



# Research on Teacher Development during Digital Transformation

## —Current Status and Prospects

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### Abstract

As digital technology continues to drive changes in education, teachers are required to develop new talents during digital transformation. European Union, UNESCO, United States, Spain, and Norway have released new frameworks for teacher development. It is necessary to learn from other's experiences. This study conducts a systematic literature analysis on teacher development during digital transformation in the SSCI database, and sorted out the theories, factors, and analyzed the research gaps in this field.

### Subject Areas

Educational Technology

### Keywords

Teacher Development, Digital Transformation, Theories, Factors, Digital Competence

## 1. Introduction

Recently, technology-driven changes in education led to the discussions about teacher standards. The Horizon Report states that teachers should develop literacy and competence in distance/blended teaching and AI-based teaching. European Union, Spain and Norway released frameworks for teacher development. For example, digital competence, first proposed by the EU [1], refers to the ability to use information society technologies confidently and critically for work, leisure and communication. It is necessary to draw reference from other countries, especially the theories and practical experiences in teacher development.

## 2. Literature Review

In the context of digital development, Scholars conducted several reviews of research on digital competence of teachers. Among them, Pettersson [2] conducted a systematic review of 41 relevant literature in higher education from 2007 to 2017, summarizing the themes and hotspots in the field. Fernández-Batanero *et al.* [3] conducted a systematic review of 2008-2018 and sorted out the impact of professional training on teachers' digital competence and the main research methods. Zhao *et al.* [4] analyzed the definitions, evaluation dimensions, research objectives, research methods, findings, and limitations of related studies in the years 2015-2021. However, the above studies lack a comparison of the content of teacher digital competence and an analysis of the factors. There is a need to do further research.

## 3. Methodology

This study will be organized around the following questions:

- 1) What theories have been used in established research?
- 2) What impacts on teachers to develop have been identified by established research?
- 3) What research gaps remain in the field?

Literature database is "SCCI core collection". Topic 1 is "digital competence", Topic 2 is "teachers" or "educators", and the search relationship between topics is "and". Based on the above conditions, a total of 459 results were first retrieved, and then the literature with low relevance to this study was manually removed, and 62 documents were finally identified.

After that, this study drew on the methodology adopted by Zhao *et al.* [5], which coded the authors, year of publication, research methodology, data sources, research subjects, research tools, number of citations, research questions, findings and research gaps.

## 4. Findings

Through a systematic analysis, it is found that the research in this field can be classified into two categories: theory construction and analysis of factors. This study conducted a comparative analysis of the representative theoretical models, sorted out the factors and proposed the research gaps that existed in this field.

### 4.1. Theoretical Construction

In the theoretical construction study, six models with high impact were identified based on the number of citations. Among them, Krumsvik [6] used a model of digital competence for teachers. This model is currently the most cited.

Instefjord & Munthe [7] analyzed the models of Zhao *et al.* [8], Mishra & Koehler [9], and Krumsvik [10]. They further argued that teachers' digital competence include technological proficiency, pedagogical compatibility, and social awareness.

Falloon [11] reviewed the SAMR model [12], the TPACK model [9], the digital competency model [13], and updated the digital competence framework for teachers.

In addition to the theoretical models proposed by scholars, international organizations such as UNESCO and the European Union, countries such as the United States, the United Kingdom, Spain, Norway, Colombia, and Chile also released frameworks of digital competence for teachers.

A comparative analysis of the models and frameworks mentioned above reveals that teachers need to master digital technology skills, develop the ability to adopt appropriate pedagogies, and adherence to ethics in the use of technology. However, there are also some individualized features that reflect different considerations of the designers. Of all the models, the one developed by the United States and the other one developed by European Union are relatively more cited. Both include areas such as teaching, professional development, digital resource application, assessment, empowering learners, and facilitating the development of learners' digital competences. Besides, American teachers are expected to promote digital applications and foster a digital culture, while EU teachers are required to produce digital information and develop students' learning strategies in digital environments.

#### 4.2. Factors on Teachers to Develop Digital Competence

The factors on teachers to develop digital competence can be categorized into personal and environmental ones. A large amount of literature focuses on personal factors, which can be further subdivided into gender, age, teaching experience, specialty, etc.

In addition to gender, age is also an important personal factor that contributes to the differences in teachers' digital competence. It is found that younger teachers are significantly more digitally competent than older ones [14], and that younger teachers try digital technology earlier than older ones [15].

In addition, it is found that teachers are motivated by their attitudes and beliefs about ICT technology to integrate technology in their class. For example, Hatlevik & Hatlevik [16] conducted a survey with 1158 teachers in 116 Norwegian schools and found that teacher self-efficacy in using ICT technology was significantly correlated with self-efficacy. Choi *et al.* [17] found through a survey that self-efficacy significantly predicted teachers perceived digital competence.

There are relatively few empirical studies on other personal factors, but it is confirmed that teachers' ICT knowledge level [18], work experience [19], training experience [20], and academic qualifications [21] are important for teachers to develop digital competence. In addition to personal factors, the role of environmental factors cannot be ignored. Teachers' digital competence may vary in different technological, policy, and pedagogical environments. Such studies help to provide a comprehensive understanding of the current status of teachers' digital competence in different environments [22].

### 4.3. Research Gaps

Based on a systematic literature analysis of established research, this study has been organized around research perspectives, objects, methods, theories and themes to address the research gaps in the field.

In terms of perspectives, the data in the established studies mainly come from the teachers themselves. However, teachers' digital competence development is not only affected by individual factors, but also by environmental factors such as policy, technology and students. In view of this, it is necessary to adopt an ecological perspective by investigating policy makers, students, and other subjects.

With regard to the object, the existing research mainly focuses on pre-service teachers. There are fewer research results related to in-service teachers. Scholars should focus more on the digital competence of in-service teachers and domestic teachers, so as to provide the academic community with more theoretical and case support.

In terms of methodology, questionnaires, interviews, and teaching reflection reports are the most frequently used methods. The conclusions of existing studies are usually based on data from a questionnaire or an interview. It is necessary to know that teacher development is not just a result, but a complex and dynamic process. During the process of professional development, teachers may be influenced by a variety of positive or negative factors, adopt individualized behaviors, and achieve corresponding results. These complex and dynamic features should be emphasized. Classroom observation over time and follow-up interviews can help to understand the process of teacher development.

In terms of theoretical foundation, existing studies adopted most the model of teachers' digital competence. It is difficult for the existing model to explain the complexity and dynamics in the process of teachers' development, and it is also difficult to present the interactive influence of teachers and other subjects, so it is necessary to draw on the theory of complex dynamic systems and socio-cultural theories to analyze the professional development of teachers in depth.

In terms of content, scholars confirmed the positive effects of the development of teachers' digital competence, but there are fewer studies on the difficulties, challenges and negative factors encountered in the process of teachers' development. The use of digital technology is indeed the foundation of professional development, but how to build on this foundation to develop other areas of teachers' digital competence is a question that remains to be answered.

In terms of themes, scholars mainly focus on the construction of theoretical models and the analysis of factors. There is an urgent need explore effective development paths for teachers to develop digital competence. Among the existing studies on development paths, there are more studies based on the results of teacher training, and not enough attention has been paid to the paths of digital competence enhancement, such as teaching practice, teacher community, and action research.

## 5. Conclusion

Modern technology calls for a new type of teacher and digital competence is the current research hotspot. Teachers are an important subject for the implementation of the national education strategy, shouldering the important task in the context of digital transformation. Digital competence is a necessary quality of teacher standards. On the basis of the established research, it is an important mission of future scholars to construct a theoretical system of digital competence for teachers with different characteristics and explore the path of competence development that meets the needs of different teachers.

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## Conflicts of Interest

The author declares no conflicts of interest.

## References

- [1] European Parliament and the Council (2006) Recommendation of the European Parliament and the Council of 18 December 2006 on Key Competences for Lifelong Learning. *Official Journal of the European Union*, **394**, 10-18.
- [2] Pettersson, F. (2017) On the Issues of Digital Competence in Educational Contexts—A Review of Literature. *Education and Information Technologies*, **23**, 1005-1021. <https://doi.org/10.1007/s10639-017-9649-3>
- [3] Fernández-Batanero, J.M., Montenegro-Rueda, M., Fernández-Cerero, J. and García-Martínez, I. (2020) Digital Competences for Teacher Professional Development. Systematic Review. *European Journal of Teacher Education*, **45**, 513-531. <https://doi.org/10.1080/02619768.2020.1827389>
- [4] Zhao, Y., Pinto Llorente, A.M. and Sánchez Gómez, M.C. (2021) Digital Competence in Higher Education Research: A Systematic Literature Review. *Computers & Education*, **168**, Article 104212. <https://doi.org/10.1016/j.compedu.2021.104212>
- [5] Zhao, Y., Pinto Llorente, A.M. and Sánchez Gómez, M.C. (2021) Digital Competence in Higher Education Research: A Systematic Literature Review. *Computers & Education*, **168**, Article 104212. <https://doi.org/10.1016/j.compedu.2021.104212>
- [6] Krumsvik, R.J. (2012) Teacher Educators' Digital Competence. *Scandinavian Journal of Educational Research*, **58**, 269-280. <https://doi.org/10.1080/00313831.2012.726273>
- [7] Instefjord, E. and Munthe, E. (2015) Preparing Pre-Service Teachers to Integrate Technology: An Analysis of the Emphasis on Digital Competence in Teacher Education Curricula. *European Journal of Teacher Education*, **39**, 77-93. <https://doi.org/10.1080/02619768.2015.1100602>
- [8] Zhao, Y., Pugh, K., Sheldon, S. and Byers, J.L. (2002) Conditions for Classroom Technology Innovations. *Teachers College Record: The Voice of Scholarship in Education*, **104**, 482-515. <https://doi.org/10.1111/1467-9620.00170>
- [9] Mishra, P. and Koehler, M.J. (2006) Technological Pedagogical Content Knowledge:

- A Framework for Teacher Knowledge. *Teachers College Record: The Voice of Scholarship in Education*, **108**, 1017-1054. <https://doi.org/10.1177/016146810610800610>
- [10] Krumsvik, R. (2007) Skulen og den digitale læringsrevolusjon. Universitetsforlaget.
- [11] Falloon, G. (2020) From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework. *Educational Technology Research and Development*, **68**, 2449-2472. <https://doi.org/10.1007/s11423-020-09767-4>
- [12] Puentedura, R.R. (n.d.) Transformation, Technology and Education: A Model for Technology and Transformation. [http://hippasus.com/resources/tte/puentedura\\_tte.pdf](http://hippasus.com/resources/tte/puentedura_tte.pdf)
- [13] Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K. and Sloep, P. (2013) Experts' Views on Digital Competence: Commonalities and Differences. *Computers & Education*, **68**, 473-481. <https://doi.org/10.1016/j.compedu.2013.06.008>
- [14] Scherer, R. and Siddiq, F. (2015) Revisiting Teachers' Computer Self-Efficacy: A Differentiated View on Gender Differences. *Computers in Human Behavior*, **53**, 48-57. <https://doi.org/10.1016/j.chb.2015.06.038>
- [15] Lucas, M., Bem-Haja, P., Siddiq, F., Moreira, A. and Redecker, C. (2021) The Relation between in-Service Teachers' Digital Competence and Personal and Contextual Factors: What Matters Most? *Computers & Education*, **160**, Article 104052. <https://doi.org/10.1016/j.compedu.2020.104052>
- [16] Hatlevik, I.K.R. and Hatlevik, O.E. (2018) Examining the Relationship between Teachers' ICT Self-Efficacy for Educational Purposes, Collegial Collaboration, Lack of Facilitation and the Use of ICT in Teaching Practice. *Frontiers in Psychology*, **9**, Article 935. <https://doi.org/10.3389/fpsyg.2018.00935>
- [17] Choi, M., Cristol, D. and Gimbert, B. (2018) Teachers as Digital Citizens: The Influence of Individual Backgrounds, Internet Use and Psychological Characteristics on Teachers' Levels of Digital Citizenship. *Computers & Education*, **121**, 143-161. <https://doi.org/10.1016/j.compedu.2018.03.005>
- [18] Garzón Artacho, E., Martínez, T.S., Ortega Martín, J.L., Marín Marín, J.A. and Gómez García, G. (2020) Teacher Training in Lifelong Learning—The Importance of Digital Competence in the Encouragement of Teaching Innovation. *Sustainability*, **12**, Article 2852. <https://doi.org/10.3390/su12072852>
- [19] Beneyto-Seoane, M. and Collet-Sabé, J. (2018) Analysis of Current Teachers Training on ICTs' Skills. Proposing a New Perspective Based on Teachers' Previous Competences, Experiences and Skills. *Revista De Currículum Y Formación Del Profesorado*, **22**, 91-110. <https://doi.org/10.30827/profesorado.v22i4.8396>
- [20] Bernal-Bravo, C., Gozávez, V., Hernando Gómez, Á. and Massanet Jorda, M.J. (2019) Relación entre formación universitaria y competencia mediática del profesorado. *Revista Complutense de Educación*, **30**, 1113-1126. <https://doi.org/10.5209/rced.60188>
- [21] Méndez, V.G., Suelves, D.M., Méndez, C.G. and Mas, J.A.R. (2022) Future Teachers Facing the Use of Technology for Inclusion: A View from the Digital Competence. *Education and Information Technologies*, **28**, 9305-9323. <https://doi.org/10.1007/s10639-022-11105-5>
- [22] Tondeur, J., Aesaert, K., Prestridge, S. and Consuegra, E. (2018) A Multilevel Analysis of What Matters in the Training of Pre-Service Teacher's ICT Competencies. *Computers & Education*, **122**, 32-42. <https://doi.org/10.1016/j.compedu.2018.03.002>