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Enactivism and Digital Learning Platforms

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Abstract

Within the field of education, the concept of active learning building on constructivism has emerged as a dominant framework of the past three decades. This perspective is critical to the objectivist idea that knowledge is something static, as an object to be acquired from the external world. Instead, it states that the learner is responsible for the knowledge construction, and therefore shall become autonomous towards this goal. From an epistemological point of view, despite the important shift of assumptions that this viewpoint has brought to education, constructivism still presents some shortcomings in terms of a change of the instructional paradigm. This paper takes a step forward and explores enactivism, as an alternative philosophical and educational worldview. It presents a theoretical discussion of the enactivist perspective and its differences from objectivism and constructivism. Enactivism proposes a more radical alternative to dualistic and objective approach, as it focuses on the intertwined and multiple interactions between mind, body and the environment. The two main perspectives of enactivism, which we grouped into the categories of "embodied cognition" and "situated cognition", are present in the field of education. The paper relates them to the two core concepts of reflection and intentionality. Drawing on these theoretical considerations, the paper applies the framework of enaction to a fieldwork research in a Danish school discussing how this concept may provide some new lenses to understand the potential of participatory approaches to the implementation of a digital learning platform. The intervention was organised through two workshops. The first workshop use the technique of the future workshop (Jung & Müller, 1984), which includes a critique phase and a fantasy phase. The second workshop (14 days later) was a design-workshop. This intervention is an example of how to understand enactive modelling, considering the relations between the participants and the environment as a dynamic and emerging relation of autonomy-dependency, a symbiosis. The analysis shows that the implementation takes place into an ecological living system made up of humans, non-humans, things, and societal entities. For the teachers (and more general the humans) to possibly accept, appropriate, act and re-enact such a learning infrastructure, it is of great importance to establish spaces for reflections, which e.g. a future workshop provides, and to support and facilitate (alternative) enactments of some of the more hidden affordances of the digital learning platform.

Keywords

Enactivism; Digital Learning Platforms; Teachers; Future workshop.

Constructivism and the learner-centred approach

In education constructivism, and to lesser degree socio-constructivism, has emerged as the dominant framework of the past three decades. According to this theoretical perspective, knowledge is constructed through experimentation and social interaction, in a historically and geographically situated context. Piaget suggested cognitive structures emerge from the subject's interaction with the immediate environment, in a process of testing the world and receiving feedback from it. Vygotsky focused on the sociohistorical context, suggesting that the individual learns through the engagement with the others, rather than in isolation. According to this view, the world is independent of our mind, but knowledge is always a human and social construction (Crotty, 1998). The dialectic between knowledge and action, contemplated by Piaget and Vygotsky, takes a step away from the objectivist view of an organized world based on immutable laws. It opens the possibility that there is

new knowledge to be produced, new properties, qualities and entities of the world to be discovered, as well as new understandings to be constructed. It transports us beyond the scope of the Cartesian objectivism, which understands the world as a sum of material artefacts and knowledge as the process to disassemble, analyse and recompose an object, according to the laws that regulate its functioning.
For the purpose of this paper, it is worth noticing that the interpretation that has been made of constructivism and socio-constructivism in recent years has partially distorted this view and placed more emphasis on the subject, rather than on the situated action. The context has become an "accessory", an element that is always mentioned, but in fact is not very important: who makes the difference in the learning relationship is the subject him/herself. Besides, there is lack of consensus on what context actually is (Dohn et al., 2018). In this way, often in literature the "constructivist teaching" or, more generally, "active learning" has become an antonym of the "traditional teaching" method (Pischetola & Miranda, 2019). From this partial and biased understanding, much of the focus of current learning theories, which define themselves as constructivist, is set on individual engagement, student's protagonism, and learning as an active and spontaneous process. Holton (2010, p. 4) underlines a "romantic" notion of these constructivist-inspired approaches, which "conflate constructivism with pure unguided discovery learning", problem-based activities and simulations. From an epistemological point of view, we recognize in these educational/instructional approaches an assumption of a dualistic relationship between reality and knowledge, and a limited change in the educational paradigm. Moreover, the emphasis on the student's centrality disregards the complex environment of interactions that the classroom represents, an environment in which the student is one element of the network (Pischetola & Miranda, 2019). In this perspective, ICT and online learning platforms are seen as a dissociated element of pedagogical practice or the learning process, another tool that "supports" teaching practice.
Based on these reflections, we argue that most of the theories that fall within the framework of (socio-constructivism) adopt the point of view of an instrumental relationship with technology and show a root in the Cartesian objectivism and dualism. According to Fenwick et al. (2011), the problem lies in using the idea of a networked and complex relationship merely as a metaphor, where concepts from concrete socio-material dynamics are abstracted and then applied as representations to pedagogical situations. Drawing on this critique, we could say that the problem in literature is that networked learning is mostly adopted as a frame, rather than considered as an analytical tool. In the following, we will approach a theoretical perspective that takes into account a non-dualistic philosophy about learning, as well as understanding technologies as one of the elements that are part of the situated environment where learning takes place. In line with Biesta and Osberg (2010), we understand that recognising the complex (and complexivist) character of educational processes is a political intervention in itself. In fact, public policies that have focused on ICT integration in the last decades have mainly addressed learning outcomes as something that can be controlled, and expected, in a deterministic cause-effect approach (Heinsfeld & Pischetola, 2019). The policy that rules the introduction of learning platforms in Denmark, which we will present in the last section of this article, is another example of this top-down approach.

Enactivism as an alternative to constructivism

Enactivism proposes a more radical alternative to Cartesian dualistic and objective approach, as it focuses on the intertwined and multiple interactions between mind, body and the environment. As a label, "enactivism" emerged from the biological work of Francisco Varela and Humberto Maturana, who in 1974 introduced the concept of autopoiesis ("self recreation") of a living organism, related to internal coherence, rather than mere adjustment to the environment. The notion of autonomy is the core of the organization of an autopoietic system. This view evolved from the biological field into a theory of human cognition and action. Varela, Thompson and Rosch (1991) offered radical critiques to some assumptions of the cognitive sciences, namely the computational model of mind as dominant aspect of the entire field, and the conception of cognition as the representation of a world that is independent of our perceptual and cognitive capacities. Drawing on these critiques, enactivism sees mental processes not only as a result of brain processes, but also as constituted by sensorimotor knowledge and bodily structures, and by the organism's ability to exercise an action on the environment. The focus placed on one or the other aspect has created different theoretical perspectives. In order to present a brief summary of each current, we will group them as follows: (1) embodied cognition, including theories on grounded cognition and sensory-motor experience; and (2) situated cognition, including theories of embedded and extended cognition.

1 Enactivism and embodied cognition

Embodied cognition is a phenomenologically inclined approach. For the French philosopher Merleau-Ponty, the space between the self and the world would be not a space of separation and distance, but rather a space of continuity and circularity. Thus, the world is not an object to be accessed through knowledge and thinking. It is

the natural setting of human thoughts and perceptions. Heidegger and Husserl, on whose ideas Merleau-Ponty draws his theory, had already stressed the pragmatic, embodied context of human experience in both its reflective and its immediate, lived aspects. The enactivist models that come from the phenomenological tradition understand thinking and cognition as “grounded in bodily actions” (Holton, 2010, p. 3). There is no more need for a distinction between “inside” and “outside” the subject, as if a learner encountered knowledge as something detached from him/herself. According to Varela et al., a key element in this encounter between the subject and the world is the concept of reflection. They suggest "a change in the nature of reflection from an abstract, disembodied activity to an embodied (mindful), open-ended reflection. By embodied, we mean reflection in which body and mind have been brought together" (Varela et al., 1991, p. 27).
In objectivism, one does not include him/herself in the reflection. Boler (2002) explains that in Cartesianism the thinking self is autonomous, isolated not only from other selves but also from one’s own body. With the constitution of a clear boundary between inner and outer, between the self and the world, there is no possibility of connections and shared material existence. Thinking and knowing are “free-from-body” processes of an autonomous and isolated being. This ideal of reality reflects a “repression” of materiality and the body (Boler, 2002) and allows to pursue only partial knowledge of the world (Varela et al., 1991).
In the phenomenological tradition, on the contrary, cognition is intended as embodied action. On this account, enactivist research focuses on the relationship between the concrete bodily experience and the mental processes, sensory behaviour and cognition, considering these aspects inseparable (Damasio 1994; Gangopadhyay & Kiverstein, 2009; Shapiro, 2004). Most of the evidence supporting this framework focuses on how abstract concepts are grounded in sensory-motor processing. One promising idea, for example, is that individuals simulate concrete situations and their related feelings to represent abstract concepts: even when they are not actually perceiving or interacting with the objects, the sensory-motor systems are active in the cognitive processes (Pecher et al., 2011, p. 220).
To sum up, the cluster of theories of embodied or grounded cognition take action and perception to be interdependent. However, as Susan Hurley (2001) points out, this model is still separating cognition (as a central core of the mind) from perception and action (peripheral processes). Cognition and sensory-motor control are assumed to belong to different categories, while - she argues - we need a more dynamic approach to the mind, where perception, action, perception compose a circular way of knowing the world. A perspective that considers the perceiver in constant interaction with the environment. In a post-Cartesian, feminist and socially progressive pedagogy perspective, says Boler (2002, p. 336), bodies are not transcended by reason. Rather, they are part of a "dynamic objectivity", where individual experience connects to the material and social environment.

2 Enactivism and situated cognition

Central to the enactive approach is also the idea of “sense-making” process, an interplay between the organism and the world. In this sense, the environment is not neutral; it has a meaning and a significance for the organism and knowledge is measured by action on the environmental structures. Here, a concept of cognition arises, as embedded in the environment and extended within the individual’s networks of meaning. Both ideas refer to a decentralized view of cognition. On these grounds, the individual (or organism) and the environment are not only interdependent, but co-dependent. According to the principle that Morin (2014) defines as self-eco-organization, an autonomous living being does not exist apart from its biophysical environment. This idea is based on a conception that looks as a paradox: our autonomy is inseparable from our dependence on the environment. That is, the more autonomous we seek to be, the more environmentally dependent we have to be. Apart from the interdependence of the parts and the exchange with the external environment, other elements characterize a living being, such as non-linearity, unpredictability and emergence (von Bertalanffy, 1950). The famous phrase that summarizes this systemic perspective was coined within the German Gestalt movement: “the whole is greater than the sum of the parts”. Applying this systemic view on cognition, we see it as dynamic and environmentally situated. It depends on complex patterns, which emerge from the way the organism couples with the environment, where by “environment” we should understand not only the discrete objects, but the network of relations and contents co-determined. This idea, stresses Hurley (2001), makes it possible to overcome the rivalry between the inner activity and the external environment (fostering the aforementioned idea of enactivism as embodiment). The core concept the author brings about is intentionality.

Enactivism in education

The two main perspectives of enactivism mentioned above – which we grouped into the categories of “embodied cognition” and “situated cognition” – are present in the field of education. We can relate to them through the two core concepts we identified in each category: reflection and intentionality.

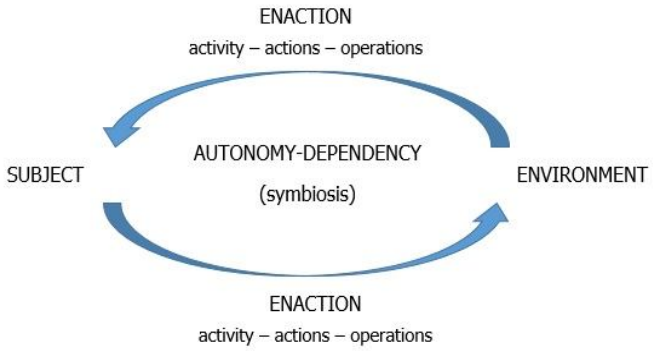
From the point of view of the embodied or grounded cognition, we saw the importance of reflection as an activity that intertwines perception and action. The first philosopher to introduce this topic in education was John Dewey in his work "How we think" (1910). He emphasizes the importance of considering the individual in its entirety, rather than separately in two dimensions, intellectual (reflecting the facts) and emotional (reflecting the imagination). The author cites some attitudes that, when present in the act of thinking and reflecting, are significant in the process of learning and knowing the world. They are: determination and wholeheartedness; trust and directness; receptivity and open-mindedness. Finally, the responsibility is the link that unifies all the other attitudes, as it ensures that the act of thinking has a real consequence that results in conscious, informed and committed action.

Drawing on some of Dewey's considerations about experiential education, the psychologist Jérome Bruner (1961) introduced the definition of enaction in education, referring to the idea of "learning by doing". According to the author, the child's active participation in the learning process results in several benefits: an increase in the subject's intellectual potency to make the acquired information more readily viable in problem solving, the incentive to intrinsic motivation, the pleasure of learning from discovery itself, and an increase of memory. In this perspective, the goal of education is not only the acquisition of knowledge, but also the improvement of thought processes. The inherent discovery in problem solving would be a method of teaching and learning designed to learn to know the world (Bruner, 1981).

The second concept of enaction, which is related to situated cognition, has its roots in the cultural/historical activity theory building on the idea that the human mind is social in its very nature. Further, that the concept of activity "bridges the gap between the subjective and the objective" (Kaptelinin & Nardi, 2006). Activity theory maintains the idea that "no properties of the subject and the object exist before and beyond activities (...) they truly exist only in activities, when being enacted" (p. 31). However, activity also has a narrower meaning, where it refers to a specific level of subject-object interaction. Kaptelinin & Nardi (2006 p. 64) present activity as a hierarchical structure, where activities are a response to a motive based in needs (biological and psychological needs). Activities have a 3 level structure composed of activities, actions and operations, which correspond to motive, goals and conditions (p. 64). Kaptelinin & Nardi underline the dynamics within the activity structure, however the graphic model illustrates a hierarchical structure of activity (p. 64), where movements depart from activity towards an object, through actions and operations.

Another important concept is agency. Leontjew defined human agency "as the ability and the need to act" (Kaptelinin & Nardi, 2006, p. 242). In a more standard definition, agency is defined as the "ability to produce an effect" or "producing an effect according to an intention" (ibid. p. 242). The first definition is related to a thing (natural or cultural) and the second to non-humans (natural or cultural) as well as human beings and societal entities. A stone produces an effect as it gives shadow, while an it-system produces an effect according to the intentions, which have been built into the system (though many of the very big IT system fails). Finally the human being also produces an effect according to an intention, but what radically divides them is that a human being is able to act according to own cultural needs, and can act on non-human beings as well as on other human beings. What is central to human agency is the concept of intention. Human beings' agency cannot be separated from intentions.

Enactivism and cultural historical activity theory are closely related providing a framework that links enactivism



to motives and intentions towards an object. However, the difference between these two perspectives is the focus. The cultural historical activity theory looks into a situation and sees the subjects and objects, the links and the conflicts, which are present among them. On the other side, the enactive perspective focuses on the relationships, rather than on the distinction and dialectic between subjects and objects. With the evolution from activity theory to enactivism, knowledge emerges of an interaction between living beings and their environment that involves both emancipation and dependence, as we mentioned above. A living being – be it a person, an organization or a forest – can be considered as an ecosystem, which is always interacting with other ecosystems.

This interaction causes the ecosystem to change in its organization, and to become flexible in order to adapt to the changing environment to survive.

Figure 1 – Relationship of subject and environment in enactivism

If we consider the classroom as an ecosystem (Pischetola & Miranda, 2019; Rossi, 2011), where multiple interconnected and entangled relations occur (Fenwick et al., 2011), we acknowledge that a teaching and learning situation is situated and unique. If we apply the same analytic perspective to a learning platform, enactivism will show us more clearly the existence of a networked architecture, which includes all the information about the environment where the educational situated action takes place. The role of collaboration, as well as the development of learning communities, are central to the systemic model. Thus, understanding the principles that underlie the learning platforms' networked learning will be of great importance for understanding the classroom from the point of view of enactivism.

Building on the early definition of networked learning developed in the JITOL project and reiterated in the book that came out of that project (Steeples & Jones, 2001) and confirmed by Goodyear et al. (2004) and which has served as a common definition for the networked learning community ever since (McConnell et al., 2012), networked learning is defined as "learning in which information and communications technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources" (p. 6). This early definition of networked learning underlines the entangled perspective of learning as dynamic and complex activity enacted by the learners, the teachers, the ICT, the learning community and its learning resources. This is in line with enactivism in educational theory, which "looks at each learning situation as a complex system consisting of teacher, learner, and context, all of which frame and co-create the learning situation." (Breen, 2005, p. 240). All the elements of an environment – student, teacher, interactions, climate, place, historical moment, emotions, brain, body, objects of knowledge, disciplines, events, society, community, relationships, connections – are taken into account, as part of a complex network that characterizes the situated context for learning (Pischetola & Miranda, 2019).

Returning to the thinking of Maturana and Varela (2001), cognition here is not considered as the result of an internal event of an ecosystem, nor does it represent the result of an external event of the world. In the enactive view, a learning process is circular, as a living organism responds to the stimuli from the environment and alters itself under this feedback. It is a constant changing system, where the relationships that the living organism establishes with the environment also feed and shape its own dynamics. In this bidirectional interaction, the reciprocity between organism and environment is what is responsible for the changes in their structures, without losing their organization. Bateson (1977) defines this process as "a dance of interacting parts", which shows the "pattern that connects" all the existing living systems. In this sense, a core concept that the author brings to the ecological/enactive theoretical perspective is the one of "co-evolution": that is the ability of a system to modify and be modified, in a relational and reciprocal way, through the interaction between systems. Bringing the matter to the realm of didactics, Rossi (2011) considers the classroom as system where co-evolution takes place with mutual influencing, which has implications for knowledge and learning. In the next section, we will argue that this idea can be applied to the implementation of learning platforms, with very interesting results.

Enactivism and implementation of digital learning platforms

In the following, we will use data from a large-scale intervention-based research project on the implementation of digital learning platforms at 15 schools in Denmark in 2016-2017 (Misfeldt et.al, 2018). We will discuss the participatory methods used in the project re-interpreting the process using the concepts from enactivism. However, before we do this, we will give a brief account of the context for digital learning platforms in the compulsory schools in Denmark.

Digital learning platforms in the compulsory school in Denmark - context

In 2014, the Danish Government decided that all Danish municipalities should purchase and implement digital learning platforms before the end of 2017. Instead of centrally creating one national learning platform, as in the case of the communication platform, AULA, which is under implementation right now (fall 2019), the government provided a functional specification of 64 requirements for the learning platform. It was then put to private business to build digital learning platforms that could live up to these requirements (Kommunernes Landsforening, 2014). A central aspect of the functional requirements is the prominent role of goal-oriented learning in teaching sequences, and the competence objectives defined by the Ministry of Education (Kommunernes Landsforening, 2014).

The above-mentioned focus on learning objectives in the digital learning platforms were intended to support the implementation of the then-recent curriculum reform from 2013. Whereas the previous curriculum described the content of teachers' lessons, the reform focused on describing students' expected learning outcomes. The reform included goals regarding students' knowledge, skills, and competencies within the different areas of each subject taught in school (Tamborg, 2019). Among others, the Danish Teacher Union argued that this reform over-emphasizes and details the learning objectives leading to a fragmentation of school subjects and to an instrumental approach to teaching and to a deprivation of teachers' professional autonomy (Tamborg, 2019). The digital learning platforms in the Danish Schools have been designed as a reification of this change in curriculum approach. As such, there are strong values and functionalities embedded in the platform to support the learning goal oriented approach.

The research project

The objective of the large-scale intervention-based research project has been to create generalizable knowledge of how learning platforms potentially and effectively support and influence the work of the educational staff, the pupil's learning and the collaboration with the parents. The focus has been on an implementation perspective more than a co-design project (Dirckinck-Holmfeld & Ræbild, 2017; Misfeldt, 2016). In the following, we will especially take a closer look into the experiences from one of the participating schools, where the second author participated as a researcher.
At each school, a group consisting of teachers, local supervisors, and representatives from the management participated in workshops facilitated by researchers/consultants from the project. The intervention was organised through two workshops. The first workshop, a future workshop (Jung & Müller, 1984), consisted of a critique phase and a fantasy phase. The second workshop (14 days later) was a design-workshop (Brown & Katz, 2009), where the teachers in groups should develop a single design idea, which was transformed into an intervention that the participants conducted as an experiment at their schools. In-between the workshops, the researchers made an "Activity-System-Analysis" (ASA) of the future workshop based on Engeström's triangles (second generation, Engeström, 2001) in order to identify tensions and contradictions in the activity system, which then could serve as a kind of springboard for the development of the design ideas (Dirckinck-Holmfeld & Ræbild, 2017). This analysis was presented for the teachers in the second workshop in order for them to choose a tension to work on and to design an intervention on. The teachers interventions run through 2 months and the teachers did a logbook in order to document their experiences and reflections. Finally, there was a small seminar in the end at each school for all the participants and representatives from the management and school district to present and discuss the interventions very detailed and the learning of the project.

Enactivism and digital learning platforms

Learning platforms are important infrastructures in the networked environment as they mediate the interactions of the participants, teachers, pupils, parents, school administrations etc. The relations between the participants and the environment is a dynamic and emerging relation of autonomy-dependency, a symbiosis (see fig.1). An infrastructure is not given, but becomes an infrastructure through use (Bygholm & Nyvang, 2009). When the workshop took place, the digital learning platform seemed to be an obstruction for the teachers in order for them to do their work. The teachers found it very time-consuming to follow the routines for describing learning goals and learning tasks, the assessment of the pupils' performance in an absolute scala on pass/not pass; moreover, they were very concerned with the values on teaching and learning, which the learning platform presented.
The main problem identified in the critique phase, and which set the framework for the vision phase and the subsequent design workshop, dealt with the human view on which the teachers believed that the digital learning platform is based. According to the teachers' proposals, the digital learning platform a teaching practice that does not see the children "as 'someone', but as 'a thing' that must always be measured and weighed". In the critique phase, the teachers formulated statements as "The system vs. Man. For the platform's sake! The platform is increasingly in focus. Do we end up spending more time on the learning platform than on the children, when teaching?"; "Robot factory"; "The use of the learning platform creates "teaching to test"!!! There is no room for formation"; "Childhood: What does it take for people to be evaluated, measured and weighed from day one in school? Quality of life. Meaningfulness. Community. Presence" (Dirckinck-Holmfeld, 2019 p. 117). In the vision phase, the teachers visualised their ideas for a learning platform arguing that the digital learning platform should facilitate fundamental values of "Meaning, caring, becoming, the child as 'some-one' not a 'thing' supporting inquiry-based learning, problem- and project based learning, outdoor school, and tangible and sensorimotor learning using Lego ++ based on trust on the pupils that "they do what they can".
The future workshop provided a necessary space of reflection for the teachers and shared meaning construction. From a methodological point of view, a future workshop is an enactment by the participants and the environment. It takes place in a specific environment (a specific school, historical moment, educational reform, the management and teaching and learning culture at the case school, the affordances of the room for sharing

and elaborating, and not least the contributions of the participants, teachers and facilitators). In this enactment the participants formulated a shared understanding of the learning platform and the built-in values for child formation, teaching and learning, and it became very present for the participants, that the design of the learning platform was conflicting with their professional identity and engagement as teachers. On the other hand, as the school has to use the learning platform, the second workshop – the design-workshop – was used to "work-around the digital learning platform", and to establish didactical design interventions, so the teachers could try out some of the functions, they would like to use in the digital learning platform in a meaningful way. The teachers focused on two interventions – how to use the learning platform for formative assessment using the portfolio function, and how to use the learning platform to strengthen the teacher-pupils-parent dialogue of the pupils progress using a function for visualising the pupils' progress in a spider web. The process of re-enactement of the platform included, on one side, the body reintegration into knowledge production. Teachers experienced embodiment when they did their interventions and began to use the learning platform.
On the other side, the teachers reinterpreted the designers' proposal of the platform, discovering some features that would suit their pedagogical goals, and even inventing new ones according to their needs. In this process, we could see a new sense-making production and a self-reflection that could take to further pedagogical creativity (see Figure 2 below).

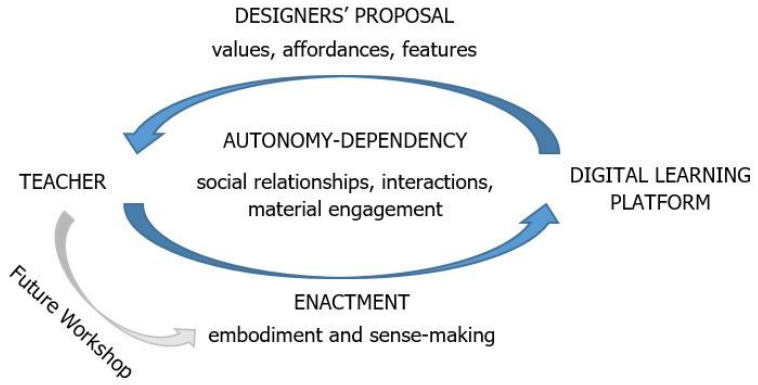


Figure 2 – Relationship of teachers and digital platform within the enactivist frame

This intervention is an example of how to understand enactive modelling. According to Holton (2010, p. 8), an enactive modelling would be a technique "in which a student does not merely observe a dynamic system, but takes over the role of one of the elements and re-enacts and controls its behaviour, observing the effects on the rest of the system". We observe that the wording of this model does not allow to look at the system overcoming the limits of objectivism. We ask here: would it be possible for a subject to "control" the behaviour of an element? Would it be possible to observe the "effects" on the rest of the system? Finally, it does not seem as the student has a say in which roles to take over. However, what we take from Holton is this idea of "taking over the role of one of the elements and re-enact it". In our intervention, we as researchers did not decide which roles the teachers would work with, this was the teachers' responsibility. This re-enactment provided the teachers with an opportunity to explore and work with some functions of the digital learning platforms, which they were not aware of. As documented in Dirckinck-Holmfeld & Ræbild (2017), the re-enactment also provided insights into some of the shortcomings in the design of these functions, however overall the teachers got a more positive attitude towards the learning platform as they found out how they partially could use it and skip other functions. From an implementation point of view, this example demonstrates that the implementation of the digital learning platform takes place into an ecological living system made up of humans, non-humans, things, and societal entities. For the teachers (and more general the humans) to possible accept, appropriate, act and re-enact such a learning infrastructure, it is of great importance to establish spaces for reflections, which e.g. a future workshop provides, and to support (alternative) enactments of some of the more hidden affordances of the digital learning platform.

Conclusion

Under the enactive perspective of a learning platform, it is necessary to bear in mind that the environment does not produce a mechanical change in the classroom system. It is through the interaction of the individuals that are present in that historical situation and in that space that the change will possibly occur. An essential principle of

the enactivist model in education is the provision of multiple perspectives on any problem. This is a very important learning to take on from the enactivist perspective. However, we would suggest to differentiate this perspective following how the ecological living system is made up of humans, non-humans, things, and societal entities, and these elements establishes qualitative different dependencies within the ecology. In conclusion, we affirm that having enactivist models and systemic thinking as a core functioning of the learning process would bring great benefits for the learner, for the teachers and for the implementer of digital learning solutions.

References

Bateson, G. (1977). Vers une écologie de l'esprit. Paris: Éditions du Seuil.

Biesta, G. & Osberg, D. (2010). Complexity, education and politics from the inside-out and the outside-in: An introduction. In Osberg, D; Biesta, G. Complexity Theory and the Politics of Education. Rotterdam: Sense.

Boler, M. (2002). The New Digital Cartesianism: Bodies and Spaces in Online Education. Philosophy of Education Yearbook 2002, p. 331-340.

Breen, C. (2005). Chapter 9: Dilemmas of change: seeing the complex rather than the complicated?. In: Vithal, R.; Adler. J.; & Keite, C. (Eds.). Researching Mathematics Education in South Africa: Perspectives, Practices and Possibilities. Cape Town: HSRC Press.

Brown, T., & Katz, B. (2009). Change by design: How design thinking transforms organizations and inspires innovation (1st ed). New York: Harper Business.

Bygholm, A., & Nyvang, T. (2009). An Infrastructural Perspective on Implementing new Educational Technology: The Case of Human Centered Informatics. In L. Dirckinck-Holmfeld, C. Jones, & B. Lindström, Analysing Networked Learning Practices in Higher Education and Continuing Professional Development. Rotterdam; Sense Publishers.

Crotty, M. (1998). The Foundations of Social Science Research: Meaning and Perspective in the Research Process, Sage.

Damasio, A. (1994) Descartes' error. New York: Grosset/Putnam.

Dohn, N. B., Hansen, S. B., & Klausen, S. H. (2018). On the Concept of Context. Educ. Sci., 8, 111.

Dirckinck-Holmfeld, L. (2019). Brugerinddragelse i brug og integration af læringsplatforme. Learning tech, 106-132.

Dirckinck-Holmfeld, L., & Ræbild, L. C. Ø. (2017). Fremtidsværksted, brugerindflydelse og ejerskab – om at understøtte det pædagogiske personales ejerskab og fagligt pædagogiske lederskab i brug af læringsplatforme. Aalborg Universitet, https://bit.ly/3aRyCOe

Engeström, Y. (2001). Expansive Learning at Work: Toward an activity theoretical reconceptualization. Journal of Education and Work, 14(1), 133–156. https://doi.org/10.1080/13639080020028747

Fenwick, T.; Edwards, R.; Sawchuk, P. (2011). Emerging Approaches to Educational Research: Tracing the Sociomaterial. London and New York: Routledge.

Gangopadhyay, N.; Kiverstein, J. (2009). Enactivism and the unity of perception and action. Topoi, 28(1) 63-73.

Goodyear, P., Banks, S., Hodgson, V., & McConnell, D. (2004). Research on networked learning: An overview. In: Advances in research on networked learning. Dordrecht: Kluwer.

Heinsfeld, B. D.; Pischetola, M. (2019). Discourse on technologies in public policies on education. Educação & Pesquisa, vol. 45. Doi: 10.1590/s1678-4634201945205167

Holton, D. (2010). Constructivism + Embodied Cognition = Enactivism. AERA Annual Meeting – Denver CO.

Hurley, S. (2001) Perception and action: alternative views. Synthese 129, p. 3–40.

Jungk, R., & Müllert, N. R. (1984). Håndbog i fremtidsværksteder. Kbh.: Politisk revy. Kommunernes Landsforening. (2014). Brugerportalsinitiativet kravspecifikation for læringsplatform – Version 1.0.

Kaptelinin, V., & Nardi, B. (2006). Acting with technology: Activity theory and interaction design. MIT Press.

McConnell, D., Hodgson, V., & Dirckinck-Holmfeld, L. (2012). Networked Learning: A Brief History and New Trends. In L. Dirckinck-Holmfeld, V. Hodgson, & D. McConnell (Eds.), Exploring the Theory, Pedagogy and Practice of Networked Learning (pp. 3–24). Springer, New York.

Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.

Misfeldt, M. (2016). Om projektet "Anvendelse af digitale læringsplatforme og læremidler". København: Styrelsen for IT og Læring.

Misfeldt, M., Tamborg, A. L., Qvortrup, A., Petersen, C. K., Svensson, L. Ø., Allsopp, B. B., & Dirckinck-Holmfeld, L. (2018). Implementering af læringsplatforme: Brug, værdier og samarbejde. Læring og Medier, 10(18). https://doi.org/10.7146/lom.v10i18.97013

Morin, E. (2014). A noção de sujeito. In: SCHNITMAN, D. F. (org.). Novos paradigmas, cultura e subjetividade. Ohio: Taos Institute Publications/WorldShare Books.

Pecher, D.; Boot, I.; & Van Dantzig, S. (2011). Abstract Concepts: Sensory-Motor Grounding, Metaphors, and Beyond. Psychology of Learning and Motivation, v. 54, 217-248.

Pischetola, M.; & Miranda, L. V. T. (2019). A sala de aula como ecossistema. Tecnologias, complexidade e novos olhares para a educação. Rio de Janeiro: Editora PUC-Rio.
Rossi, P. G. (2011). Didattica enattiva. Milano: Franco Angeli.
Shapiro L (2004) The mind incarnate. Cambridge, MA: MIT Press.
Steeples, C., & Jones, C. (Eds.). (2001). Networked learning in higher education. Berlin: Springer.
Tamborg, A. L. (2019). Organizational and Pedagogical Implications of Implementing Digital Learning Platforms in Danish Compulsory Schools. Aalborg University Press. Aalborg University.
Varela, F.; Maturana, H.; Uribe (1974). Autopoiesis: The Organization of Living Systems, its Characterization and a Model. BioSystems, 5, 187-196.
Varela, F.; Thompson, E. and Rosch, E. (1991). The Embodied Mind. Cognitive Science and Human Experience. Cambridge, MA: MIT Press.