



The Role of E-Learning and Information Culture in Educational Institutions in Transforming European Education

Sirje Virkus, Valentina Kirinić, and Nina Begičević Redep

Abstract Due to the rapid development of information and communication technology, society has had to change the way it lives, works, communicates, collaborates, educates and learns. Academic research has begun to focus on this phenomenon, which is widely known as digital transformation (DT). This chapter explores how e-learning and information culture influence DT in education. The structure of this chapter is organised as follows: after the introduction, the second section discusses the concepts of digital transformation, e-learning and information culture. The third section describes the role of information culture and e-learning in

S. Virkus

School of Digital Technologies, Tallinn University, Tallinn, Estonia

e-mail: sirje.virkus@tlu.ee

V. Kirinić (✉) • N. Begičević Redep

Faculty of Organization and Informatics, University of Zagreb, Varazdin, Croatia

e-mail: valentina.kirinic@foi.unizag.hr; nbegicev@foi.hr

the European Framework for the Digital Competence of Educators and the European Framework for Digitally Competent Educational Organisations. In the fourth section, the conclusion is given.

Keywords E-learning • Information culture • Educational institutions
• Digital transformation

Due to the rapid development of information and communication technology, society has had to change the way it lives, works, communicates, collaborates, educates and learns. Academic research has begun to focus on this phenomenon, which is widely known as digital transformation (DT) (Henriette, Feki, & Boughzala, 2015). Educators globally are changing the way they think about learning, teaching and assessment in the digital environment, as well as the theories and practices related to making claims about learning based on digital evidence. Three elements have combined to form new digital pathways for learning: (1) self-organising learning groups, (2) open badges and (3) changing conceptions of education (Gibson, Coleman, & Irving, 2016; Virkus, 2019a). However, digital transformation does not only refer to a shift in technology. According to Stolterman and Fors (2004, p. 689), digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life. Thus, information culture constitutes a context of how information is communicated and shared in an organisation and how the attitudes, norms and values are developed concerning creating, sharing and using information.

This chapter explores how e-learning and information culture influence DT in education. The structure of this chapter is organised as follows: after the introduction, the second section discusses the concepts of digital transformation, e-learning and information culture. The third section describes the role of information culture and e-learning in the European Framework for the Digital Competence of Educators and the European Framework for Digitally Competent Educational Organisations. In the fourth section, the conclusion is given.

INTRODUCTION

Although digital transformation is in most cases connected to the business world, it is also discussed in the context of educational organisations, that is, institutions at primary, secondary and tertiary levels as well as internal or external providers of corporate training and human resource development services (Seufert & Meier, 2016, p. 27). In education, the topics being discussed include new formats for learning and development (e.g. MOOCs, open digital badges and micro-credentials, nanodegrees, informal learning and performance support), platforms for learning and collaboration (e.g. cloud based services) and integrated processes (e.g. knowledge maps, competency gap analyses) (Seufert & Meier, 2016, p. 27). Globally, educators are changing the way they think about learning, teaching and assessment in the digital environment, as well as the theories and practices related to making claims about learning based on digital evidence (Virkus, 2019a). Mahlow and Hediger (2019) propose to use digital transformation as an opportunity to re-contextualise learning.

There are many approaches and models of digital transformation. The digitisation and digital transformation of education is often related to e-learning. Zaoui and Souissi (2018, p. 2) note that several models are proposed in previous research, which differ in the approach adopted for the integration of information and communication technology in schools. However, they note, “there are many fundamental components towards which these models converge, among others, the pedagogic, technological or cultural axis.” According to Wang (2008), the key components of a generic model guiding information and communication technology integration in education are pedagogy, social interaction and technology. Pedagogy is the set of approaches used to teach and facilitate learning. The social aspect in a learning environment involves communication, exchange and sharing of information between individuals (Zaoui & Souissi, 2018, p. 2). The social aspect is closely linked to information culture. Seufert and Meier (2016, p. 27) note that digital transformation is rather a matter of establishing changed cultures of learning and defining new business models. Information culture constitutes a context of how information is communicated and shared in an organisation and how the attitudes, norms and values are developed concerning creating, sharing and using information (Lauri, Heidmets, & Virkus, 2016).

As for technology, it involves information and communication technology tools used in teaching and learning processes. However, digital

transformation does not only refer to a shift in technology. According to Stolterman and Fors (2004, p. 689), digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life. Looking at educational institutions more generally, digital transformation can be understood as a development affecting all major processes: educational marketing and application, student management via programme/course development and delivery, all the way to assessment, certification and alumni management (Seufert & Meier, 2016, p. 27).

One approach is to explore the competencies required for digital transformation. A large number of frameworks and characterisations have been put forward. Most of them are based on skills development and the ability to use a specific set of tools and applications (Seufert & Meier, 2016, p. 27).

This chapter explores two important aspects of digital transformation in education: e-learning and information culture, and their role in transforming education.

THE CONCEPTS OF DIGITAL TRANSFORMATION, E-LEARNING AND INFORMATION CULTURE

The Concept of Digital Transformation

Although digital transformation is a hot topic at the moment, ideas relating to digital products, services and mediums were already well understood in the 1990s and 2000s (Auriga, 2016; Schallmo, Williams, & Boardman, 2017). Many authors have attempted to define and discuss the exact notion of digital transformation, and there are many definitions and approaches on what digital transformation means.

According to Solis (2017), digital transformation may be defined as “the realignment of, or new investment in, technology, business models, and processes to drive new value for customers and employees and more effectively compete in an ever-changing digital economy.” Following this line of reasoning, from an organisational point of view, digital transformation can be seen as a deep and accelerating transformation with regard to processes, activities, competences and models. It allows organisations to

take advantage of the changes and opportunities offered by digital technologies. Uhl and Gollenia (2016) enrich the digital transformation concept and argue that the adoption of technology-based change is focused on four technology enablers: (1) cloud, (2) mobile, (3) social and (4) big data—analytics. Hence, digital transformation draws on these four pillars to place a business context over the technologies, while taking advantage of them to support innovation (as cited in Ferreira, Moreira, & Seruca, 2017; Virkus, 2019b).

Rocha, Adeli, Reis, and Costanzo (2018, p. 417) have explored various definitions of digital transformation on the basis of Institute for Scientific Information – Web of Science (ISI) and have concluded that no formal categorisation of digital transformation exists in academic literature and its boundaries are often blurred. They highlight three distinct elements used in defining digital transformation: technological, organisational and social.

From the technological perspective, digital transformation is based on the use of new digital technologies such as social media, mobile, analytics or embedded devices. For example, Stolterman and Fors (2004, p. 689) refer to “changes associated with the application of digital technology in all aspects of human life,” and Schlepp (2019) refers to “The novel use of digital technology to solve traditional problems in new ways and enable new types of innovation.” Westerman, Bonnet, and McAfee (2014) highlight the use of digital technologies to radically improve organisational performance and scope. The use of digital technology is mainly related to artificial intelligence, cloud computing, adaptive robotics, augmented and virtual reality, mobile technology, analytics, and the Internet of Things to transform society, business, education and everyday life. This dominated approach is based on technological determinism, that is, believing that the use of digital tools and the digitisation of processes lead to improved processes and services, and the organisation’s ability to change. However, several authors emphasise that the way society changes cannot be attributed to digital technology alone and that digital transformation is not just about technology. Instead, it is about the way organisations work and how society’s use of technology changes work practices (Dunleavy, Margetts, Bastow, & Tinkler, 2006; Mergel, Edelman, & Haug, 2019; Rocha et al., 2018).

From the organisational perspective, digital transformation requires a change in organisational processes or the creation of new business models. It is believed that digital transformation is the process of profound transformation. It involves business and organisational activities, processes,

competencies and models to fully leverage the changes and opportunities offered by a mix of digital technologies and accelerating their impact across society in a strategic and prioritised way, that is, with present and future shifts in mind (Attwell et al., 2015; Matt, Hess, & Benlian, 2015). Digital transformation is “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019, p. 118). Attwell et al. (2015) point out five areas, in which shortcomings often hinder the adoption of new technologies: (1) attitudes and knowledge, (2) technology readiness and infrastructure, (3) data security and privacy, (4) business models, and (5) innovation take up (Rocha et al., 2018).

From the social perspective, digital transformation is a phenomenon that is influencing all aspects of human life, for example, enhancing the customer service experience (Rocha et al., 2018; Virkus, 2019b).

Rocha et al. (2018, p. 418) found that almost all of these aspects are used in the researchers’ definition of digital transformation (e.g. Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014; Solis, Lieb, & Szymanski, 2014; Westerman, Calm ejane, Bonnet, Ferraris, & McAfee, 2011). Therefore, they define digital transformation as the use of new digital technologies that enable major business improvements and influence all aspects of a customer’s life. Westerman et al. (2014) conclude that digital transformation marks a profound transformation and the radical rethinking of how an organisation uses technology, people and processes to fundamentally change business performance (Virkus, 2019b).

The Concept of Information Culture

However, several researchers highlight the need for change in organisational culture. For example, De la Pe na and Cabezas (2015, p. 52) consider digital transformation to be “a necessary process of significant technological and cultural change that the whole organisation needs to carry out in order to “live up to” its digital clients” (as cited in Menendez, Maz-Machado, & Lopez-Esteban, 2016). Duparc (2013) argues that digital transformation is only achieved when the whole organisation understands and embraces the importance of digital culture and makes it their own across all levels. Thus, it is not just about technology, but rather about people and organisational culture.

Mancini (2018) highlights the important role of intelligent information management in digital transformation. He believes that the effectiveness of digital transformation is imperilled by a rising tide of information chaos and confusion. Despite major improvements in information management capabilities over the past ten years, organisations have only marginally kept pace with the new wave of “Big Content” challenges. While most organisations continue to increase the number of content systems they use, a rising portion of critical business content remains outside those content management systems (Mancini, 2018).

The rising tide of information chaos and confusion is creating a demand for new information management practices. Mancini (2018) notes that organisations need to transform, and a modern approach to information management needs to be at the heart of that transformation. He emphasises that we need to develop a new framework that considers the information management practices and methodologies that are critical to digital transformation in order to meet the challenge of radically redefining experiences with customers, employees and partners. He believes that we need a new way to talk about what organisations are doing with content and information, and how they are doing it. The framework he offers is “intelligent information management” (Mancini, 2018).

Based on all of this, the concept of information culture comes into focus. Lauri, Heidmets and Virkus state,

Information culture constitutes a context for how information is communicated in an organisation and how the attitudes, norms, and values are developed concerning creating, sharing, and using information. Whereas organisational culture has an effect on aspects of organisational behaviour, the information culture, being part of it, forms the socially-shared context for information use in organisations. (Lauri et al., 2016)

According to Choo (2002, p. 54) “information culture is reflected in an organisation’s values, norms, and practices with regard to the management and use of information.” Values are the deeply held beliefs about the goals and identity of the organisation and how it should go about attaining set goals. They could be indicated by the importance of information in organisational achievements, perceptions of information management as an organisational priority, attitudes towards new ideas and innovations, trust, integrity, openness in information creation and the use and ownership of information assets. Norms, derived from values and having more

direct influence on information behaviour, are rules or socially accepted standards that define what is normal or to be expected in the organisation. They may be informal and formal (Choo, 2002). Practices are revealed by observing or describing how people find, organise, use and share information as part of their normal work patterns. They are repeated patterns of behaviour that involve organisational roles, structures and forms of interaction (Choo, 2002).

Effective information culture requires effective communication flows, cross-organisational partnerships, cooperative working practices, open access to relevant information, management of information systems, clear guidelines and documentation for information and data management, trust, as well as the willingness to share information (Svärd, 2017).

Various authors have suggested various types of information culture. From the perspective of organisational effectiveness, Choo (2013, p. 777) has proposed four categories of information culture and related types of goals:

- Result-oriented culture: information culture pursues goal achievement and competitive advantage
- Rule-following culture: information culture pursues control, compliance and accountability
- Relationship-based culture: information culture encourages communication, participation and commitment
- Risk-taking culture: information culture encourages innovation, creativity and the exploration of new ideas

Davenport (1997, p. 84) as cited in (Douglas, 2010, p. 49) distinguishes the following types of information culture:

- Open or closed
- Factually oriented or rumour and intuition based
- Internally or externally focused
- Controlling or empowering
- Having preferences for information channels or media

Marchand (1995, p. 470 as cited in Ward & Peppard, 2002) identified four types of information culture:

- Functional culture: managers use information as a means of exercising influence or power over others.
- Sharing culture: managers and employers trust each other to use information (especially about problems and failures) to improve their performance.
- Enquiring culture: managers and employees search for better information to understand the future and ways of changing what they do to align themselves with future trends/directions.
- Discovery culture: managers and employees are open to new insights about crisis and radical changes and seek ways to create competitive opportunities.

Marchand's typology of information culture could be said to reflect best the types of information culture expected in digital transformation of education and will be used in further analyses.

Based upon key elements of information culture that have been identified in previous studies, Douglas (2010, pp. 171–173) presents the five meta-level elements of information culture:

- Strategic thinking and planning
- Leadership
- Valuing and understanding information
- Organising to find information
- Using information (synthesising)

Information culture is studied in law firms, public health agencies, engineering, metalworking, and insurance companies, small and medium-sized enterprises as well as large corporations. There has not been much research on information culture in educational environments. Information-sharing culture has been studied from the perspective of social capital in the university context in Finland (Tötterman & Widén-Wulff, 2007). Oliver (2008) studied information behaviour, values and management in universities in different cultural contexts using a multiple case-study approach. Lauri et al. (2016) explored the relationships between information culture, information management, job satisfaction, leadership style and self-reported individual performance in Estonian higher education institutions. Zamoryonova (2015) studied information culture at universities in the Poltava region of Ukraine.

Only two studies that were found focussed on information culture in schools. Mullins (2017) examined information culture in convents and industrial schools in Ireland and Kiisk (2018) in adult upper secondary schools in Estonia. Overall, there is a huge gap in the study of information culture in educational institutions.

The Concept of e-Learning

According to Sangrà, Vlachopoulos, and Cabrera (2012, para 1) e-learning is a part of the new dynamic that has characterised education systems since the start of the twenty-first century. The concept of e-learning is subject to constant change, making it difficult to come up with a single definition of e-learning that would be accepted by the majority of the scientific community. The different understandings of e-learning are conditioned by particular professional approaches and interests. The authors presented the outcomes of their project, which resulted in an inclusive definition of e-learning subject to a high degree of consensus that would provide a useful conceptual framework to further identify the different models in which e-learning is developed and practiced (Sangrà et al., 2012, para 1).

Sangrà et al. (2012) identified on the basis of their literature review different elements of e-learning. Specifically, four general categories of definitions were identified: (1) technology driven, (2) delivery system oriented, (3) communication oriented and (4) educational paradigm oriented.

Technology-driven definitions mostly include definitions from private companies and a small number of academics. These definitions emphasise the technological aspects of e-learning, while presenting the rest of its characteristics as secondary. The definitions in this category portray e-learning as the use of technology for learning. For example, one such definition states, “E-learning is the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters” (Guri-Rosenblit, 2005 as cited in Sangrà et al., 2012).

Delivery-system-oriented definitions present e-learning as a means of accessing knowledge (through learning, teaching or training). The focus of these definitions is the accessibility of resources and not the results of any achievements. For example, “E-learning is the delivery of education (all activities relevant to instructing, teaching, and learning) through various electronic media” (Koohang & Harman, 2005 as cited in Sangrà et al., 2012).

Communication-oriented definitions consider e-learning to be a communication, interaction and collaboration tool and assign secondary roles to its other aspects and characteristics. For example, “E-learning is education that uses computerised communication systems as an environment for communication, the exchange of information and interaction between students and instructors” (Bermejo, 2005 as cited in Sangrà et al., 2012).

Educational-paradigm-oriented definitions frame e-learning as a new way of learning or as an improvement on existing educational paradigms. Most authors falling into this category work in the education sector. Within this framework e-learning can be defined as “the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration” (Alonso, López, Manrique, & Viñes, 2005 as cited in Sangrà et al., 2012).

The results of their research confirm the difficulty of devising a single, inclusive definition of e-learning that would be accepted by the majority of the scientific community. This situation has occurred due to the existence of different perspectives on this concept based on authors’ professional and academic profiles (Sangrà et al., 2012).

THE ROLE OF INFORMATION CULTURE AND E-LEARNING IN EUROPEAN FRAMEWORKS

In the context of digital transformation there are two main challenges for educational organisations: (1) competence clarification, that is what relevant digital competences in terms of knowledge, skills and attitudes do students and teachers need in order to cope with digital transformation? (2) Competence development, that is how to organise, design and support learning and teaching contributing to digital competences and digital transformation? (Seufert & Meier, 2016). To cope with these challenges, a large number of frameworks have been put forward, most of them focused on developing the digital competences of teachers and students.

Digital Competence can be defined as “the set of knowledge, skills, attitudes that are required when using digital technologies and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing,

consuming, and empowerment” (Ferrari, 2012). It could be recognised that competence areas and competences focus predominantly on two types of information culture: sharing culture—where educators trust each other to use information to improve their performance; and enquiring culture—where educators search for better information to understand the future and ways of changing so that they align themselves to future trends.

The European Framework for the Digital Competence of Educators: DigCompEdu (Redecker, 2017) helps educators at all levels of education, from early childhood to higher and adult education, to assess their competence, identify their training needs and offer targeted training. It is a scientifically sound framework which helps to guide policy and can be directly adapted to implement regional and national tools and training programmes. The DigCompEdu Framework aims to capture and describe educator specific digital competences. It proposes 22 elementary competences organised in six areas: (1) professional engagement (using digital technologies for communication, collaboration and professional development), (2) digital resources (sourcing, creating and sharing digital resources), (3) teaching and learning (managing and orchestrating the use of digital technologies in teaching and learning), (4) assessment (using digital technologies and strategies to enhance assessment), (5) empowering learners (using digital technologies to enhance inclusion, personalisation and learners’ active engagement), and (6) facilitating learners’ digital competence (enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem-solving).

As defined in the DigCompEdu (Redecker, 2017, pp. 16–17), areas 2–5 are the core of the framework explaining educators’ digital pedagogical competences, that is “the digital competences educators need to foster efficient, inclusive and innovative teaching and learning strategies.” Area 1 is “directed at the broader professional environment, i.e. educators’ use of digital technologies in professional interactions with colleagues, learners, parents and other interested parties, for their own individual professional development and for the collective good of the organisation.” Area 6, relates to “the specific pedagogic competences required to facilitate students’ digital competences.”

In both information culture and digital transformation, leadership plays a key role. Yang (2007 as cited in Arun, 2019) identified eight leadership roles: (1) monitor, (2) coordinator, (3) director, (4) producer, (5)

innovator, (6) broker, (7) facilitator and (8) mentor roles. He singled out the roles of mentor and facilitator to be central to knowledge sharing.

In the European Framework for Digitally Competent Educational Organisations: DigComOrg (Kampylis, Punie, & Devine, 2015), the Leadership and Governance Practices element refers to the role of leadership in the organisation-wide integration and effective use of digital technologies with respect to teaching and learning goals and activities. The element consists of three sub-elements: (1) integration of digital-age learning as a part of the overall mission, vision and strategy; (2) strategy for digital-age learning supported by an implementation plan and (3) management and governance model. A digitally competent educational organisation refers to the effective use of digital technology by the educational organisation and its staff in order to provide a compelling student experience and to realise a good return on investment in digital technology (Kampylis et al., 2015).

Besides the element of Leadership and Governance Practices, DigCompOrg encompasses the element of Infrastructure. Both elements may be seen as organisational responsibilities, while other elements such as Teaching and Learning Practices refer more to individual responsibilities (Kampylis et al., 2015). It has been emphasised that a “digitally-competent educational organisation needs a combination of strong leadership and governance (for vision and top-down strategies) and at the same time needs staff and stakeholders who are individually capable of taking responsibility for self-initiated actions and bottom-up efforts and initiatives (Kampylis et al., 2013 as cited in Kampylis et al., 2015).” This means that digitally transformed educational organisations, that is, those that are digitally competent, depend on the involvement of all stakeholders and they are responsible for the organisational culture, especially information culture. The descriptions within the DigCompOrg sub-elements mention various necessary cultural conditions that ensure digital competence. For example, with reference to sharing culture, it is stated that “A commitment to knowledge exchange through partnerships is evident.” With reference to enquiring culture, it is mentioned that, “There are twin goals of modernising existing educational provision and offering new opportunities.” In relation to discovery culture, it is stated that “Staff are partners in change.” Despite there being slight references, it must be noted that information culture as a concept is not mentioned in DigCompEdu at all.

CONCLUSION

E-learning and Information culture are recognised as important elements of digital transformation in education systems. E-learning is the delivery of education by using digital technologies; meanwhile, information culture refers to how information is communicated in an organisation and how the attitudes, norms and values are developed concerning creating, sharing and using information. To become a digitally competent educational organisation, an effective use of digital technology by the organisation must be ensured in order to provide a compelling student experience and to realise a good return on investment in digital technology. Digital transformation requires not only general skills and attitudes. It requires that such skills and attitudes are applied and used in the specific functions and professional domains that constitute the organisation. To effectively support digital transformation at an organisational level, an answer must be given to the following question: what relevant digital competences in terms of knowledge, skills and attitudes do students and teachers need in order to cope with digital transformation? The digital transformation of education relies on the digital competencies of teachers as well as other school employees. In every organisation, employees play a key role in the success of digital transformation, but the process of transformation must be successfully guided by the leadership of the educational organisation and supported by a relevant and complementary organisational and information culture.

REFERENCES

- Alonso, F., López, G., Manrique, D., & Viñes, J. M. (2005). An Instructional Model for Web-Based E-Learning Education with a Blended Learning Process Approach. *British Journal of Educational Technology*, 36(2), 217–235.
- Arun, K. (2019). Knowledge Sharing in Business Organisations: Leadership Role in Knowledge Sharing at Turkish Enterprises. In P. Jain & N. Mnjama (Eds.), (2016). *Managing Knowledge Resources and Records in Modern Organisations* (pp. 44–65). IGI Global.
- Attwell, G., Pfeffer, G., Treasure Jones, T., Kerr, M., Kämäräinen, P., & Deitmer, L. (2015). *Changing Learning Practices in Healthcare and Construction: Deployment, Sustainability, Exploitation of the Layers Solutions*. Learning Layers project report 5, Unpublished project report.

- Auriga. (2016). *Digital Transformation: History, Present, and Future Trends*. Retrieved from <https://auriga.com/blog/digital-transformation-history-present-and-future-trends/>
- Bermejo, S. (2005). Cooperative Electronic Learning in Virtual Laboratories Through Forums. *IEEE Transactions on Education*, 48(1), 140–149.
- Choo, C. W. (2002). *Information Management for the Intelligent Organisation: The Art of Scanning the Environment*. Medford, NJ: Information Today, Inc.
- Choo, C. W. (2013). Information Culture and Organisational Effectiveness. *International Journal of Information Management*, 33(5), 775–779.
- Davenport, T. H. (1997). *Information Ecology: Mastering the Information and Knowledge Environment*. New York: Oxford University Press.
- De la Peña, J., & Cabezas, M. (2015). *La gran oportunidad. Claves para liderar la transformación digital en las empresas y en la economía*. Barcelona: EdicionesGestión, 2000.
- Douglas, J. (2010). *The Identification, Development and Application of Information Culture in the Western Australian Public Sector*. PhD Thesis. Retrieved from <https://ro.ecu.edu.au/theses/1882>
- Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New Public Management Is Dead—Long Live Digital-Era Governance. *Journal of Public Administration Research and Theory*, 16(3), 467–494.
- Duparc, P. F. (2013). Evolution in the C-Suite as Organisations Maximise Growth Opportunities: The Chief Digital Officer Takes Centre Stage. Retrieved from <https://www.boyden.com/media/evolution-in-the-c-suite-as-organisations-maximise-growth-opport-589983/index.html>
- Ferrari A. (2012). *Digital Competence in Practice: An Analysis of Frameworks*, EUR 25351. JRC Technical Reports. Luxembourg: Joint Research Centre, Institute for Prospective Technological Studies, Retrieved from <http://ftp.jrc.es/EURdoc/JRC68116.pdf>
- Ferreira, M. J., Moreira, F., & Seruca, I. (2017). Organisational Training Within Digital Transformation: The ToOW Model. *Proceedings of the 19th International Conference on Enterprise Information Systems (ICEIS 2017)*, 2, 526–532.
- Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing Digital Technology: A New Strategic Imperative. *MIT Sloan Management Review*, 55(2), 1–12.
- Gibson, D., Coleman, K., & Irving, L. (2016). Learning Journeys in Higher Education: Designing Digital Pathways Badges for Learning, Motivation and Assessment. In D. Ifenthaler, N. Bellin-Mularski, & D. K. Mah (Eds.), *Foundation of Digital Badges and Micro-Credentials* (pp. 115–138). New York: Springer.
- Guri-Rosenblit, S. (2005). Distance Education’ and ‘E-Learning’: Not the Same Thing. *Higher Education*, 49(4), 467–493.

- Henriette, E., Feki, M., & Boughzala, I. (2015). The Shape of Digital Transformation: A Systematic Literature Review. *MCIS 2015 Proceedings*, 431–443.
- Kampylis, P., Law, N., Punie, Y., Bocconi, S., Brecko, B., Han, S., Looi, C., & Miyake, N. (2013). *ICT-Enabled Innovation for Learning in Europe and Asia: Exploring Conditions for Sustainability, Scalability and Impact at System Level*. Retrieved from <https://op.europa.eu/en/publication-detail/-/publication/374f1394-11a1-4e8d-a4be-61f4efcced85/language-en>
- Kampylis, P., Punie, Y., & Devine, J. (2015). *Promoting Effective Digital-Age Learning—A European Framework for Digitally-Competent Educational Organisations*. EUR 27599 EN. <https://doi.org/10.2791/54070>
- Kiisk, M. (2018). *Infokultuur ja infopraktikad Tartu Täiskasvanute Gümnaasiumis [Information Culture and Information Practices in Tartu Adult Gymnasium]*. Magistritöö, Tallinn: Tallinna Ülikool.
- Koohang, A., & Harman, K. (2005). Open Source: A Metaphor for E-Learning. *Informing Science Journal*, 8, 75–86.
- Lauri, L., Heidmets, M., & Virkus, S. (2016). The Information Culture of Higher Education Institutions: The Estonian Case. *Information Research: An International Electronic Journal*, 21(3), n3.
- Mahlow, C., & Hediger, A. (2019). Digital Transformation in Higher Education—Buzzword or Opportunity? *eLearn*, 2019(5), 13.
- Mancini, J. (2018). *The State of Intelligent Information Management: Getting Ahead of the Digital Transformation Curve*. Retrieved from <https://www.m-files.com/Content/documents/en/res/ebooks/eBook-AIIM-The-State-of-Intelligent-Information-Management-2018.pdf>
- Marchand, P. (1995, December 8). Mastering Management: What Is Your Company's Information Culture? *Financial Times*.
- Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business Information Systems*, 57(5), 339–343.
- Menendez, F. A., Maz-Machado, A., & Lopez-Esteban, C. (2016). University Strategy and Digital Transformation in Higher Education Institutions. A Documentary Analysis. *International Journal of Advanced Research*, 4(10), 2284–2296.
- Mergel, I., Edelmann, N., & Haug, N. (2019). Defining Digital Transformation: Results from Expert Interviews. *Government Information Quarterly*, 36(4), 101385.
- Mullins, E. (2017). Information Culture in the Convent and the Industrial School: A Case Study of the Congregation of the Sisters of Mercy in Ireland. *The Journal of the Archives and Records Association*. Retrieved from <https://www.tandfonline.com/doi/abs/10.1080/23257962.2017.1388223?tab=permissions&scroll=top>

- Oliver, G. (2008). Information Culture: Exploration of Differing Values and Attitudes to Information in Organisations. *Journal of Documentation*, 64(3), 363–385.
- Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, Luxembourg, ISBN 978-92-79-73494-6, <https://doi.org/10.2760/159770>, JRC107466.
- Rocha, Á., Adeli, H., Reis, L. P., & Costanzo, S. (Eds.). (2018). *Trends and Advances in Information Systems and Technologies* (Vol. 1). Cham: Springer.
- Sangrà, A., Vlachopoulos, D., & Cabrera, N. (2012). Building an Inclusive Definition of e-Learning: An Approach to the Conceptual Framework. *The International Review of Research in Open and Distributed Learning*, 13(2), 145–159.
- Schallmo, D., Williams, C. A., & Boardman, L. (2017). Digital Transformation of Business models—Best Practice, Enablers, and Roadmap. *International Journal of Innovation Management*, 21(08), 1740014.
- Schlepp, C. (2019). *Cloud ERP: Another Step in Your Digital Journey*. Retrieved from <https://www.interdynartis.com/blog/cloud-erp-another-step-in-your-digital-journey>
- Seufert, S., & Meier, C. (2016). From eLearning to Digital Transformation: A Framework and Implications for L&D. *International Journal of Corporate Learning (iJAC)*, 9(2), 27–33.
- Solis, B., Lieb, R., & Szymanski, J. (2014). *The 2014 State of Digital Transformation*. Altimeter Group (2014).
- Solis, D. (2017). Digital Transformation—The Six Stages of Digital Transformation. Retrieved from <http://www.briansolis.com/2017/01/definition-of-digital-transformation/>
- Stolterman, E., & Fors, A. C. (2004). Information Technology and the Good Life. In *Information Systems Research* (pp. 687–692). Boston, MA: Springer.
- Svård, P. (2017). *Enterprise Content Management, Records Management and Information Culture Amidst E-Government Development*. Cambridge, MA: Chandos Publishing.
- Tötterman, A., & Widén-Wulff, G. (2007). What a Social Capital Perspective Can Bring to the Understanding of Information Sharing in a University Context. *Information Research*, 12(4), paper colis19. Retrieved from <http://information.net/ir/12-4/colis/colis19.html> (Archived by WebCite® at <http://www.webcitation.org/6eyKgy53u>).
- Uhl, A., & Gollena, L. A. (2016). *Digital enterprise transformation: A business-driven approach to leveraging innovative IT*. London: Routledge.
- Vial, G. (2019). Understanding Digital Transformation: A Review and a Research Agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144.

- Virkus, S. (2019a). The Use of Open Badges in Library and Information Science Education in Estonia. *Education for Information*, 52(2), 1–18.
- Virkus, S. (2019b). *A Keynote Speech Delivered at the 30th Central European Conference on Information and Intelligent Systems (CECIIS 2019)*. Croatia: University of Zagreb.
- Wang, Q. (2008). A Generic Model for Guiding the Integration of ICT Into Teaching and Learning. *Innovations in Education and Teaching International*, 45(4), 411–419.
- Ward, J., & Peppard, J. (2002). *Strategic Planning For Information System* (3rd ed.). Baffins Lane, Chichester: John Wiley & Sons.
- Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading Digital: Turning Technology Into Business Transformation*. Cambridge, MA: Harvard Business Press.
- Westerman, G., Calm ejane, C., Bonnet, D., Ferraris, P., & McAfee, A. (2011). Digital Transformation: A Roadmap for Billion-Dollar Organisations. *MIT Center for Digital Business and Capgemini Consulting*, 1–68.
- Yang, J. T. (2007). Knowledge Sharing: Investigating Appropriate Leadership Roles and Collaborative Culture. *Tourism Management*, 28(2), 530–543.
- Zamoryonova, D. (2015). Information Culture in Criteria and Typology. *Journal of European Economy*, 14(4). Retrieved from <http://dspace.tneu.edu.ua/bitstream/316497/11217/1/Zamoryonova%2C%20D.pdf>.
- Zaoui, F., & Souissi, N. (2018). Onto-Digital: An Ontology-Based Model for Digital Transformation’s Knowledge. *Innovation*, 5, 6.