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Veteran teachers and digital technologies: myths, beliefs and professional development

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ABSTRACT

According to the Teaching and Learning International Survey (2019), the average age for a teacher, across OECD countries, is 44 years old, and the teacher workforce has aged in a number of countries, over the past 5 to 10 years. Given the demands expected from the contemporary teaching profession, the study of possible implications of ageing on the use of digital technologies in education is even more pertinent and relevant. This study aims to analyse veteran teachers' perceptions about digital technologies and outline possible pathways for their professional development. Data collected through literature review and content analysis of veteran teachers' perceptions, expressed in a continuing education training programme, show there are positive and negative thoughts and dilemmas related to the role of digital technology in education, and that there are myths regarding veteran teachers' digital skills, competences and motivation to change practices, as well as misconceptions about the relationship between technologies and educational reforms. The results also indicate possible pathways to successful training practice with this target group.

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Veteran teachers; digital technologies; innovation; digital literacy; professional development

Introduction

According to the Teaching and Learning International Survey (2019), the average age for a teacher, across OECD countries, is 44 years old, and the teacher workforce has aged in a number of countries, over the past 5 to 10 years. Several factors have contributed to this increase, such as the increase in average life expectancy and the consequent increase (in many countries) of the minimum age required for retirement (OECD, 2019); the decrease in generational renewal, resulting from lower birth rates, translates into a decrease in the school population, which, in turn, makes it less necessary for the systems to renew staff. Therefore, the population of teachers has aged, in Portugal (OECD, 2019). The consequences of this ageing, for educational systems, are numerous, and they exhibit an association with more conservative actions by teachers. These actions are related to their pedagogical practices (OECD, 2019b), with the increase in indiscipline phenomena, usually correlated with generalised ageism (Redman & Snape, 2002); and, finally, with

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greater difficulty to ensure a closer connection between the interests of students and the types of curricular work proposed to students, thereby causing a decrease in professional satisfaction and motivation. Part of this disenchantment will also result from the generational divide that exists between teachers and their students, a difference that is accentuated when associated with the digital familiarity that characterises the profile of current students, and the differences in terms of interests, languages and reasoning that between teachers and students (ref). As a consequence, this disenchantment is associated with a feeling of inefficiency and a large amount of curricular work, which is at the origin of many professional burnout processes.

However, more and more tasks are demanded from schools and education in general, which are given more responsibility and the quality of the educational action developed is expected to be higher. For this reason, the project in which this article fits is entitled 'Digital Migrations and Curriculum Innovation: Reframing the Experience and (Re) Enchanting the Teaching Profession after 50' (REKINDLE + 50) and aims to counter some effects of ageing in the teaching profession, exploring it as an asset of curricular agency.

The aforementioned project is underway in two Teacher Training Centers, in Portugal, and includes the participation of about 40 teachers, who underwent training in the previous year, and continue to be monitored by, and interact with the research team. This project intends to study the conditions and possibilities of professional re-enchantment among teachers, mediated by collaborative use and supported by digital technologies in the classroom. Specifically, the present study aims to analyse veteran teachers' thoughts about digital technologies and outline possible pathways for their professional development.

Veteran teachers and professional development: definition and scope

Age and length of service are the hallmarks of the definition of 'veteran teachers'. There is no consensus in the literature with regard to this definition, which is often used interchangeably or as a synonym for the term 'experienced teachers' (Day & Gu, 2009; McIntyre, 2010).

The combination of experience and age, which varies between 20 years of experience and from the age of 50 onward, is the most frequent use (Admiraal et al., 2019; Day & Gu, 2009; J. Orlando, 2014; Thorburn, 2014; Veldman et al., 2016). Professional development, where there is a predominance of studies on teachers' professional life cycles (Ben-Peretz et al., 2018; Hargreaves, 2005; Louws et al., 2018; Meister & Ahrens, 2011) and professional knowledge (Asikainen & Hirvonen, 2010; Englund et al., 2017; Orlando, 2014; Woolley, 2019), are the main aggregating themes in studies on veteran teachers. In addition to these criteria, the idea of 'expertise' is also mobilised when it comes to defining veteran teachers (Andrei, Ellerbe & Kidd, 2019; Lakkala, 2015).

Although the length of service and age of teachers are the central axes in the definition of veteran teachers, the dimensions of expertise, professional dispositions, accomplishment, and the ability to reflect on their own experience are elements present in the definition of veteran teachers (Carrillo & Flores, 2018). In this study, the term 'veteran teacher' is used to describe teachers who are 50 years of age or older and who, in this case, have been in the profession for at least 20 years.

Method

The study followed a phenomenological and interpretive orientation, resorting to qualitative data. In the first phase of the study, data were collected through literature review, whereas in the second phase, the perceptions of participating teachers were collected during the training period.

The literature review focused on two databases – SCOPUS and Web of Science. An exploratory and free search on the ageing of teachers allowed the identification of a set of keywords that were used in the search: 'veteran teachers' OR 'experienced teachers' OR 'senior teachers' OR 'elderly teachers' OR 'late career teachers' OR 'long serving teachers' AND 'technology', to be identified in the title and/or abstract and/or keywords. The search was restricted to publications from the year 2000 onward, and to the full articles available, published in Portuguese, English, Spanish and French. Nine articles were selected, whose main inclusion criterion was the simultaneous mobilisation of themes of professional development, the use of digital technologies and the ageing of teachers. From the articles that were identified, another 4 articles were included in the review, thus coming to a total of 13 articles.

The articles selected for analysis were published between 2007 and 2017, and involved mostly (8) qualitative, phenomenological and interpretive studies. Data collection mainly involved the use of interviews, individual or collective. In one study, the interviews are supplemented with questionnaires and observations. From a geographical point of view, the articles were written by authors from four continents: Oceania (4 articles), Europe (3 articles), North America (3 articles), and Asia (3 articles).

For the second phase of the study, data were collected through a questionnaire with open questions, administered before the beginning of the training and the reflections that the teachers made throughout the training. The participants were 37 teachers, between the ages of 50 and 62, with periods of experience between 20 and 39 years. This is an intentional sample, defined by convenience since all participants underwent continuing training on innovative learning scenarios with mobile devices, within the scope of the REKINDLE + 50 projects, in two different locations, in the northern region of Portugal. As for gender, the majority (78%) are female.

The teachers who participated in the study teach at different levels of education, from pre-school to high school. Of these, more than half (51%) accumulate their teaching functions with other positions and functions in the school, such as educational support, member of the school board, class director and coordinator of the Subject Area/Group.

The data from the literature review, questionnaires and the teachers' reflections were analysed with the support of the Nvivo12 program, following the procedures associated with content analysis (Ryan & Bernard, 2000): pre-analysis (floating reading); exploration of the material (coding and categorisation), having, as unit of analysis, the excerpts from the discourse with relevant meaning for the respective (predefined) categories and (emerging) subcategories; treatment, inference and interpretation of results.

From an ethical point of view, the anonymity of the participants was guaranteed, as well as the right to free and voluntary participation, without financial compensation. Consent was formalised by signing an informed consent form.

Findings

From the content analysis of the literature (phase 1) and the written reflections made by teachers at the end of the training (phase 2), it was possible to identify teachers' beliefs about the role of digital technologies in educational contexts, myths, as well as practices that enhance professional development by veteran teachers, which will be presented and discussed in the present article.

Veteran teachers' beliefs about digital technologies in education

In the literature review, several authors reported the existence of a relationship between teachers' beliefs about digital technologies and the use of these technologies in the classroom, for educational purposes. Examples of this are the following statements:

> Evidence demonstrates that beliefs can and do influence the choices a teacher makes regarding the integration of technology for instructional purposes (Shifflet & Weilbacher, 2015, p. 2)

> . . . teachers perceive about using ICT in their classroom affect teachers' behavior. Mumtaz (2000, cited in BECTA, 2004, p. 17) argues that teachers' belief is significant aspect which contributes to teachers' willingness to uptake ICT. Similarly, BECTA (2004, p. 17) contends that teachers may also resist to integrate ICT to their teaching because they do not believe their teaching can be more effective when they use technology (Suryani, 2017, p. 177)

Regarding the perceptions of veteran teachers about Digital Technologies, Laborda and Royo (2009) report the existence of two main trends: those in favour of technologies as a new way to develop and evaluate skills that have yet to be measured and, on the other hand, those who are reluctant to accept any change.

Based on the text analysed in the literature review, the number of references coded as negative perceptions of teachers about technologies in an educational context is higher than positive perceptions (five positive references and nine negative references), as shown in Table 1.

Through the data presented in Table 1, it is possible to assume that positive perceptions are related to the ubiquity and inevitability of ICT, the possibilities for improving teaching effectiveness and efficiency and the possible positive effects in terms of learning,

Table 1. Perceptions of veteran teachers about technologies in an educational context. Source: literature review.

Positive perceptions about digital technologies	Negative perceptions about digital technologies
They are part of the school culture (Suryani, 2017).	Teachers fear change (Suryani, 2017)
Allows for the improvement of the efficiency and effectiveness of teaching (Suryani, 2017).	Technologies require time for teaching content and important aspects of the curriculum, effort and resources (Kaloyanova & Ivanova, 2013)
Allows for the evaluation of skills in an unprecedented way	Students are more competent than teachers in the use of technologies (Kaloyanova & Ivanova, 2013)
Contributes to the development of literacy, logical reasoning and critical reasoning	When students use technology, they might become lazy in their studies (Kaloyanova & Ivanova, 2013)
Increases the motivation of students for learning (Shifflet & Weilbacher, 2015)	Technology entails loss of teacher authority and status
	Teachers experience difficulties and lack of confidence and motivation to learn to use technologies
	ICT integration measures are taken top-down, without involving teachers
	Some teachers feel isolated and that teaching practices are no longer good enough (Plair, 2008)

such as increased motivation by students and the development of transversal skills. On the other hand, negative perceptions are related to professional practice, the limited abilities they believe to have regarding technologies, fears, as well as possible 'risks' they consider to be associated with these practices.

In the second phase of the study, when veteran teachers were asked about the potential risks of using technology in the classroom, of the 37 respondents, 2 (5.4%) said there were no risks, while the rest mentioned the following aspects:

- Improper use or misuse of technologies by students (20 references);
- Distraction, agitation in the classroom and indiscipline (11 references);
- Need for guidance, rule-setting for use and supervision by the teacher (4 references);
- Disrespect to privacy (4 references);
- Technical issues (4 references);
- Reinforcing economic and social inequality (1 reference);
- Weakens human relationships (1 reference);

When asked about the benefits of technologies in the classroom, teachers mentioned:

- Performing tasks and activities (e.g., games; searches; access to information; text, image, sound and video editing; presentations; questionnaires, etc.) (21 references)
  - Motivation/engagement in tasks (12 references)
  - Develops skills and enhances learning (4 references)
  - Personalisation of learning (3 references)
  - Simulates autonomy (3 references)
  - Evaluates learnings (3 references)
  - Enhances interactive and collaborative work (2 references)

Some of the perceptions, such as those here exemplified, are associated with beliefs that are commonly accepted and disseminated by common sense, but which, according to the literature consulted, do not fully correspond to reality. In this study, they were considered myths.

In the literature review and in the responses of the participating teachers, it was possible to identify some myths related to digital technologies and veteran teachers, such as the exclusive responsibility of digital technologies for educational reform; the innate ability of students to engage with technologies, as opposed to veteran teachers who do not use them or use them less efficiently than less experienced teachers.

- Regarding the myth that technologies are primarily responsible for educational reform, Lakalla states that 'technology is often implemented within existing educational structures, methods and curriculum, and technology does not work as a catalyst for educational reforms . . . '. (Lakkala, 2015, p. 1)
- Although the name 'Digital Natives' (Prensky, 2001) is still commonly accepted for students because they were born in the technological age, in the literature review, it was possible to identify authors and reports from teachers stating that students have limitations in this domain, such as difficulties in using the keyboard, less use of technologies for learning purposes. They also present individual differences in terms

of skills, competences and low tolerance for more sequenced and formal learning processes, in the use of digital tools. Examples of this are the following statements:

> The students themselves, in particular their varied technology skills, presented a roadblock that prevented Mike from using this strategy with his entire class. Their lack of keyboarding skills presented a substantial problem (. . .) that the mere presence of technology did not ensure that learning occurred. (Shifflet & Weilbacher, 2015)

> These students arrive with a greater level of comfort with technology but little practical experience with how technology can support their learning. (Plair, 2008)

> This limited range of student technology skills presented a definite concern . . . While Cheri acknowledged the constant presence of technology in her students' lives, she was aware of the differences in students' ability to use technology within the classroom and in their personal lives. Both Mike and Cheri expressed the concern that students have an expectation that the automaticity of today's smart phones extends to all technologies". (Shifflet & Weilbacher, 2015)

The widespread perception that more experienced teachers do not use technology in their daily lives and, for this reason, have no interest in integrating it in practice, is contradicted by Kaloyanova and Ivanova (2013) and by Laborda and Royo (2009). The reasons why they sometimes use technologies for personal purposes but do not always integrate them in pedagogical practice, should, according to Orlando (2014), be further studied: 'Veteran teachers are not noted for a lack of capacity, knowledge or commitment in any other aspect of their role, which suggests deeper issues are at the core of their lack of use'. (Orlando, 2014)

(i) Regarding the myth that less experienced teachers use educational technologies more efficiently than more experienced teachers, the studies by Lakkala (2015) and Orlando (2014) argue that more experienced teachers use technologies more significantly, in the classroom, when they consider it relevant, favouring students' autonomy and knowledge building processes:

> While the practices of veteran teachers appear to remain unchanged they are engaging with technology in ways they consider necessary, that meet their priorities of their career stage and the needs of their students (Orlando, 2014, pp. 436-437).

> The teachers' way of orchestrating epistemic aspects in the classroom activities was very different: the less experience teachers focused on straight forward guidelines (e.g., directing pupils to write a research question) and factual knowledge (e.g., identifying plants), whereas the more-experienced teachers addressed pupils' own epistemic agency, such as knowledge creation (e.g., encouraging pupils to invent many answers) or the examination of final products (e.g., evaluating the final stories together). (Lakkala, 2015, p. 9)

Among the reflections of the teachers who participated in this study, perceptions about some of the myths mentioned above can be identified:

> "Indeed, students are not digital natives".

> "Heterogeneous classes, also in terms of digital literacy"

> "Students only use the smartphone, but can't use a computer, in grades 5 and 6, students can't use a keyboard or mouse".

> "Students are not motivated by learning, but may be by technology, but not to obtain knowledge through technology".

> "The desire to change and improve practices, to adapt them to the real/current world, makes me resort to technology and digital resources, because I recognize the potential in the involvement and motivation of students that they provide."

> "During the 29 years of my profession I have only taught Math to high school students (grades 10, 11 and 12). So it's quite difficult for me to use some of these tools in my classes, since I can't see it bringing benefits/gains for the explanation of the topics I teach and for the motivation of students."

Veteran teachers' professional development practices related to digital technologies

Given the different levels of digital skills of veteran teachers, continuing training has diversified in recent years, as stated by Lakkala (2015, p. 11): 'There is inevitably a need for various kinds of in-service training practices because teachers with different competences in digital technology benefit from different types of training'.

Of the training/professional development processes mentioned in the articles analysed in the literature review, accredited and mandatory seminars and courses stand out (Laborda & Royo, 2009) as well as in-service training, related to teaching practice and collaborative learning processes.

Regarding in-service training, Cerveira and Cantabrana (2015) report that this has an impact on classroom activities, since teachers apply the designs created collaboratively in training, while taking responsibility for their implementation in the classroom. The authors also mention the need to avoid training focused on the instrumental use of ICT, in favour of practice-oriented training, with a focus on curriculum development.

> In the process of professional development for teachers, we feel that approaches which are too focused on technical or instrumental aspects should be rejected in favor of training actions centered on the use of ICT at the educational level and for curricular development, while always remaining practice-oriented (Cerveira & Cantabrana, 2015, p. 120)

Regardless of the training modalities promoted, collaborative learning processes were identified, by several authors, as facilitators of learning among teachers and promoters of professional development (Lakkala, 2015; Suryani, 2017).

Lakkala (2015) highlights the role of peer tutoring by stating: 'The teachers thought that the models and tutoring from their more experienced colleague encouraged them to try more challenging practices and use of ICT than they would have done on their own' (p. 11). Clement and Vandenberghe emphasise the role of collegiality in professional development, stating that it can translate into storytelling and scanning for ideas, aid and assistance, sharing and joint work. Suryani (2017) mentions the role of observational pedagogical practice among peers, to raise awareness about the benefits of ICT in teaching and learning processes.

Based on the literature review and with the contribution of veteran teachers participating in the project, the continuing training that has been developed is based on the following pillars:

collaboration and sharing of theoretical and experiential knowledge between peers; planning innovative, contextualised and meaningful learning scenarios; practical application in the field and reflection on practice. When reflecting on the formative process of the current project, teachers mentioned difficulties in time management and in carrying out the planned tasks. However, they highlight the importance of updating practices, sharing, diversifying strategies and of the reflective component. This is exemplified in the following statements:

> "The planning and preparation of many of these classes requires time availability inside and outside the classroom, and this often compromises the fulfilment of the programs, most of which have a wide range of content, as well as the essential learning that accompanies them".

> "The fulfilment of this paradigm shift in education involves the classroom, the teacher, the students, and collaborative and cooperating work from all. Mobile devices and technology are a fundamental complement to this change, by providing innovative learning scenarios. However, it is necessary to favor different strategies in the entire process, which contribute to the achievement of significant learning".

> "Having recognized the school as a privileged space for the acquisition of the multiple literacies that students need to mobilize, in order to respond to the fast and (un)predictable changes that take place in society, it is necessary to prepare students to learn throughout life. The most effective way to do so, undoubtedly, would include the questioning and reflection about our beliefs, methodologies, options and decisions. It was also due to this that I applied for this continuous training course: to continue to learn how to teach. And I believe I can say that this training was an asset for the exercise of my job".

Discussion and conclusion

In a European scenario of teacher ageing and an increased demand for the updating of pedagogical practices due to accelerated technological development, this article intended to analyse veteran teachers' thoughts about digital technologies and outline possible pathways for their professional development.

The present study, as mentioned above, is part of a research project on the professional re-enchantment of teachers, from the age of 50 onward. Data were obtained through the content analysis of the literature review and the written reflection of 37 veteran teachers, who participate in the continuing in-service training provided in the project.

As for the perceptions about digital technologies and their relationship with pedagogical practices, they are divided into positive and negative perceptions. Positive perceptions, both from the literature review and from the veteran teachers, mention the potential of technologies as a motivating element. However, there seems to be a more pragmatic view among participating teachers, when they mostly highlight aspects related to the performance of specific and utilitarian tasks with digital technologies, in lieu of global and transversal aspects. The literature review also listed other advantages, generally associated with the creation of virtual environments that promote learning, such as the possibility of personalised teaching, the development of transversal skills and the possibility of using ICT in evaluation, which were mentioned less frequently by the participants of the study.

As for the negative perceptions about digital technologies, the literature review focused on difficulties related to professional and personal issues of veteran teachers, with time management being a major factor. The disruption and loss of efficiency in the management of planned

academic activities was another difficulty identified in the literature. This idea is in line with the answers obtained in this study. Teachers mentioned possible behavioural problems exhibited by students when using digital resources, such as misuse, distraction, agitation, indiscipline and disrespect, as well as the need for 'control'. This list of possible problems is related to some of the fears of veteran teachers, identified in the literature and associated with the fear of change since it causes insecurity and a possible feeling of loss of status and authority.

Based on the literature review and the analysis of veteran teachers' perceptions about digital technologies, some myths are discussed, such as the myth of the 'digital native', suggesting that veteran teachers do not use technologies or do so less efficiently, than less experienced teachers. As main conclusions, the study allows us to affirm that the level of mastery in digital literacy evidenced by students and verified either in the literature or in the practice of the teachers who were inquired, is variable, as they exhibit difficulties in using the technologies for educational purposes, or even in learning from technology. Therefore, it seems that students reveal a very technical use of technology and focused on the immediate result and practical application of its use.

It is also possible to conclude that veteran teachers, in general, use technology for personal purposes, but only use them for pedagogical purposes when they consider it an asset for learning. In other words, when it becomes clear to them that there is adequacy between their methods and strategies for promoting learning, and the organisational, aesthetic or temporal possibilities, among others, that technology introduces. Therefore, it is pivotal that the search for pedagogical sense in the use of technologies is accompanied both by an unveiling of the pedagogical practices that teachers use and by hermeneutics of technological devices, in order to ensure true innovation in the classroom.

These considerations reveal the need to invest in professional development and in the continuing training of these teachers. Thus, regarding professional pathways, the literature review and the project in which the present study is included are in agreement, by pointing out the need for continuous training to be provided in-service, with an impact on activities developed in the classroom, and that this process should ensure a break from previous practices. In more specific terms, it is important that training be focused, not on the instrumental use of digital technologies but on pedagogical issues and curriculum development. It is also important for training to include the planning and design of learning scenarios mediated by technology, to have a workshop format and make teachers responsible for the implementation of activities in the classroom. Finally, the training plan should incorporate reflection, sharing and collaboration processes, including peer observation systems and tutorials.

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References

Admiraal, W., Veldman, I., Mainhard, T., & Van Tartwijk, J. (2019). A typology of veteran teachers' job satisfaction: Their relationships with their students and the nature of their work. *Social Psychology of Education*, *22*(2), 337–355. https://doi.org/10.1007/s11218-018-09477-z

Andrei, E., Ellerbe, M., & Kidd, B. (2019). "What am I going to do?" A veteran teacher's journey of teaching writing to newcomer English language learners. *TESOL Journal*, *10*(2), 2. https://doi.org/10.1002/tesj.413

Asikainen, M. A., & Hirvonen, P. E. (2010). Finnish cooperating physics teachers' conceptions of physics teachers' teacher knowledge. *Journal of Science Teacher Education*, *21*(4), 431–450. https://doi.org/10.1007/s10972-010-9187-y

BECTA. (2004). *A review of the research literature on barriers to the uptake of ICT by teachers by Becta*.

Ben-Peretz, M., Gottlieb, E., & Gideon, I. (2018). Coaching between experts–opportunities for teachers' professional development. *Teacher Development*, *22*(3), 303–313. https://doi.org/10.1080/13664530.2018.1438310

Carrillo, C., & Flores, M. A. (2018). Veteran teachers' identity: What does the research literature tell us. *Journal of Education*, *48*(5), 639–656. https://doi.org/10.1080/0305764X.2017.1394982

Cerveira, M., & Cantabrana, J. (2015). Professional development in teacher digital competence and improving school quality from the teachers' perspective: A case study. *New Approaches in Educational Research*, *4*(2), 115–122. https://doi.org/10.7821/naer.2015.7.123

Day, C., & Gu, Q. (2009). Veteran teachers: Commitment, resilience and quality retention. *Teachers and Teaching*, *15*(4), 441–457. https://doi.org/10.1080/13540600903057211

Englund, C., Olofsson, A. D., & Price, L. (2017). Teaching with technology in higher education: Understanding conceptual change and development in practice. *Higher Education Research and Development*, *36*(1), 73–87. https://doi.org/10.1080/07294360.2016.1171300

Hargreaves, A. (2005). Educational change takes ages: life, career and generational factors in teachers' emotional responses to educational change. *Teaching and Teacher Education*, *21*(8), 967–983. https://doi.org/10.1016/j.tate.2005.06.007

Kaloyanova, N., & Ivanova, T. (2013). Elderly teachers and ICT – Opportunities for active aging in the profession. *Ariadna*, *1*(1), 25–32. https://doi.org/10.6035/Ariadna.2013.1.5

Laborda, J. G., & Royo, T. M. (2009). Training senior teachers in compulsory computer based language tests. *Procedia – Social and Behavioral Sciences*, *1*(1), 141–144. https://doi.org/10.1016/j.sbspro.2009.01.026

Lakkala, M. (2015). A case study of developing ICT-supported pedagogy through a collegial practice transfer process. *Computers & Education*, *90*, 1–12. https://doi.org/10.1016/j.compedu.2015.09.001

Louws, M. L., Meirink, J. A., Van Veen, K., & Van Driel, J. H. (2018). Understanding teachers' professional learning goals from their current professional concerns. *Teachers and Teaching: Theory and Practice*, *24*(1), 63–80. https://doi.org/10.1080/13540602.2017.1383237

McIntyre, J. (2010). Why they sat still: The ideas and values of long-serving teachers in challenging inner-city schools in England. *Teachers and Teaching: Theory and Practice*, *16*(5), 595–614. https://doi.org/10.1080/13540602.2010.507968

Meister, D. G., & Ahrens, P. (2011). Resisting plateauing: four veteran teachers' stories. *Teaching and Teacher Education*, *27*(4), 770–778. https://doi.org/10.1016/j.tate.2011.01.002

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, *9*(3), 319–341.

OECD (2019), *Teachers by age (indicator)*. OECD Data. https://data.oecd.org/teachers/teachers-by-age.htm

Orlando, J. (2014). Veteran teachers and technology: change fatigue and knowledge insecurity influence practice. *Teachers and Teaching: Theory and Practice*, *20*(4), 427–439. https://doi.org/10.1080/13540602.2014.881644

Plair, S. (2008). Revamping professional development for technology integration and fluency. *Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *82*(2), 70–74.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, *9*(5), 1–6. https://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Redman, T., & Snape, E. (2002). Ageism in teaching: Stereotypical beliefs and discriminatory attitudes towards the over-50s. *Work, Employment and Society*, *16*(2), 355–371. https://doi.org/10.1177/095001702400426884

Ryan, G. W., & Bernard, H. R. (2000). Data management and analysis methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 769–802). Sage.

Shifflet, R., & Weilbacher, G. (2015). Teacher beliefs and their influence on technology use: a case study. *Contemporary Issues in Technology and Teacher Education*, *15*(3), 368–394. https://citejournal.org/volume-15/issue-3-15/social-studies/teacher-beliefs-and-their-influence-on-technology-use-a-case-study/

Suryani, A. (2017). "I am an old car, my engine is not powerful anymore". A senior teacher's voice on his ICT learning, obstacles and its implications for teachers' development. *International Journal of Pedagogy and Teacher Education*, *1*(2), 174–188. https://doi.org/10.20961/ijpte.v1i2.15000

Thorburn, M. (2014). It was the best of times, it was the: subject aims and professional identity from the perspective of one veteran male teacher of physical education in Scotland. *Teachers and Teaching: Theory and Practice*, *20*(4), 440–452. https://doi.org/10.1080/13540602.2014.881641

Veldman, I., Admiraal, W., Van Tartwijk, J., Mainhard, T., & Wubbels, T. (2016). Veteran teachers' job satisfaction as a function of personal demands and resources in the relationships with their students. *Teachers and Teaching: Theory and Practice*, *22*(8), 913–926. https://doi.org/10.1080/13540602.2016.1200546

Woolley, M. C. (2019). Experiencing the history national curriculum 1991–2011: voices of veteran teachers. *History of Education*, *48*(2), 212–232. https://doi.org/10.1080/0046760X.2018.1544668