seen in face-to-face education (noted by examination and in the Robinia and Anderson study). In addition, other research studies about *learner* self-efficacy suggest that it affects outcomes significantly in online education (see DeTure 2004; Kuo *et al*. 2013; Roblyer and Marshall 2003; Tseng and Kuo 2014 and others); therefore, it may be valid to further investigate whether the association between teacher self-efficacy and learner outcomes is comparatively more/less significant in online education and whether differences exist between primary/secondary environments and higher education. It is possible that the significant role of learner self-efficacy in online education (noted as self-direction, learner independence, motivation, academic ability and other descriptors by Barbour and Reeves, who published a comprehensive review of the literature in 2009) affects the association.

A persistent question in the development of education programmes for online teachers is as follows: what balance of online knowledge domains – among pedagogy, content and technology – has the most likelihood of success? Research also suggests that the order in which subjects are taught – pedagogy, content, technology and others – has some bearing on the successful development of self-efficacy in online teachers (Chai, Koh, and Tsai 2010; Graham, Borup, and Smith 2012; Kontkanen *et al*. 2016); as such, it may be beneficial to examine the structure of entire teaching programmes instead of focusing on individual courses.

Finally, many researchers have noted a subtle but consequential difference in the nomenclature of the self-efficacy construct whereby some researchers have used the terms ‘teacher self-efficacy’ and ‘teacher efficacy’ interchangeably. Teacher efficacy has been found to affect student outcomes; however, teacher efficacy differs from teacher self-efficacy. Teacher efficacy is a measure of the degree to which a teacher believes he/she has the ability to perform correctly the tasks suggested as best practices in teaching. In other words, teacher efficacy is based on expectations of efficacy (as in Gibson and Dembo 1984), while teacher self-efficacy is based on expectations of outcomes (Dellinger *et al*. 2008; Leslie 2011; Tschannen-Moran, Hoy and Hoy 1998; Woolfolk and Hoy 1990). Most teacher self-efficacy measurement

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instruments in this review were based on scales internally validated for teachers using a face-to-face mode of education delivery. There has been some effort to internally validate teacher self-efficacy instruments specially modified for online education, but nowhere near the specialisation efforts seen in face-to-face education. In addition, nomenclature is a continual challenge in that it is unclear whether the studies of self-efficacy for online teachers distinguish between teacher efficacy (efficacious behaviour) and teacher *self*-efficacy (efficacy expectation); this is a compelling question for future research and discussion.

Clearly, underexplored research topics abound in the domain of teacher self-efficacy in online education. Given its influence on student outcomes in face-to-face education, efforts to understand it in online education must continue.

Conclusion

While online learning continues to grow in primary/secondary and higher education, the goal of educators remains the same: positive outcomes for students. This review identified several themes in the literature, such as the importance of quality in both the technology and the curriculum of online education and the need for more research in defining and specifying the construct of self-efficacy in online education. It also revealed many unanswered questions pertaining to best practices in teacher education programmes and the need to further examine correlations between teacher self-efficacy and student outcomes. As such, any investigation into the association between teacher self-efficacy and student outcomes in online education could bring much new knowledge to the field. In addition, designers of teacher education programmes and PD courses may benefit from research that explores an optimal balance of technology, pedagogy and content curriculum in online teaching. By definition, teacher self-efficacy is malleable (Bandura 1997) and research has demonstrated its association with student outcomes (Goddard, Hoy, and Hoy 2000; Tschannen-Moran, Hoy, and Hoy 1998). As such, teacher self-efficacy is an appealing concept to teachers because it is based on factors that are often in the teacher's control (such as student behaviour management or knowledge of content-specific pedagogical strategies). It is appealing to researchers because its empirically validated foundation is most often based on social cognitive theory (Bandura 1977), which is an area of human psychology that has been subject to extensive empirical scrutiny over the years and has remained relatively intact. Given its role in affecting student outcomes for face-to-face learning, it seems logical to propose that the construct of teacher self-efficacy offers an opportunity for fruitful research in the field of online education. The findings of this literature review support this proposition and invite additional research in this area. Thus, additional research and programmes designed to improve teacher self-efficacy in online learning are worth the allocation of time and resources as they can lead to greater student success.

References

Al-Sayyed, F. & Abdalhaq, B. (2016) 'Interventional factors affecting instructors adoption of e-learning system: a case study of Palestine', *Journal of Theoretical and Applied Information Technology*, vol. 83, pp. 119–137.

Archambault, L. M. & Barnett, J. H. (2010) 'Revisiting technological pedagogical content knowledge: exploring the TPACK framework', *Computers & Education*, vol. 55, pp. 1656–1662. https://doi.org/10.1016/j.compedu.2010.07.009

Archambault, L. & Crippen, K. (2009) 'Examining TPACK among K-12 online distance educators in the United States', *Contemporary Issues in Technology and Teacher Education*, vol. 9, pp. 71–88.

Archambault, L., DeBruler, K. & Freidhoff, J. (2014) 'K-12 online and blended teacher licensure: striking a balance between policy and preparedness', *Journal of Technology and Teacher Education*, vol. 22, pp. 83–106.

Archambault, L. & Oh-Young, C. (2009, March) 'Putting the T in PCK: exploring the nature of the TPACK framework among K-12 online educators using a web-based survey', *Society For Information Technology And Teacher Education International Conference*, Charleston, SC, pp. 4008–4014.

Armor, D. (1976) *Analysis of the school preferred reading program in selected Los Angeles minority schools (Report No. R-2007 LAUSD*), RAND Corp., Los Angeles, CA.

Bandura, A. (1977) 'Self-efficacy: toward a unifying theory of behavioral change', *Psychological Review*, vol. 84, pp. 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (2001) 'Social cognitive theory: an agentic perspective', *Annual Review of Psychology*, vol. 52, no. 1, pp. 1–26. https://doi.org/10.1146/annurev.psych.52.1.1

Barbour, M. K. & Reeves, T. C. (2009) 'The reality of virtual schools: a review of the literature', *Computers & Education*, vol. 52, no. 2, pp. 402–416. https://doi.org/10.1016/j.compedu.2008.09.009

Beach, L. R. & Mitchell, T. R. (1978) 'A contingency model for the selection of decision strategies', *Academy Of Management Review*, vol. 3, pp. 439–449. https://doi.org/10.5465/AMR.1978.4305717

Burgoyne, N., Graham, C.R. & Sudweeks, R. (2010) 'The validation of an instrument measuring TPACK', *AACE Society for Information Technology & Teacher Education International Conference*, Chesapeake, VA, pp. 3787–3794.

Chai, C. S., Koh, J. H. L. & Tsai, C. C. (2010) 'Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK)', *Educational Technology & Society*, vol. 13, no. 4, pp. 63–73.

Corry, M. & Stella, J. (2012) 'Developing a framework for research in online K-12 distance education', *Quarterly Review of Distance Education*, vol. 13, no. 3, pp. 133–151.

Davis, F. D. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *MIS Quarterly*, vol. 13, pp. 319–340. https://doi.org/10.2307/249008

Dellinger, A. B. (2005) 'Validity and the review of literature', *Research in the Schools*, vol. 12, pp. 41–54.

Dellinger, A. B., Bobbett, J. J., Olivier, D. F. & Ellett, C. D. (2008) 'Measuring teachers' self-efficacy beliefs: development and use of the TEBS-Self', *Teaching and Teacher Education*, vol. 24, no. 3, pp. 751–766. https://doi.org/10.1016/j.tate.2007.02.010

DeTure, M. (2004) 'Cognitive style and self-efficacy: predicting student success in online distance education', *American Journal of Distance Education*, vol. 18, pp. 21–38. https://doi.org/10.1207/s15389286ajde1801_3

Gibson, S. & Dembo, M. H. (1984) 'Teacher efficacy: a construct validation', *Journal of Educational Psychology*, vol. 76, pp. 569–582. https://doi.org/10.1037/0022-0663.76.4.569

Goddard, R. D., Hoy, W. K. & Hoy, A. W. (2000) 'Collective teacher efficacy: its meaning, measure, and impact on student achievement', *American Educational Research Journal*, vol. 37, pp. 479–507. https://doi.org/10.3102/00028312037002479

Gosselin, K. P. (2009) *Development and psychometric exploration of the online teaching self-efficacy scale*, Dissertation Thesis, Texas Tech University.

Graham, C. R. (2011) 'Theoretical considerations for understanding technological pedagogical content knowledge (TPACK)', *Computers & Education*, vol. 57, no. 3, pp. 1953–1960. https://doi.org/10.1016/j.compedu.2011.04.010

Graham, C. R., Borup, J. & Smith, N. B. (2012) 'Using TPACK as a framework to understand teacher candidates' technology integration decisions', *Journal of Computer Assisted Learning*, vol. 28, pp. 530–546. https://doi.org/10.1111/j.1365-2729.2011.00472.x

Hart, C. (2001) *Doing a literature search: a comprehensive guide for the social sciences*, Sage, Thousand Oaks, CA.

He, Y. (2014) 'Universal design for learning in an online teacher education course: enhancing learners' confidence to teach online', *Journal of Online Learning and Teaching*, vol. 10, pp. 283–298.

Hernandez, T., et al., (2014, October) 'Training teacher candidates to teach in online learning environments: an analysis of online teaching projects', *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, vol. 2014, no. 1, pp. 829–838.

Horvitz, B. S., et al., (2015) 'Examination of faculty Self-efficacy related to online teaching', *Innovative Higher Education*, vol. 40, pp. 305–316. https://doi.org/10.1007/s10755-014-9316-1

Hung, M. L., et al., (2010) 'Learner readiness for online learning: scale development and student perceptions', *Computers & Education*, vol. 55, no. 3, pp. 1080–1090. https://doi.org/10.1016/j.compedu.2010.05.004

Kontkanen, S., et al., (2016) 'Pre-service teachers' experiences of ICT in daily life and in educational contexts and their proto-technological pedagogical knowledge', *Education and Information Technologies*, vol. 21, pp. 919–943.

Kopcha, T. J. & Alger, C. (2011) 'The impact of technology-enhanced student teacher supervision on student teacher knowledge, performance, and self-efficacy during the field experience', *Journal of Educational Computing Research*, vol. 45, pp. 49–73. https://doi.org/10.2190/EC.45.1.c

Kuo, Y., et al., (2013) 'A predictive study of student satisfaction in online education programs', *The International Review of Research in Open and Distributed Learning*, vol. 14, no. 1, pp. 16–39. https://doi.org/10.19173/irrodl.v14i1.1338

Lee, M. H. & Tsai, C. C. (2010) 'Exploring teachers' perceived self-efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web', *Instructional Science*, vol. 38, pp. 1–21.

Leslie, B. B. (2011) *Faculty perceptions of self-efficacy beliefs about facilitating discussions in small seminar classrooms: a mixed methods study*, Dissertation Thesis, Kansas State University.

Liaw, S. S., Huang, H. M. & Chen, G. D. (2007) 'Surveying instructor and learner attitudes toward e-learning', *Computers & Education*, vol. 49, no. 4, pp. 1066–1080. https://doi.org/10.1016/j.compedu.2006.01.001

Lin, C. H. & Zheng, B. (2015) 'Teaching practices and teacher perceptions in online world language courses', *Journal of Online Learning Research*, vol. 1, pp. 275–303.

Mishra, P. & Koehler, M. J. (2006) 'Technological pedagogical content knowledge: a new framework for teacher knowledge', *Teachers College Record*, vol. 108, pp. 1017–1054.

Moore-Adams, B. L. & Jones, W. M. (2015, March) 'Lessons learned from the development of an online teaching certificate program for K-12 teachers', *Society for Information Technology & Teacher Education International Conference*, Charleston, SC, pp. 1492–1499.

Newby, T. J., et al., (2011) *Educational Technology for Teaching and Learning*, 4th edn, Allyn & Bacon/Pearson Education, Inc., Boston, MA.

Niederhauser, D. S. & Stoddart, T. (2001) 'Teachers instructional perspectives and use of educational software', *Teaching and Teacher Education*, vol. 17, pp. 15–31. https://doi.org/10.1016/S0742-051X(00)00036-6

Pajares, M. F. (1992) 'Teachers' beliefs and educational research: cleaning up a messy construct', *Review of Educational Research*, vol. 62, pp. 307–332.

Robinia, K. A. & Anderson, M. L. (2010) 'Online teaching efficacy of nurse faculty', *Journal of Professional Nursing*, vol. 26, pp. 168–175. https://doi.org/10.1016/j.profnurs.2010.02.006

Roblyer, M. D. & Marshall, J. C. (2003) 'Predicting success of virtual high school students: preliminary results from an educational success prediction instrument', *Journal of Research on Computing in Education*, vol. 35, no. 2, pp. 241–255. https://doi.org/10.1080/15391523.2002.10782384

Rice, K. L. (2006). A comprehensive look at distance education in the K-12 context. *Journal of Research on Technology in Education*, vol. 38, no. 4, pp. 425–448.

Rotter, J. (1966) 'Generalized expectancies for internal versus external control of reinforcement', *Psychological Monographs: general and Applied*, vol. 80, no. 1, pp. 1–28. https://doi.org/10.1037/h0092976

Shulman, L. S. (1987) 'Knowledge and teaching: foundations of the new reform', *Harvard Education Review*, vol. 57, pp. 1–21. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Smith, N. M. (2010) *Investigating the reliability and construct validity of a measure of preservice teachers' self-efficacy for TPACK*, Master Thesis, Brigham Young University.

Swanson, E. B. (1987) 'Information channel disposition and use', *Decision Sciences* vol. 18, pp. 131–145. https://doi.org/10.1111/j.1540-5915.1987.tb01508.x

Tschannen-Moran, M. & Hoy, A. W. (2001) 'Teacher efficacy: capturing an elusive construct', *Teaching and Teacher Education*, vol. 17, no. 7, pp. 783–805. https://doi.org/10.1016/S0742-051X(01)00036-1

Tschannen-Moran, M., Hoy, A. W. & Hoy, W. K. (1998) 'Teacher efficacy: its meaning and measure', *Review of Educational Research*, vol. 68, pp. 202–248. https://doi.org/10.3102/00346543068002202

Tseng, F. & Kuo, F. (2014) 'A study of social participation and knowledge sharing in the teachers' online professional community of practice', *Computers & Education*, vol. 72, no. 1, pp. 37–47. https://doi.org/10.1016/j.compedu.2013.10.005

Vannatta, R. A. & Nancy, F. (2004) 'Teacher dispositions as predictors of classroom technology use', *Journal of Research on Technology in Education*, vol. 36, pp. 253–271. https://doi.org/10.1080/15391523.2004.10782415

Waheed, M. (2010, October) 'Instructor's intention to accept online education: an extended TAM model', *AACE World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, Chesapeake, VA, pp. 1263–1271.

Watson, G. (2006) 'Technology professional development: long-term effects on teacher self-efficacy', *Journal of Technology and Teacher Education*, vol. 14, no. 1, pp. 151–166.

Woodcock, S., Sisco, A. & Eady, M. (2015) 'The learning experience: training teachers using online synchronous environments', *Journal of Educational Research and Practice*, vol. 5, no. 1, pp. 21–34.

Woolfolk, A. E. & Hoy, W. K. (1990) 'Prospective teachers' sense of efficacy and beliefs about control', *Journal of Educational Psychology*, vol. 82, pp. 81–91. https://doi.org/10.1037/0022-0663.82.1.81

Wright, J. M. (2011, June) 'Effect of quality matters training on faculty's online self-efficacy', *Annual Distance Learning Administration Conference*, Jekyll Island, GA, pp. 1–5.

Yuen, A. H. & Ma, W. W. (2008) 'Exploring teacher acceptance of e-learning technology', *Asia Pacific Journal of Teacher Education*, vol. 36, pp. 229–243.

Citation: Research in Learning Technology 2018, **26**: 2047 - http://dx.doi.org/10.25304/rlt.v26.2047