

# ***Using Philosophy of Information to look at teaching, technology and networked learning***

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## **Abstract**

In this conceptual paper, Luciano Floridi's philosophy of Information (PI) is interpreted and used for generating and presenting alternative or deviating, even provoking, understanding and scenarios on Information and Communication Technologies (ICTs), in connection with teaching and networked learning, today and in the future. The relation between teacher and technology and the functions of networked learning are here in focus for the application of Philosophy of information (PI) on issues of teachers, learners and technology. We are as humans, according to Floridi, presently changing our self-understanding, as we also have done at earlier occasions during history, for adapting to scientific and technological developments while still keeping but also changing our agency as humans. Humans are seen as the only known "semantic engines" in the world. The digital technology we presently use, with ICTs who process information and communicates in networks to other ICTs, changes our position and role as humans, as information-processing earlier was purely human activity. Now we have ICTs that are "syntactical engines"; they can process information both fast and precise, although they have "intelligence as a toaster". Humans today are in PI called "inforgs", living in an "infosphere", where information is the most critical asset, and we increasingly experience the world in informational terms. Floridi categorises ICTs as documenting, communicating and information-processing. A longer historical perspective on ICTs in teaching and learning, from Sumer 2000 B.C. and forward leads here to questioning if not the concepts of distance-, e- and online learning are soon old and obsolete, and mainly were continuing something traditional. What is characteristic for digital ICTs is according to Floridi the processing of information, and what we can find when we look for these ICTs in teaching and learning is Learning Analytics, Adaptive Learning, Calibrated Peer Review and similar ICTs for e-teaching. Furthermore, the general concepts of living together with information-processing ICTs are re-ontologisation, enveloping and transdiegetisation. These concepts describe what the ongoing integration of ICTs affects the human, as a teacher or a learner. Networked learning persists and is highly relevant, but includes also networking with applications of artificial intelligence. A critical discussion wraps up the paper.

## **Keywords**

Teaching, E-teaching, Teaching and technology, Networked learning, Philosophy of Information, enveloping, re-ontologisation, transdiegetisation, informational friction,

## **Introduction**

A new vantage point can help or force us to view our everyday conceptual landscape differently, and both researchers and practitioners of contemporary technology-enabled teaching and learning can need some shake-ups now and then about what we think we know well. Kuriansky once looked at human history from the perspective of salt trade and provided thereby a very interesting and thought-provoking side-view of history (2011). When we use a whole new philosophical theory for reflecting over what we already think we know, we can end up having earlier theoretical underpinnings confirmed or detect exciting aspects of what we already know, or discover a world in a different light.

The new theory used in this paper is Luciano Floridi's theory Philosophy of Information (PI), which is a work in progress to make "a philosophy of our time, for our time" (Floridi 2011). Floridi is most known by the general public for his work with "the right to be forgotten", together with the European Commission in conflict and negotiation with Google, and his subsequent function as an ethical adviser for this company. He is not a specialised educational philosopher, but a general one, working on a giant project; a new prima philosophia, with all from ontology, epistemology, ethics and politics to method. He has explicit and recurring reflections on education in his work (2013, 2014a p. 79ff), and of course, epistemology and education always connect (Floridi

2011a, 2016b), but most of the following is the author's applications of his theory, or parts thereof, on education and technology and networked learning. This is how PI is provoking my understanding of ICTs, e-teaching and networked learning.

## Focus and aim

One focus in the following is the "e-" in e-teaching; how technology and teaching can be understood how it may develop. Another focus is networked learning in times of omnipresent and integrated digital technology which not only refers to documents and communication but also to specialised artificial intelligence.

The terms "teaching" and "learning" will here be kept apart when possible, for reasons of clarity. There are signs of recent confusion of these terms; matters around teaching and organisation of teaching are often called learning, so much that Oliver and Trigwell called for the word learning to "be rightfully returned to the learner" (2005, p. 24). Biesta writes about the "learnification of education", as a confusing market-driven phenomenon (Biesta 2015, p. 62-64). Another issue is that good teaching can scaffold and interact with learning so well that it becomes the same process, "obuchenie", to follow Vygotsky (1980, see also Cole, 2009).

Ilich (1973) saw learning in networks as an alternative to formal teaching with the learner as a consumer. In a digital age, good conditions for networked learning has improved (Czerkawski, 2016) leading also to formulation of learning theories, as Siemens connectivism (2004).

This paper aims to bring e-teaching and networked learning into alternative and thought-provoking light by applying Floridi's Philosophy of Information or parts thereof. The interpretations are the author's if Floridi is not explicitly cited.

## 1. The Philosophy of Information

Luciano Floridi, a professor of Philosophy and Ethics of Information at Oxford Internet Institute, is the architect behind the Philosophy of Information, even if many co-authors assist in the work and there also is a broader group of researchers, contributing and discussing the same or similar issues (see Demir, 2012). It has a connection to the older cybernetics tradition of Wiener but also to classic information theory (Pierce, Shannon, Weaver) and to Dretske's philosophy of language and information. One of Floridi's arguments for a new philosophy comprises a tree metaphor: the branches and leaves of the tree of information technology with all its products, possibilities and implications have made the tree top heavy and unstable. The roots which must be there for keeping the tree upright are much less developed. These roots are our understanding and ethics of ICTs.

Floridi points out that we humans today are changing our self-understanding as humans, as we previously were in the time of Copernicus, when we realised that our earth is not the centre of the solar system, or in the 19th century when Darwin pointed out that humans are not entirely separate from other biological life, or around 1910 when Freud showed that we are not even in conscious control over ourselves (2014a, p. 89). The new kind of self-understanding we now are proceeding into is first implicated by Alan Turing (1948). We humans are not the only entities that process information and draw conclusions. Machines will do that as well, in their own ways.

There are according to Floridi four recent transformations we experience as a result of the pervasiveness of ICTs, and that in a special way calls for a new frame of reference: the blurring of the distinctions 1) between reality and virtuality; 2) between human, machine and nature and 3) the reversal from information scarcity to abundance and finally 4) the "shift of primacy of entities to primacy of interactions" (Floridi, 2014b, p. 7).

Floridi sums up his book "Philosophy of Information" (2010) in the following short way (2013):

Semantic information is well-formed, meaningful and truthful data; knowledge is relevant semantic information properly accounted for; humans are the only known semantic engines and conscious inforgs (informational organisms) in the universe who can develop a growing knowledge of reality; and reality is the totality of information (notice the crucial absence of "semantic"). (p. xiv)

The world does not consist of information, nor does Floridi think of information as a layer on top of the physical or as a separate new world in parallel to the physical. He does not question a materialist ontology but describes how we perceive reality increasingly as information and networks, instead of as before as physical entities

(2014a, p. 40). We are "infosphere" living in an "infosphere". We are recommended to associate to "biosphere" rather than "cyberspace". The societies we live in are increasingly living on informational assets. A sign that a nation is an information society is that "only those who live by the digit, may die by the digit" (2014a, p. 4). Humans, ("semantic entities"), live in the infosphere together with "syntactical entities"; algorithms, computer programs, and robots. These ICTs are "enveloping the world", with our design and permission, taking over work and functions bit by bit, with our permission. Floridi argues that we need not be afraid of any strong artificial intelligence, who like a monster takes over the world (2016a, 2017). Instead, we must watch, design and learn to live together with weak and specialised artificial intelligence, which can process specific information very fast and communicate it with other ICTs, but has "the intelligence of a toaster" (2014a, p 141). This stupidity of ICTs can help make us more human, not less (2017). ICTs functions the home team of the infosphere, the natives, and we are the away team (2014a, p. 96).

For a look at technology-enabled teaching (today sometimes called e-teaching) back and forward in history, I will use Floridi's thoughts about technology and development of ICTs, and his concept of how ICTs are re-ontologising, enveloping and transdiegetising education. For discussing networked learning, I will take help from his constructionist epistemology and his concepts of informational friction and what it can mean for life in the infosphere. I will continue with some notes on Floridi's more explicit own reflections on education, and finally, a discussion will follow.

## 2. E-teaching and PI

Technology (T) in general is for Floridi characterised by its "in-between-ness". The most straightforward kind of case is human-axe-wood (T of the first order). The axe (T) is between the prompter (P) wood and the human agent (A) who is prompted (by his need, his role, the piece of wood) to use the axe to split the wood. A-T-P. Second order technology is the chain A-T-T-P. Human-screwdriver-screw- pieces of wood. The industrial society is characterised by longer and longer chains and transmissions between human and prompter, which still are to be found at their ends of the chain. Third order technologies are characterised by the missing human. A temperature sensor (T) sends values to a processing unit (T), which compares with other incoming data (T) and its pre-set objectives and takes action (T) to lower the temperature (P). T-T-T-T-P. The human agent is no longer in the technology loop, but should still be on the loop. (2014a p. 30).

ICTs are a kind of technologies, used to document, communicate and in recent times also to process information. Following Floridi, documenting and communicating types of ICTs are very old but have been dramatically improved through history, until the digitalised versions of documenting and communicating ICTs we use today. Information-processing ICTs are new and inherently digital, they are enabled by digital technology and therefore characteristic of the information society.

The age of historical societies begins with written sources. With the writing on cuneiform tablets, we have a documenting ICT. A clay tablet can be brought with a messenger to the next village, and so we have a communicating ICT. The "informational friction" (Floridi's useful term, 2007, p. 5) was very high, though; transports were slow, and the tablet could easily break before it arrived at its destination. Anyway, the cuneiform tablet was a whole lot better, more exact and more durable than oral messages only kept in the mind of the messenger. Documenting and communicating ICTs develop by history in number, kinds and most of all in diminishing informational friction. Already before digital times, messages could be sent quickly around the world without information loss. Floridi argues that what is characteristic for digital ICTs, and our age of "hyper history" is not primarily better documenting and communication, but the processing of information.

### Generated reflections on e-teaching:

#### *1) Teaching with technology is not at all new*

This is a rhetorical question, but sometimes when e-teaching and e-learning are discussed, it is easy to come to believe that there was no technology to talk about earlier, but we have all of it now, and that there is a choice for a teacher to teach with technology or to continue without. This seems to be the result of not reflecting too deeply on technology and teaching in history. Teaching has adopted new and improved ICTs for centuries. Floridi uses a broad definition of technology in general and of ICTs especially; also writing is a technology.

Organised school teaching seems to have been born in the aftermaths of the ICT innovation of writing, which is an important technology. This is as far back as we can know, as our earliest written (sic) sources are from the Sumerian culture about 2000 B. C. (Kramer 1949, Robson 2001). Too much had to be accounted for and written down. The scribes were few, and a lot of apprentices per scribe were slowing down their production. So someone organised a "tablet house", a space with walls where the many who did not know the skill could learn from a chosen scribe that knew it well, a teacher. The school walls protected the teacher and students from

information and activities that were irrelevant for the educational objective in question. A kind of information-starving situation was designed, for the concentration of learner attention on one issue at a time, and not everything at once. Collaboration within the space is OK, but any networked learning is not supported. The classroom itself can in this way be seen as an ICT (see Norberg, 2017, p. 63), a technology between the teacher and the learners, regulating information flow. Since Sumerian times, it can be argued, most, if not all, teachers use technology to teach and have a technology-dependent curriculum to teach. It is tough to imagine any technology-free teaching situation; any unblended learning (Oliver & Trigwell 2005, p. 24). Instead, it can be argued that the more different ICTs we have available, the more adaptive designs of teaching are we able to implement.

*2) The concepts of distance -, e-, and online teaching/learning may show to be the last of something old, and not clearly the start of something new.*

If we follow Floridi concerning the developments of ICTs, we can, as explained above, make a difference between digitalised older ICTs and digital ICTs. Most of the ICTs we use for e-teaching and e-learning today are documenting and communicating ICTs, which for him are part of older historical societies. We could do distance teaching earlier as well, but it has become cheaper, faster and more possible with digitalised ICTs for documents and communication. Furthermore, a student is never distant to his learning, as we can be made believe by the term "distance learning". The student can have varying means and quality of communication with teachers and peers as well as within networks, which enables him to learn or not, where place is only one factor. Concerning e-learning, in the end, it comes down to the possible difference between learning from a text on a screen or printing the text out and learning from the text on the paper. Online learning separates our perceived world in two separate; one traditional and well-known physical-social, and one new, exciting, partly unknown and perhaps dangerous. Don Quijote mixed the realities too by reading too many knight novels, but in this case, it was the new technology of print that caused the danger and confusion. This dualism between an old and a new ICT-mediated reality may exist only as a transient phenomenon before we get accommodated to a new kind of technology. Today we live in an ICT-integrated world, where we hardly can imagine life without ICTs. It may be unnecessary to think of dual worlds according to Floridi; we live already online: "we are probably the last generation that will experience a clear difference between onlife and online" (2007, p. 9). In other words: the world is so technology-blended that it has become a solution of its components, a new normal (Norberg, Dziuban & Moskal, 2011).

*3) Digital ICTs are here and developing*

Beyond the information and communication explosion of documenting and communicating ICTs, a new generation of ICTs is here. Information-processing ICTs are already in use, but not so much in education. They are applications that help the teacher (or the student) to process information for a better teaching/learning process; as a design and on the go. Examples are learning analytics (Siemens & Long, 2011), adaptive learning (Dziuban, Moskal, Cassisi & Fawcett, 2016; Moskal, Carter & Johnson, 2017), UCLA:s Calibrated Peer Review and MIT's Automatic Essay Grader (Balfour 2013). These ICTs do not only help the teacher with making good material available and communicate fast and problem-free, but they can also take over some information-processing tasks from the teacher, if we permit, trust and cooperate with these information-processing ICTs. The interfaces between human and ICT must be well constructed, so the digital ICTs can be used to save the teacher for the tasks that an algorithm cannot do: to problematise, explain, discuss, be creative and give personal feedback to learners. These ICTs "envelop" parts of the teacher's tasks if we let them. "Envelope" as a concept comes from industrial robotics and is the defined area within which the robot can be allowed to become successful. Humans should wisely keep away from this area. Floridi uses the metaphor of a dishwasher (2007, p. 10). It does not do the dishes as we do, but if we let it work in its own way in its warm and wet cubicle and we can control the result, so why not? We thought once that washing the dishes should forever stay a human activity, but we have no problems assigning this activity to a machine. If we have a robot vacuum cleaner, we have a similar situation. Next time we buy a new sofa, we may want one with higher legs, so the robot can tidy up also under the sofa - so we do not have to. The robot is thereby enveloping our environment, expanding its reach, with our consent. To envelope can be to trust an ICT to review student essay's for example or to make a diagnosis of individual student's skills and knowledge gaps and find the right material for them to work with to fill these gaps. Adaptive learning is a potentially powerful and somewhat disruptive technology. It can come to break the stipulated time-based cohort organisation for schooling, in a more extended perspective the course as a unit and the idea of a cohort of learners that can be taught at the same speed.

We can see the co-existence between ICTs and humans as a very uneven marriage, where one partner is very energetic, focused, specialised and attentive to details and the other is more laid-back, reflective, creative and social. Floridi proposes that the only way to a happy marriage is if the lazy and reflective partner designs the co-

existence around what the active partner can do, but keeps and develops the parts that are meaningful to him/her and which the energetic partner cannot do anyway. The "Manifesto for Teaching Online" (2016) from teachers and researchers at Digital Education at the University of Edinburgh, is a provocative document containing 21 short claims and propositions. There we read: "Algorithms and analytics re-code education: pay attention!" and "Automation need not impoverish education: we welcome our new robot colleagues."

*4) As student's whereabouts become less interesting for the organisation of teaching, we can get "combined study groups".*

Provided communication can work better and better, and that students will not use increased time and place flexibility to procrastinate more, we can imagine organisation of study groups which do not care about any place factor but are not distance courses either. Young traditional students often thrive at campuses in bigger cities, but also older, untraditional and second-chance learners with place and time obstacles can participate in the same study group, with the same teacher, in the same organisation. This can both keep the cost down and maximise access to education in a sustainable way but will become different depending on the character of the course in question. It may be necessary to travel for shorter periods to access labs for example, but the organisation of teaching has a lot to gain by disregarding the place factor and concentrate on designing a functional and including learning process instead with the help of chosen ICTs.

### **3. PI and networked learning**

Still today, we consider it quite rude if a person next to us uses his smartphone all the time and does not notice or try to communicate with people in the same location. But what if this person with smartphone considers communication with other contacts as far more critical and exciting, and is not letting his occasional physical context trouble him? Seen in another way, this can also earn our respect. We are still not entirely used to a society where we can communicate with whoever wants to communicate with us, independent of location. If I understand Floridi right, we should imagine a new environment for human life which is much less influenced and obstructed by physical location. We often consider synchronous communication in a room as superior and prioritised in all ways, but it is not problem-free either, and reasonable not a direct communication but mediated as well, by language, expectations, social factors, backgrounds, personal thinking and communication skills, and so forth. We are re-ontologising our environment; we are beginning to understand it differently, in informational terms in the context of the infosphere. One example of this, I think, is Floridi's conceptual re-engineering of the concept of presence (Floridi, 2005). Telepresence and presence are becoming, and more dependent on interaction than on physical presence. To be present today, in the infosphere, is to be interactable (Floridi 2005, p. 19f.). Floridi describes what re-ontologisation is leading to: "As a consequence of such re-ontologisation of our ordinary environment, we shall be living in an infosphere that will become increasingly synchronized (time), delocalised (space) and correlated (interactions)" (Floridi, 2007, p. 61) and "The infosphere has many nodes, but no ultimate centre, so one can be only more or less provincial" (2014, p. 80). To be present and part of a network is first to be interactable, not necessarily to meet in the same physical space. However, a student who is doing his Facebook updates at the back of a lecture room may not be present in the perspective of the teacher, although he can still be present for a friend who has another perspective, another "level of abstraction", to talk with Floridi.

#### **Generated reflections on networked learning**

When we hear that someone has 5000 friends on Facebook, we may want to discuss the meaning of "friend". However, digital ICTs has given us unprecedented contact and communication possibilities, and we can today seek contacts in the most specific interests and questions independent of our physical location. We may however still be limited in the number of meaningful contacts we can handle. For the purpose of networked learning, the communication possibilities to find both learning resources and learning peers stretch today very clearly beyond the organised course and the classroom environment. It cannot any longer be contained in the classroom, with present information flows.

The classroom walls have become information-leaky, and do not work as in earlier times when unwanted information could be kept out of the classroom. Floridi's idea about "transdiegeticisation" is interesting; information has now so little friction that it causes problems. The term relates to film theory. Some information in a movie can be diegetic, which means that it belongs to a scene also for the actors, as talk and ambience sounds which they can hear. Other information, such as a narrators voice and film music, is non-diegetic, it is not part of the film scene but of the viewer experience. In recent times, information has been very difficult to

keep in the designed place and kept out of other domains. The ontological friction of information has become so tiny that it flows through classroom walls for example, and changes its function as an ICT. Learner's personal smartphones and tablets can possibly for a while more be kept out of primary education classrooms, but hardly from higher education premises if ICTs has become part of student identities. This leads us to a risk of chaos in the traditional classroom, as students can communicate and acquire information from whom- and wherever they want. This situation is of course also a considerable asset, if teachers and learners can use it wisely. A thought experiment if it becomes transparent which other courses with the same or similar objective running during the same period can show some possibilities for teachers to swap lectures and form study groups across borders. A student can find a peer working with the same problem for a discussion in the middle of the night. Learners in networks can organise peer learning in new ways on the fly.

If the digital and information-processing ICT "adapted learning" can be expected to develop fast, we probably all want constant learning and variable time, instead of variable learning and a fixed time for learning. This, however, can make many present forms of social, peer and networked learning obsolete, since learners are not organised to move on at the same pace in courses, schedules and semesters as in today's often more industrial kind of organisation. A re-engineering of networked learning can be possible though - one possibility is to study and follow closely how the students will handle it.

Siemens (2004) claimed in his seminal paper that "Learning may reside in non-human appliances". A first association we may make is that access to digital information resources augments the human brain. We do not have to keep so many details in our brains. Floridi helps us further on this road of thought. Artificial intelligence (AI), -kind of ICTs, can help both the teacher and the learner to process information, and also find the right network contacts. We need good interfaces to use these information processing powers; humans should be "in the loop". However, ICTs are permitted to communicate and network by themselves as well. One AI application detects that a student gets a math problem wrong and communicates with a database of open learning resources to find good material for bridging this gap and also informs the teacher on what is going on and what student possibly could collaborate and network with whom. This networking between AI:s will extend the information-processing ability of both teacher and learner.

## 4. Floridi on e-ducation

Floridi's term for education in the infosphere is "e-ducation" (2014a, p 79), with the meaning that the "e", the ICTs, is already integrated into education, as in the "onlife" we increasingly live. He argues that the "how" of education is less crucial than the "what" and "what for" of education. The most burning question is curricular, what to learn, not how to learn the old subjects in new ways. This also demands an answer on the "what for" question, which is more political and ethical (2014a, p. 80-82). The closest Floridi comes to a makeshift answer on the what question is "the languages of information" (Floridi, 2013), meaning all from natural languages to the concepts and terminologies of disciplines to programming and connecting sets of information to produce new information - and handling the co-existence with artificial intelligence ICTs though enveloping. Floridi is a constructionist (like Papert), not to be confused with constructivism, which he criticises (Floridi , 2011a, p. 85). He views Plato's prioritisation of the user's knowledge over the maker's knowledge as a serious historical mistake (p. 82). If Alice causes a change to the world, Bob observes Alice cause a change to the world, and Carol is informed about the change to the world being made, their knowledge is different (Floridi, 2016b ). However, knowledge can be shared and thereby increased, and global sharing can make educational standards increasingly global. It is also increasingly important to agree on what we do not know, or cannot know, for avoiding conflicts. Instead of thinking of how to teach all this new information to students, we can also turn the problem around and instead focus on "distributing ignorance equally" by global networking (Floridi 2013).

## Discussion and conclusion

Floridi is very connected to Western philosophy but has ambitions to build a new global philosophy for a new time. This can show to be very difficult. However, he has a hope to make a foundation for his philosophy and ethics in global ICT culture itself, on another level of networking than local culture and religion. Furthermore, he seems to emphasise the placeless infosphere so much that dimensions of place loose meaning. Even if we communicate instantly and worldwide, our local setting means a lot to us and is important also for our possibility to learn. This mistake is known from before; place can be a considerable problem also in online learning for example, as people are always somewhere.

Floridi writes that philosophy usually does not do nuances well, and loves to cause debates and conflicts by, as an example, formulating dualities. He wants instead to point at integration effects of ICTs into the human world, which we do not observe easily as we do not so well understand the world any longer - as our philosophical orientation is outdated. The expression "first we shape our tools, then our tools shape us" is usually attributed to McLuhan, but is relevant for Floridi as well. He is trying to describe and communicate how ICTs "inscribe" themselves into the world (Floridi, 2014a, p.129ff), and he does it in a serious and fascinating way - which of course also causes debate.

The concept of how ICTs are enveloping the world can be at first frightening. Soon also many ordinary administration jobs are threatened by the implementation of ICTs (Frey & Osborne, 2013). We have heard the joke "If a teacher can be replaced by a computer, he should be". Floridi would agree, but not at all think we because of this can be without teachers, but instead that teachers can have more meaningful and human tasks than those which can be performed by ICTs.

We can also make a reasonable objection that enveloping of digital ICTs, in any case, is a real threat to educators who have many reasons to be critical when living and working in societies under permanent economic stress. The situation is similar to what was said to industrial workers when robotic automation in manufacturing proceeded: their work tasks, those who remained after the industrial robots had been installed, would become very qualified, exciting and well paid. This seldom showed to be the case; sometimes the remaining work tasks were even more boring than before (Carr, 2015). However, enveloping is for Floridi a term used to describe what happens, so we can be aware of it and do something about it. Poritz and Rees argue that the use of ICTs in education must become connected to a broadened concept of academic freedom (p. 23, p. 53). They also propose five laws to follow in all education. The first is "1. Every real student deserves individual attention from, and interaction with, a real teacher", and the last: "5. It is the responsibility of the academic faculty to keep current on technological developments, no matter how far from their comfort zone they may be" (p. 117).

ICTs are, if we choose to follow Floridi, today the digital natives of the infosphere, but only we humans, as "a beautiful bug" in evolution (2017, para. 13-14), can understand what is happening and work to design the new onlife environment after human needs: "...we are constructing the new environment that will be inhabited by future generations" (Floridi, 2007). My general conclusion is that the Philosophy of Information is a very interesting framework to have in mind when we critically review how ICTs are affecting our agency and our understanding of the world. The impressions of the areas of use we first got when we began to use digitalised ICTs for e-teaching and networked learning will probably not be the foundations for any final understanding.

## References

- Balfour, S. P. (2013). Assessing Writing in MOOCs: Automated Essay Scoring and Calibrated Peer Review. *Research and Practice in Assessment*, 2013(8), 40-48.
- Biesta, G. J. (2015). *The Beautiful Risk of Education*. London: Routledge.
- Carr, N. (2015). *The glass cage: Where automation is taking us*. Random House.
- Cole, M (2009). The Perils of Translation: A First Step in Reconsidering Vygotsky's Theory of Development in Relation to Formal Education. *Mind, Culture, and Activity*, 16, 291-295.
- Czerkowski, B. C. (2016). Networked learning: design considerations for online instructors. *Interactive Learning Environments*, 24(8), 1850-1863.
- Demir, H. (Ed.) (2012). *Luciano Floridi's philosophy of technology: Critical Reflections*. Dordrecht: Springer.
- Dziuban, C. & Moskal P. (2011). A course is a course is a course: Factor invariance in student evaluation of online, blended, and face-to-face learning environments. *Internet and Higher Education*, 14(4), 236-241.
- Dziuban, C., Moskal, P., Cassisi, J., & Fawcett, A. (2016). Adaptive learning in psychology: wayfinding in the digital age. *Online Learning Journal*, 20(3), 74-96.
- Floridi, L. (2005). The Philosophy of Presence: From Epistemic Failure to Successful Observation. *Presence: Teleoperators and Virtual Environments*. 14(6), 656-667.
- Floridi, L. (2007). A Look into the Future Impact of ICT on Our Lives. *The Information Society*, 23(1), 59-64.
- Floridi, L. (2011a). A defence of constructionism: Philosophy as conceptual engineering. *Metaphilosophy*, 42(3), 282-304.
- Floridi, L. (2011b). The philosophy of information - of our time, for our time. [Video lecture]. Retrieved from <https://vimeo.com/27333888>
- Floridi, L. (2013). E-ducation and the Languages of Information. Editorial letter. *Philosophy and Technology* 2013(26), 247-251.

- Floridi, L. (2014a). *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*. Oxford: Oxford University Press
- Floridi, L. (Ed.) (2014b). *The Onlife Manifesto: Being human in a Hyperconnected era*. Basel: Springer
- Floridi, L. (2014c). *Transdiegetic information: What it is and why it matters*. (Lecture slides.) June 27, 2014 Politecnico di Torino. Retrieved from <https://nexa.polito.it/nexafiles/2014-floridi-transdiegetic-information.pdf>
- Floridi, L. (2015). *The Ethics of Information*. Oxford: Oxford University Press.
- Floridi, L. (2016a). Should we be afraid of AI? True AI is both logically possible and utterly implausible. *Aeon Essays*. Retrieved from <https://aeon.co/essays/true-ai-is-both-logically-possible-and-utterly-implausible>
- Floridi, L. (2016b). What a maker's knowledge could be. *Synthese*, 1-17.
- Floridi, L. (2017) Charting Our AI Future. (News article, January 2nd. 2017) Retrieved from <https://www.project-syndicate.org/commentary/human-implications-of-artificial-intelligence-by-luciano-floridi-2017-01?barrier=accessreg>
- Frey, C. B., & Osborne, M. A. (2013). The future of employment. How susceptible are jobs to computerisation. Retrieved from <http://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of-employment.pdf>
- Illich, I. (1973). *Deschooling society*. Harmondsworth, Middlesex.
- Kramer, S. N. (1949), Schooldays: A Sumerian Composition Relating to the Education of a Scribe, *Journal of the American Oriental Society*, 69(4), pp.199-215.
- Kurlansky, M. (2011). *Salt: A world history*. Random House.
- Manifesto for teaching online (2016). The research group Digital Education at the School of Education at Edinburgh University. Retrieved from <https://onlineteachingmanifesto.wordpress.com/the-text/>
- Moskal, P., Carter, D. & Johnson, D. (2017) 7 Things You Should Have Known About Adaptive Learning. Educause Learning Initiative. Retrieved from <https://library.educause.edu/~media/files/library/2017/1/eli7140.pdf>
- Norberg, A., Dziuban, C. D., & Moskal, P. D. (2011). A time-based blended learning model. *On the Horizon*, 19(3), 207-216.
- Norberg, A. (2017). *From blended learning to learning onlife: ICTs, time and access in higher education* (Doctoral dissertation, Umeå University). Retrieved from <http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-130567>
- Oliver, M. & Trigwell, K. (2005). "Can 'blended learning' be redeemed?", *Elearning*, 2(1), 17-26.
- Robson, E., (2001). The tablet House: a scribal school in old Babylonian Nippur. *Revue d'assyriologie et d'archéologie orientale* 93(1), p. 39-66.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International journal of instructional technology and distance learning*, 2(1), 3-10.
- Turing, A. M. (1948). Intelligent machinery, a heretical theory. *The Turing Test: Verbal Behavior as the Hallmark of Intelligence*, 105.
- Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Boston: Harvard university press.