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A multidimensional approach to support training activities in the digital era

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Abstract

The digital revolution is producing changes that require continuous learning interventions. Accordingly, there is an increasing demand for lifelong learning that requires new teaching–learning approaches applicable to a large number of learners. A transformative learning is argued to be a powerful approach to tackle the online learning issues, providing trainees with the opportunity to learn, confront, engage, reflect and explore new learning modalities. In this paper, we present an ongoing research aimed to employ online learning for different student needs. It has been carried out within the scope of an applied research project, DocTDLL.
We illustrate the multidimensional approach that has been developed to support the online training activities of Ph.D. students, integrating both the transformative learning and social learning paradigms. We also report the data that emerged from a survey conducted in Latvia on a sample of 260 people to explore the attitudes and expectations regarding digital learning.

Keywords**:** Digital revolution, transformative learning; online learning; smart-learning environments; social learning, student education.

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1. Introduction

For the past decade, digital technologies such as the Internet of things, robotics, virtual reality and artificial intelligence are having an increasingly disruptive effect on every aspect of human life. They are not only impacting on industrial production (Lasi, Fettke, Kemper, Feld & Hoffmann, 2014) and the way of organising and delivering services but also on people's everyday lives.

There is a broad consensus, in fact, that the fourth industrial revolution has begun. Figure 1 shows the different phases of industrial revolution, from the mass production of cotton weaving to the smart factories of today.

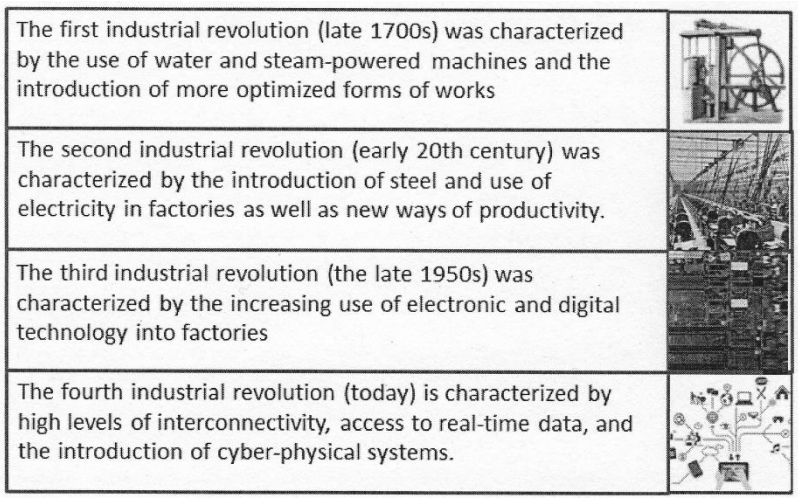

Figure 1. The four industrial revolutions

The fourth industrial revolution differs from the previous ones, in which it combines the physical, digital and biological worlds.

It has been observed that, nowadays, an inclusive approach is required to address the ongoing technical and societal transformations and challenges. It is argued, in fact, that the fourth industrial revolution:

> '[…] will require collaborative and flexible structures that reflect the integration of various ecosystems and that take fully into account all stakeholders, bringing together the public and private sectors, as well as the most knowledgeable minds in the world from all backgrounds' (Schwab, 2017, p. 112).

An increased digitisation and automation also impact on education. Massive amounts of content are available on the Internet, and the digital technology offers new teaching–learning opportunities. However, the use of digital content requires new competence and skills, both for teachers and students. In this regard, the following soft skills are often identified as representing crucial factors for the future labour market (Sabaityte, Davidaviciene & Karpoviciute, 2020*):*

- Ability and willingness to learn new skills;
- Critical thinking and problem-solving;
- Collaboration and teamwork;
- Interpersonal communication;
- Computational thinking.

The research confirms the importance of the above qualities, and new educational programmes should be developed accordingly in order to incorporate the social and emotional learning and enhance the learners' intrapersonal, interpersonal and cognitive competences (Gibert, Tozer & Westoby, 2017).

Despite the evident differences in interpreting future societal trends, the experts are broadly persuaded that it is necessary to invest in education if one wants to prevent the negative impacts of the fourth revolution. In theworld, in which people live longer and where routine work—either of a physical or intellectual nature—will be progressively automated, a continuous learning appears the high road to ensure a job, not only for blue-collar but also for white-collar workers. Transformative learning is argued to be a powerful approach to support a continuous learning, providing trainees with the opportunity to learn, confront, engage, reflect and explore new learning modalities (Taylor & Cranton, 2012).

In the International Encyclopedia of Adult Education, transformative learning is defined as:

> '[…] a process by which previously uncritically assimilated assumptions, beliefs, values and perspectives are questioned and thereby become more open, permeable and better validated' (Cranton, 2016; Markoska, 2019).

In this paper, we present the results of an ongoing research aimed to lever the transformative digital learning (TDL) for the needs of Ph.D. students in pedagogical sciences.

2. Research objectives

The research has been carried out within the project, DocTDLL (Implementation of Transformative Digital Learning in Doctoral Program of Pedagogical Science in Latvia), funded by the Latvian Council of Science.

The DocTDLL aims to apply the transformative learning in defining a new educational model to support student self-learning in an online environment (Zogla, Prudnikova & Mykhailenko, 2019).

In the following paragraphs, the main findings of the research activity are highlighted, focusing on the survey conducted in Latvia.

Moreover, some results of the literature research on transformative learning in online environments are presented and commented

3. Methodology

The research included a systematic literature analysis of articles on TDL and a survey conducted on a sample of Latvian students and lecturers/professors.

The literature analysis was undertaken between January 1st, 2019, and October 30th, 2019. From this, we collected the significant articles published in Scopus and ISI Web of Science conference proceedings, as well as in the databases of leading world publishers such as Wiley Online Library and SAGE. We also used Google Scholar to integrate the results obtained and evaluate the popularity of articles, taking account of their citations (*Kukey, Gunes & Genc, 2019*).

The sample of the survey was composed of 260 Latvian respondents: 44 malesand 213 females (3 respondents did not indicate their gender); of these, 205 were students and 55 were lecturers/professors.

The Likert scale has been used to measure the responses to the questionnaire, whereas the Mann–Whitney test and the Kruskal–Wallis test have been used to analyse the statistical relevance of the data (*Kalashi, Bakhshalipour, Azizi & Sareshkeh, 2020*).

4. Findings

Five factors have been considered in evaluating the attitudes and opinions of respondents towards information technology (IT):

- Factor 1—terest in IT;
- Factor 2—IT practical value;
- Factor 3—IT negative impact;
- Factor 4—gender equality in IT;
- Factor 5—positive effects of IT on the labour market.

These factors are the same as those proposed by Gokhale, Brauchle and Machina (2013).

Tables 1 and 2 show, respectively, the average values of the five factors and the statistically relevant differences amongst respondents, whereas Table 3 shows how these factors have been represented in the questionnaire.

From the survey, it emerges that, in evaluating the effect of IT on the labour market, lecturers/professors appear to be a little less optimistic than students. Another statistically significant difference ($p > 0.05$) concerns how males and females evaluate their 'Interest in IT' and the 'Negative Impact of IT'. The relationship between these factors is evidenced by the Pearson correlation ($r = -0.191$, $p = 0.002$). The data reveal that the less respondents are interested in IT, the more they agree with the view that IT has a negative impact and vice versa. In particular, females are more likely to agree with the negative impact of IT and generally demonstrate less interest in IT. One may assume that these attitudes are the result of societal beliefs, as well as of the influence of the learning environment on girls' level of achievement and interest in science and mathematics in general (European Commission, 2015; Grimson & Grimson, 2019).

Table 1. Average values of factors influencing the attitudes and opinions of respondents

Factors	Mean				
	All	Males	Females	Students	Lecturers/ professors
Interest in IT	3.22	3.61	3.16	3.20	3.28
Practical value of IT	3.74	3.77	3.76	3.73	3.77
Negative Impact of IT	3.18	2.99	3.24	3.24	2.94
Gender equality in IT	4.02	4.01	4.05	4.02	3.99
Positive effect of IT on labour market	3.43	3.38	3.45	3.46	3.31

Table 2. Statistically significant differences amongst respondents

Factors	Differences					
	p	Mean rank		*p*	Mean rank	
		Males	Females		Students	Lecturers/ professors
Interest in learning about IT	0.000	942.41	736.19	–	–	–
Practical value of IT	–	–	–	–	–	–
Negative impact of IT	0.011	464.53	524.82	0.000	538.62	452.98
Gender equality in IT	–	–	–	–	–	–
Positive effect of IT on labour market	–	–	–	0.046	529.63	486.46

Table 3. The representation of the five factors in the questionnaire

Factors	Statement	Media				
		All	Males	Females	Students	Lecturers/ professor
Interest in IT	I enjoy learning about IT developments	3.57	3.84	3.54	3.56	3.64
	I am well informed about developments in IT	3.06	3.23	3.03	3.07	3.02
	I am interested in new applications of IT that can improve our lives	3.43	3.70	3.39	3.43	3.44
	I like to read about IT	3.07	3.64	2.97	3.04	3.16
Practical value of IT	I like to watch movies that deal with IT	3.16	3.70	3.07	3.16	3.16
	I have searched on the internet for information about IT advances	3.02	3.52	2.94	2.95	3.29
	IT is making thelives healthier, easier and more comfortable	3.83	3.77	3.85	3.87	3.67
	IT knowledge is important in the daily life	3.82	4.05	3.79	3.79	3.93
	IT courses very appropriately contribute to people's education	3.91	4.00	3.92	3.86	4.09
Negative Impact of IT	Women should take a career in IT	3.58	3.43	3.58	3.52	3.60
	IT researchers work on making life better	3.58	3.80	3.77	3.77	3.67
	Women should be encouraged to take a career in IT	2.59	3.55	3.62	3.57	3.64
	IT makes rapid changes	3.93	3.86	3.97	3.93	3.93
	Advancements in IT will likely destroy the earth	2.75	2.36	2.84	2.83	2.45
	People would live better without so much IT	3.08	2.73	3.03	3.04	2.65
	IT applications create an artificial and inhuman way of living	3.74	3.00	3.11	3.18	2.71
Gender Equality in IT	Men and women have the same opportunity to succeed in IT	4.14	4.09	4.18	4.18	4.00
	Men and women have the same opportunity to develop their capability in IT	4.17	4.18	4.21	4.18	4.15
	Men and women tackle the same work environment	3.75	3.75	3.76	3.72	3.82
Positive Effect of IT on labour market	IT will create more jobs than it will eliminate	3.02	2.82	3.07	3.10	2.71
	Thanks to IT, work will become more appealing	3.58	3.48	3.62	3.60	3.49
	IT can create family-friendly environments	3.08	3.16	3.07	3.09	3.04
	Thanks to IT, the next generations will have more opportunities	4.03	4.07	4.05	4.03	4.02

From the review of the literature, it results that TDL represents a relatively new scope of the research. The investigation on TDL started in the early part of this current decade, and until 2015, the overwhelming majority of literature was conceptual.

The first article on TDL, which reported experimental data, appeared in 2010 (Killeavy & Moloney, 2010).

At this point in time, the articles about TDL are not numerous. Authors tend to use the terms online transformative learning and transformative digital learning as synonyms although transformative digital learning does not necessarily require an online environment (*Atabek, 2020*).

Most of the authors focus on the use of games (Camacho, Esteve-Gonzalez & Gisbert, 2016; Oliver, 2019; Shute, 2011; Tierney, Corwin, Fullerton & Ragusa, 2014), whereas few of them tackle the issue of how to transfer the experience matured in face-to-face settings into the online context.

Since there is a broad consensus that collaborative learning could foster the transformative learning, many efforts are being made to create online transformative learning environments (Jung & Gunawardena, 2015).

5. Transformative learning in online environments

Nowadays, online education has become an increasingly important part of tertiary education and takes two primary forms. The first consists of for-credit courses offered by higher education institutions. The second form of online education consists of professional training and the preparation for certifications.

An online learning environment is characterised by the use of the internet to access learning materials and to interact with content, teachers and other students. Online learning should allow time and space for independent learning, enabling learners to progress at their own learning speed (*Coskun, Adiguzel & Catak, 2019*).

The primary learning models in an online environment are blended learning and digital social learning.

Blended learning combines e-learning with traditional classroom methods (face-to-face learning), whereas digital social learning is an approach, whereby an individual achieves their learning goals by accessing learning resources available online as well as by interacting on the internet with teachers and other learners.

Blended learning is a formal education programme, in which a student learns, at least in part, through online tools. Essentially, it is the combination of two historically distinct teaching–learning models: traditional face-to-face learning systems and distributed learning systems. In blended learning, computer-based technologies play a central role (Figure 2).

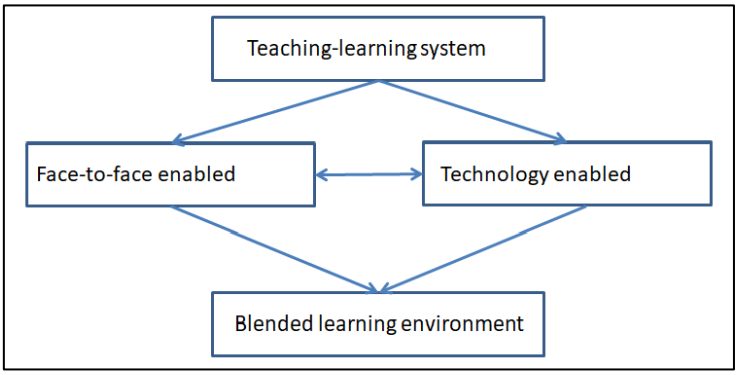

Figure 2. The blended learning model (authors' own elaboration)

Over the past few years, as a consequence of the spread of digital technologies, digital social learning has been assuming a strategic role in the online learning environment. In an effort to alleviate

the critical aspects due to poor interactive capability and asynchronous scheduling, some e-learning platforms such as Blackboard and Moodle have begun to incorporate digital social learning components (chatrooms and virtual classrooms). Nowadays, most of the platforms allow interaction between students (through user-generated posts/comments) and provide question asking/answering functions. Figure 3 shows the digital social learning model.

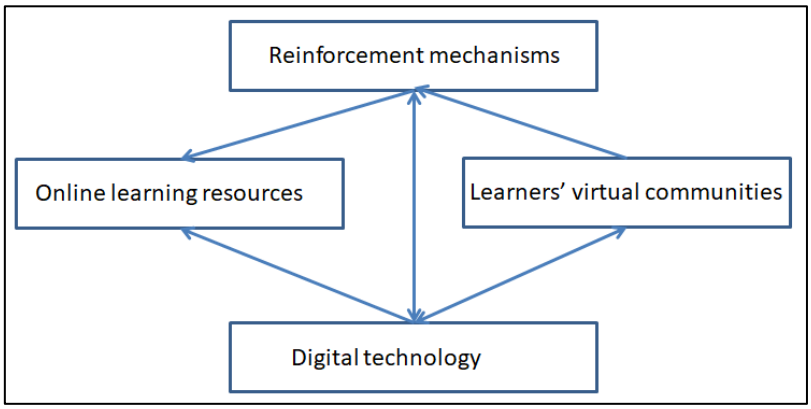

Figure 3. The digital social learning environment (authors' own elaboration)

The massive abundance of online content also suggests new forms of self-learning activities. Accordingly, new opportunities and challenges have arisen.

The presence on the internet of broad and disparate scientific claims necessitates the selective retrieval tools and effective evaluation strategies. Learners should be supported in the selection of learning materials and trained on how to evaluate the internet content, e.g., what is the authority of the venue/website/institution that is the source? What are the motives that pushed the author of a content to write and publish it?

A search engine such as Google or Bing allows a user to search for information on the internet based on their query (which is in the form of natural language) to find the content and to rank them. They return the set of webpages that best match to the query. However, the process of accessing the semantic information from the text data available on the internet is not easy. A recent work conducted on the Intelligent Information Retrieval has aimed to support conceptual search, but the results have not been particularly encouraging.

Finally, the growth of online education has not been without challenges in other areas, both technical and social.

The individual learning styles (e.g., visual, auditoryand kinaesthetic) impact learners' preferences and results (Daghan & Akkoyunlu, 2012), whereas there is evidence that people's experiences of digital education are patterned distinctly in relation to social class, race and disability. As such, online learning environments do not unproblematically reduce the differences between individuals (Selwyn, 2016).

Transformative learning is argued to represent a powerful approach to tackle the issues of online learning, deriving from the fact that such programmes are designed and configured to the norm of an abstract, self-motivated and high-level individual. The specific cultural background of learners can limit the benefits associated with online learning, but transformative learning can provide opportunities for learning through confronting, engaging and reflecting, with the possibility to learn through exploring new meanings, roles, relationships and actions and arriving at new interpretations (Taylor & Cranton, 2012).

In the transformative learning perspective, learning is voluntary, in which the learner must be willing to engage in critical self-reflection. Accordingly, learners should be self-directed to be aware of their beliefs and assumptions, as well as to actively participate in discussions related to their self-analysis.

6. A multidimensional learning model for PhD students

According to transformative learning theory, we develop and construct a personal meaning from the experiences and validate it through interaction and communication with others (Cranton, 2006).

Learning is a social process. We do not learn the isolated facts and abstract theories, but, rather, we learn in relationship to what else we know, what we believe, the prejudices and the fears.

To improve the digital social innovation competence of Ph.D. students in the field of social work or social education, we have developed a multidimensional model based on computational thinking (CT) in an online environment. The model integrates both Mezirow's transformative learning and Bandura's social learning theories.

According to Wing, thinking computationally is a fundamental skill for everyone, not just computer scientists. Indeed, CT is a method of analytical thinking that encompasses many skills, such as designing algorithms, decomposing problems and modelling phenomena. It can take place without a computer since it is 'a way of solving problems, designing systems and understanding human behaviour that draws on concepts fundamental to computer science' (Wing, 2006, p. 35).

The ICT is crucial for the design and support of digital social innovative services (Marzano, Lizut & Ochoa, 2019).

From Bandura's theory (Bandura, 1977), two fundamental principles have been included in the multi-dimensional model:

- Intrinsic reinforcement offers learners a reward that is derived internally and gives them a sense of accomplishment and satisfaction.
- The gain of knowledge through participating and interacting with others since learning is reinforced through observing the behaviour of other individuals.

These principles, included in a transformative learning approach, can allow learners to achieve their learning goals in an online environment.

Indeed, cultivating critical thinking may not be enough to create a disorienting dilemma that is the first step in transformative learning. A disorienting dilemma occurs when an individual is provided with experiences that disconfirm evidence and offer an alternative perspective, causing the individual to question their own previously deeply held beliefs. Hence, we need to train learners, providing them with new patterns by which they can interpret their experience and learn to overcome their biases. Figure 4 shows how observation and interaction can facilitate learner engagement in critical reflection, bringing them beyond their beliefs and assumptions.

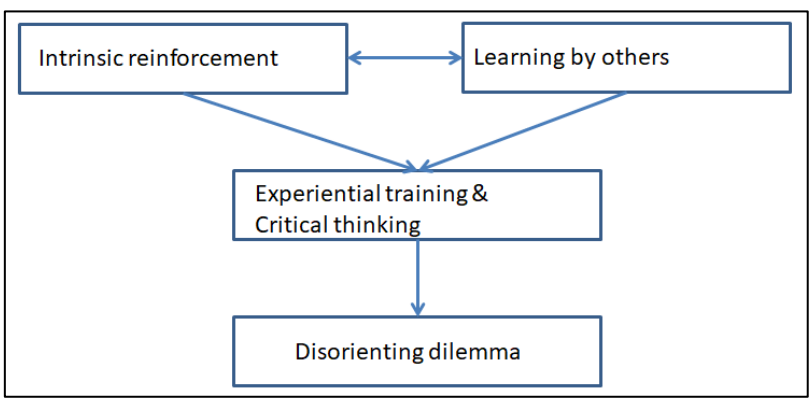

Figure 4. Learning by others and intrinsic reinforcement as key factors for generating the disorienting dilemma

7. Conclusion

The digital revolution poses a question for transforming learning, namely: 'what kind of thinking does one primarily have to transform'? A corollary is 'how can TDL support these transformations'?

At the moment, however, there are no data from field research, which can offer evidence-based suggestions to answer these questions.

An effort should be made to model the interaction amongst learners and between learners and facilitators in an online environment. There are substantial differences between face-to-face learning and online learning, and some characteristics of face-to-face learning cannot be simulated or emulated in an online environment such as emotions and relational factors.

From this research, it results that a new survey should be carried out to evidence the needs of teachers and learners in an online environment, as well as to collect elements useful to design intelligent agents that can support the activity of facilitators in an online participatory learning environment.

The next step of this research will be the design of a smart learning environment based on the TDL approach. It should support learners by analysing their learning activities, rearranging the learning units dynamically as well as integrating them with materials available on the web.

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References

Atabek, O. (2020). Alternative certification candidates' attitudes towards using technology in education and use of social networking services: a comparison of sports sciences and foreign language graduates. *World Journal on Educational Technology: Current Issues*, *12*(1), 1–12. doi:10.18844/wjet.v12i1.4433

Bandura, A. (1977). *Social learning theory.* Morristown, NY: General Learning Press.

Camacho, M., Esteve-Gonzalez, V. & Gisbert, M. (2016). From digital storytelling to 3D game-based storytelling: fostering student's creativity in initial teacher training. In: *Global learn* (pp. 240–245). Morgantown, WV: Association for the Advancement of Computing in Education (AACE).

Coskun, Z., Adiguzel, T. & Catak, G. (2019). Acoustic labyrinth: validation of a game–based heart auscultation educational tool. World Journal on Educational Technology: Current Issues, 11(4), 245–256. doi:10.18844/wjet.v11i4.4394

Cranton, P. (2006). Fostering authentic relationships in the transformative classroom. *New Directions for Adult and Continuing Education, 2006*(109), 5–13.

Cranton, P. (2016). Transformative learning. In: L. English (Ed.), *International Encyclopedia of adult education* (pp. 630–637). Cham, Switzerland: Springer.

Daghan, G. & Akkoyunlu, B. (2012). An examination through conjoint analysis of the preferences of students concerning online learning environments according to their learning styles. *International Education Studies, 5*(4), 122–138.

European Commission. (2015). She figures 2015, directorate-general for research and innovation. Retrieved December 12, 2019, from, https://ec.europa.eu/research/swafs/pdf/pub_gender_equality/she_figures_2015-final.pdf

Glowa, L. & Goodell, J. (2016). Student-centered learning: functional requirements for integrated systems to optimize learning. *International Association for K-12 Online Learning*. Retrieved December 12, 2019, from https://eric.ed.gov/?id=ED567875

Gokhale, A. A., Brauchle, P. E. & Machina, K. F. (2013). Scale to measure attitudes toward information technology. *International Journal of Information and Communication Technology Education (IJICTE), 9*(3), 13–26.

Grimson, J. & Grimson, W. (2019). Eliminating gender inequality in engineering, industry, and academia. In: *The engineering-business nexus* (pp. 315–339). Cham, Switzerland: Springer.

Jung, I. & Gunawardena, C. N. (Eds.). (2015). *Culture and online learning: global perspectives and research*. Sterling, VA: Stylus Publishing, LLC.

Kalashi, M., Bakhshalipour, V., Azizi, B. & Sareshkeh, S. (2020). The effect of the application of ICT skills on the process of knowledge management components and the effectiveness of creativity indicators for the improvement of employees' performance system in the Ministry of Sports and Youth. *World Journal on Educational Technology: Current Issues, 12*(1), 48–61. doi:10.18844/wjet.v12i1.4382

Killeavy, M. & Moloney, A. (2010). Reflection in a social space: can blogging support reflective practice for beginning teachers? *Teaching and Teacher Education, 26*(4), 1070–1076.

Kukey, E., Gunes, H. &Genc, Z. (2019). Experiences of classroom teachers on the use of hands-on material and educational software in math education. *World Journal on Educational Technology: Current Issues, 11*(1), 74–86. doi:10.18844/wjet.v11i1.4010

Lasi, H., Fettke, P., Kemper, H. G., Feld, T. & Hoffmann, M. (2014). Industry 4.0. *Business and Information Systems Engineering, 6*(4), 239–242.

Markoska, R. (2019). Managing ICT solutions for training and evaluation of C++ programming skills in e-learning ecosystem. *New Trends and Issues Proceedings on Humanities and Social Sciences, 6*(7), 33-41. https://doi.org/10.18844/prosoc.v6i7.4509

Oliver, W. H. (2019). Serious games in theology. *HTS Teologiese Studies/Theological Studies, 75*(4). Retrieved December 12, 2019, from https://hts.org.za/index.php/hts/article/view/5465/14085.

Sabaityte, J., Davidaviciene, V. & Karpoviciute, R. (2020). Learning skills for enhancing the use of Big Data. *World Journal on Educational Technology: Current Issues, 12*(1), 23–36. doi:10.18844/wjet.v12i1.4438

Schwab, K. (2017). *The fourth industrial revolution*. New York, NY: Portfolio Penguins.

Selwyn, N. (2016). *Is technology good for education?* Hoboken, NJ: John Wiley & Sons.

Shute, V. J. (2011). Stealth assessment in computer-based games to support learning. *Computer Games and Instruction, 55*(2), 503–524.

Taylor, E. W. & Cranton, P. (2012). *The handbook of transformative learning: theory, research, and practice*. Hoboken, NJ: John Wiley & Sons.

Tierney, W. G., Corwin, Z. B., Fullerton, T. & Ragusa, G. (Eds.). (2014). *Postsecondary play: the role of games and social media in higher education*. Baltimore, MD: JHU Press.

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33–35.

Zogla, I., Prudnikova, I. & Mykhailenko, O. (2019). *Pedagogical assumptions of transfor-mative digital model for social change* (vol. I, pp. 645–656). In Proceedings of the International Scientific Conference.