Futures 132 (2021) 102804

Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures

Building individual futures capacity through transformative futures learning

Laura Pouru-Mikkola *, Markku Wilenius

Finland Futures Research Centre, University of Turku, Finland

ARTICLE INFO

Keywords:
Futures education
Futures literacy
Transformative learning
Transformative futures learning

ABSTRACT

This article focuses on examining the parallels between the recent discussion on futures literacy as human capability and the longer tradition of futures education as a means to enhance the individual's capacity to use the future. Merging these two lines of discussion with transformative educational theory, we proceed to propose a conceptual model for transformative futures learning and a new 21st century futures paradigm for educational institutions. Transformative futures learning, as we define it, is aimed at changing the frames of reference that define how people engage with the future. The model we propose takes a holistic approach to human learning, in which the aim is to develop the individual's cognitive, motivational and action-oriented faculties of engaging with the future. The article is based on a review and analysis of futures education, transformative learning and futures literacy theories.

> "Paradigm change in a single individual can happen in a millisecond. All it takes is a click in the mind, a falling of scales from the eyes, a new way of seeing."
> -Meadows, D. H. 2008

1. Introduction

People generally aren't very good at futures thinking. Even though recent research indicates that humans do have futures consciousness (Ahvenharju et al., 2018) and that anticipation is natural to all living beings (Poli, 2017; Rosen, 1985), it seems to be difficult for us to stretch our imagination towards the emergent and to overcome the constraints of our assumptions of what is possible and probable now and in the future (Bell, 2002). The human view of the future is also affected by subjective emotions and experiences and by the views, values and opinions shared throughout society (Rubin, 1998, 165).

Our capability to think about the future manifests in our actions: our images and assumptions about the future influence our actions in the present, while our actions in the present contribute greatly to how the future begins to take shape. This two-way relationship between future and present has long been recognized in the field of futures studies (e.g. Ketonen, 1985; Malaska, 2017; Rubin, 1998). While the need to develop the individual capacity to imagine and use futures has been at the core of the academic tradition of futures education, the main focus of interest in the wider field of futures studies has been on environmental, societal and organisational futures.

However, the recent research on anticipation, futures literacy and futures consciousness has brought new perspectives to the

* Corresponding author at: Finland Futures Research Centre, Korkeavuorenkatu 25 A 2, 00130, Helsinki, Finland.
E-mail address: laura.pouru@utu.fi (L. Pouru-Mikkola).

https://doi.org/10.1016/j.futures.2021.102804
Received 30 June 2020; Received in revised form 22 December 2020; Accepted 8 July 2021
Available online 10 July 2021

discussion on the development of futures thinking capacity on an individual level (e.g. Ahvenharju et al. 2018; Miller, 2018; Poli, 2017). Drawing from sociological and biological research, the concept of anticipation is defined as "a forward looking attitude, and the use of the former's result for action" (Poli, 2017, 1), or "the form the future takes in the present" as imaginary futures and frames (Miller, 2018a, 2). The concept of futures literacy builds on the theory of anticipation, as it points to the capability to consciously use these imaginary futures and frames in the present. Miller defines futures literacy as "the capability to 'use-the-future', for different reasons and in a variety of ways" (Miller, 2018a, 2). Other authors have previously defined the concept of futures literacy differently. For example, Slaughter (2001, 414) uses the concept of futures literacy to distinguish critical futures studies methods (e.g. CLA) that focus on internal understanding, skill and capacity from those futures studies methods that focus on operation in the external world (Delphi, Scenarios, Forecasting). However, in this article we follow Miller's definition of futures literacy. Alternatively, based on a socio-psychological approach to futures research, futures consciousness has been recently defined as "the capacity that an organization or an individual has for considering future consequences, having a sense of empowerment towards influencing their courses of action, openly assessing alternative courses, approaching problems from a holistic and systemic point of view, and striving for a better future not only for the self but for all of humanity" (Ahvenharju et al., 2018, 11). Futures consciousness consists of five dimensions: time perspective, agency beliefs, openness to alternatives, systems perception and concern for others. The work on the concept of futures consciousness by Ahvenharju et al. is anchored in empirical research, while futures literacy is still a much more fluid concept. According to Miller (2018b, 19) futures literacy is a capability that can be developed, but a precise and conclusive definition will necessarily remain elusive. There have also been some attempts to develop greater synergy and interaction between futures studies and anticipation studies (Wilenius & Kurki, 2017).

As it stands, the lack of conceptual clarity and rigour is hampering the discussion about the development of futures thinking capabilities on an individual level. The recent discussion on developing futures literacy has also numerous parallels with the discussion on futures education. The learning goals for futures literacy development are similar to those for futures education: both are aimed at more creative and critical ways of using and imagining futures. Indeed, futures literacy is sometimes mentioned as the overall learning goal of futures education (e.g. Bateman, 2012), even though the content of the concept might differ from Miller's definition. To add to the conceptual confusion, in our literature review on futures education we found various different definitions for concepts such as futures literacy, futures consciousness, futures orientation and futures readiness. All of these concepts have been used in the peer-reviewed research literature on futures education to express the development of the individual capacity to observe, understand, reflect, imagine, use and act upon the future. Because it is beyond the scope of this article to present a detailed review of all of these concepts, we have chosen to use the generalized concept of ***individual futures capacity*** to refer to the outcome capability gained through the individual futures learning process. Also, in this article, we use the concept of futures education to refer to futures pedagogy that builds on the theoretical underpinnings and methods of futures studies.

Our aim with this article is to contribute to the discussion on futures literacy as a human capability through structuring the parallels between futures education and futures literacy theories and examining the underlying theory of transformative learning more explicitly. We focus particularly on futures education at upper secondary level schools and aim at answering the questions: What might the futures discourse and futures education of the 21 st century look like in secondary schools? Does the discussion on futures literacy bring something new to the discussion on futures education and vice versa? In order to answer these questions we first review the key literature on futures education and some of the theoretical foundations of transformative learning and reflect the relationship of these

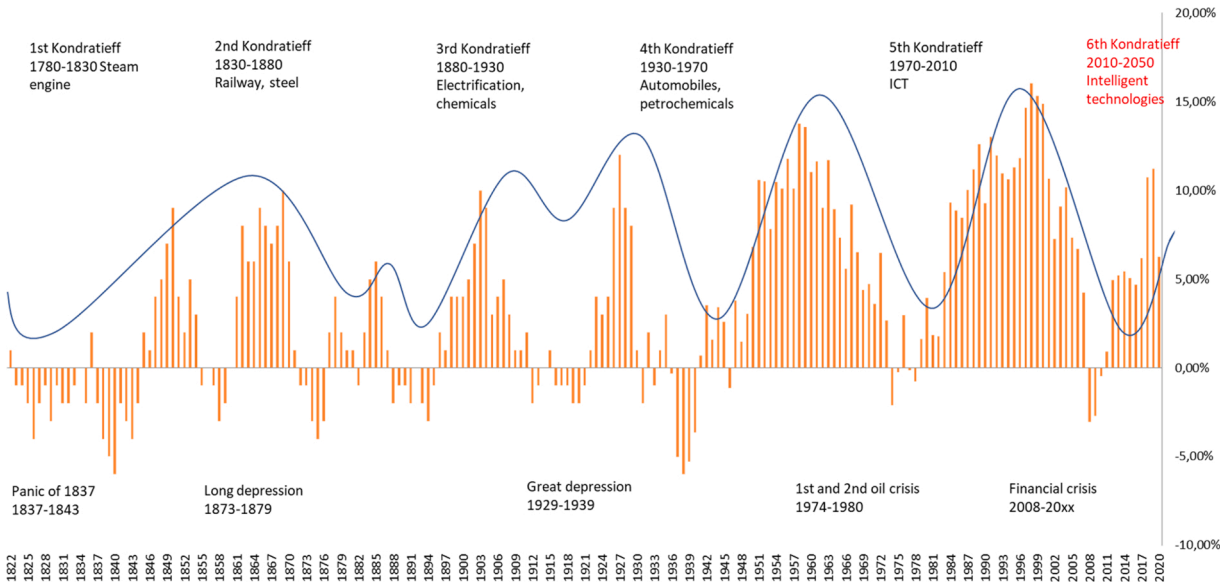

Fig. 1. Kondratieff waves (Wilenius, 2017). Rolling 10-year return on the S&P 500 from Jan 1814 to March 2020 (in % per year). Source: Datastream, Bloomberg, Helsinki Capital partners (illustration).

to the futures literacy theory. After that we present our proposition of a conceptual model for transformative futures learning that contains the key components that construct futures capacity in an individual. The model presented in this article was first designed as a practice-oriented, heuristic tool for creating shared understanding of futures education and individual futures capacity among secondary level teachers in our collaboration schools. The model has raised further interest in academic conferences and therefore with this article we would like to take the opportunity to present the model to the research community. The model is based on a review and analysis of futures education, transformative learning and futures literacy theories.

2. 21st century futures discourse

The importance of developing the individual's capacity to use, imagine and act for futures has become increasingly clear as we move forward in the 21st century. The pressing problems resulting from the destruction of nature, climate change and biodiversity loss; the acceleration of globalization and the growth of inequality as part of its tapestry; the growing uncertainty in the world of work and the rise of mental health problems – all have a message to send to human civilization: the on-going changes are as rapid as they are profound, and we need to transform our ways of thinking and relating to the world and renew the skills we need to cope with these changes (Wilenius, 2017).

One framework for explaining the long-term development of societies is the Kondratieff wave theory. This theory connects our future studies approach with societal and individual transformation. According to this theory, we are currently in transition from the fifth to the sixth wave of social development (Wilenius, 2017). Such periods of transition are characterized by acute economic crisis that pushes society towards the next stage (Fig. 1). Whereas the preceding fifth wave (1970–2010) saw the advent of digital platforms, the sixth wave (ca. 2010–2050) will create technologies and service models to bring a dramatic increase in resource efficiency. The seventh wave (2050–2100) will in turn take us even deeper into a future where technological systems increasingly begin to resemble natural systems, both in terms of their operating principles and their user interfaces. At the same time, the complexity of societies will tend to increase, making life in many ways more challenging.

Globalization and the growth of a multipolar world, the collapse of relations between humanity and nature, the increasing complexity of societies and technologies – all these trends are challenging our existing institutions to reconsider the way they address the future. These developments create demand for new kind of competencies and skills, needed to thrive in the world of increasing complexities, disruptions and rapid changes. The current Covid-19 pandemic provides a great illustration of the type of challenges we are about to face in the unfolding century: they are born global, are result of complex interactions and they push us towards new boundaries.

In addition to these challenges, the sixth wave (2010–2050) will also open interesting new opportunities. Values are currently changing in many ways. Material values are giving way to post material values, yet social inequality is growing exponentially, with capital earnings exceeding economic growth (Piketty, 2013). At the same time, significant changes are taking place in the world of work: atypical employment is becoming the new standard, and the system regulated by industrial society is searching for a new direction (e.g. Prime Minister's Office, 2017). Inside organizations, new and more distributive forms of leadership are gaining ground at the expense of hierarchic work organization (Kurki & Wilenius, 2016).

It has become obvious that the tools and solutions of the past will be inadequate in the face of the growing complexity of the 21st century. The on-going planetary crisis requires us humans to change our ways of thinking and behaving. It calls for lifestyles more aligned with planetary boundaries, while our economies need to take into account all the externalities caused as a by-product of industrial production (Wijkman & Rockström, 2012). Accordingly, a new kind of awareness is rising that challenges prevailing notions of growth and progress. For example, we have recently seen how climate anxiety has prompted young people around the globe to march for climate justice (Pihkala, 2019).

Creating change and transformation depends on our capability to imagine alternative futures (Jungk, 1969). Subjective perceptions of the future are significant in the lives of everyone of us, and particularly in those of young people. Young people's perceptions, expectations and feelings about the future have various concrete consequences, both at a personal and societal level. Several studies on young people's images of the future have shown that young people tend to see their personal future in a more positive light than the future of their local region or the whole world (e.g. Hicks & Holden, 1995; Rubin, 1998). This difference is often explained by reference to differences in empowerment and influence: young people feel more empowered to influence their personal future than they do to influence local or global futures. Studies also show that pessimism towards the future tends to increase during adolescence (e.g. Hicks & Holden, 2007). The Finnish Youth Barometer 2016 (Myllyniemi, 2017) explored young people's (15–29 years) perceptions of the future and found that confidence in the future is crucial to experiencing life as meaningful. Without a positive outlook on the future, the present will also seem dark and gloomy. One of the key findings of the barometer was the rapid increase in cynicism and mistrust among young people. The lack of positive visions for the future may manifest in educational choices or societal restlessness, for example. Without positive and alternative visions of the future, it might be difficult for young people to imagine a future that is desirable or different from that of close relatives and friends. Satisfaction with one's own life was highest among those young people who had trust in a good future and who thought that society had both the ability and the will to solve the problems lying ahead (Myllyniemi, 2017).

Given these trends and challenges, it is imperative that educational institutions consider how futures should be addressed in teaching. Schools play a central role in providing young people with the capacities and tools they need to engage with the rapidly changing world. However, it is only very rarely that the future is explicitly incorporated as part of educational agendas and curricula (Bateman, 2014; Hicks, 2007). Or in the word of Gough (1990): the future is too often used in tacit, token or taken-for-granted forms in educational contexts. *Tacit* use of futures refers to the silent presence of futures: the future is not discussed, but it is simply assumed that

Table 1
Overview of academic literature focusing on futures education at secondary level in chronological order.

Author	Learning goals	Content	Methods of education	Theoretical background
Rubin (1995)	• To develop futures consciousness, futures thinking and futures readiness • To develop capacity to manage change and live in uncertainty • To understand the plurality of futures and that the future can be impacted • To understand change and cause-effect relationships • To understand cultural plurality • To build trust in the future and in oneself • To learn to use imagination and methods to vision alternative futures	• Change and transition • Values • Time perspectives • Humanistic idea of man and humanity • Thematic content, e.g. sustainable development, environment, energy, demographic development, economy, democracy, work	• Essays • Group works • Scenario exercises • Workshops • Delphi • Theme days	• Futures Studies • Self-direction • Communicative Learning
Mikkonen (2000)	• To develop individual futures readiness: comprehensive readiness in the fields of information, skills, emotions and actions to face any kind of future and act on its development	• Emphasis on holistic integration of futures dimension into existing curricula, as a new future-oriented approach to teaching old contents with the help of futures studies methods	• Possible, preferable, probable futures • Scenarios • Visions • Other methods and content based on Futures Studies	• Futures Studies • Constructivist learning theory
Hicks (2002, 2007, 2012)	• To develop individual futures orientation • To think more critically and creatively about the future on personal, local and global levels • To understand the plurality of futures • Critical thinking • Creative imagination • Responsible citizenship and decision-making	• State of the world • Change management • Alternative futures • Hopes and fears • Past-present-future • Visions for the future • Future generations • Sustainable futures	• Images of the future • Futures wheels • Scenarios • Probable and preferable futures • Timelines • Trend mappings	• Futures studies • Geography • Global education • Experiential learning
Bateman (2012), Bateman and Smith (2004)	• To develop individual futures literacy • To increase students' futures consciousness and equip them with critical futures tools and concepts	• Personal, local, global futures • Ethical decision- making • Integration of FS methods with existing subjects and their contents	• Possible, probable, preferable futures • CLA • Visions • Scenarios • Role play • Futures wheel; Concept mapping; Extended present	• Futures studies • Futures time perspective (FTP) • Constructivist learning theory
Ahvenainen et al. (2015)	• To develop individual futures consciousness and futuresness • To promote creative and critical thinking • To understand the plurality of futures • To develop self-knowledge and trust own decision-making process	• Subjective expectations, needs, hopes, emotions and values • Changes in the external operating environment	• Simulations and games that provide an opportunity to rehearse and reflect futures choices through imaginary futures that help to assess own assumptions, incentives, and motives regarding the future	• Futures Studies • Experiential learning • Problem-based learning • Expansive learning • Socio-dynamic learning, • Critical-reflective learning • Non-rational decision making

(*continued on next page*)

Table 1 (*continued*)

Author	Learning goals	Content	Methods of education	Theoretical background
Emanuelli et al. (2018)	• To develop individual futures literacy: to develop skills and abilities to see, think and analyze the future in a strategic way • To develop a richer, broader, and more aware vision of the future and the decisions one may have to take • To develop the capacity to be flexible and to imagine different possibilities	• Exploring personal futures through 3-phased futures laboratories: 1) understanding past and current changes, 2) probable and preferable personal futures, 3) personal plan of action	• Futures laboratories include methods such as timelines, posters, interviews, questionnaires, movies and examining earlier forecasts	• Self-efficacy • Futures Studies • Anticipation

it will appear by itself. *Token* use of futures refers to discussing futures in terms of empty stereotypes and clichés with no real content. And finally, *taken-for-granted* futures refer to discussing a few alternative futures, as if there were no other options. All of this calls for a new kind of a futures discourse in the educational institutions: the future needs to be liberated, democratized and uncolonised, and individuals need better tools to embrace the complexity of the future.

3. The tradition of futures education

Initiatives to incorporate futures education into formal educational systems go back nearly as far as the academic discipline of futures studies. This kind of futures education has often been called as "explicit futures education". As early as the 1970s Alvin Toffler argued that schools need a more explicit approach to futures (Toffler, 1974). Explicit futures education explores futures with a futures pedagogy that builds on the theoretical premises of futures studies. Explicit futures education recognizes the plurality of futures and aims to develop students' individual capacity to use, imagine and act upon futures. The aim is to provide young people with the tools they need to formulate their own view and understanding of the future. Bateman (2012, 16) defines explicit futures education as "that which attempts to develop futures literacy, drawing widely upon futures studies literature for processes and content, and expressed in curriculum statements and outcomes that clearly problematise the future".

Over the decades there have been numerous initiatives aiming to establish explicit futures education as part of secondary schooling, for example in Australia (Bateman, 2012; Slaughter, 2008), the UK (Hicks, 2012) and Finland (Halinen & Järvinen, 2007). However, these initiatives have not translated into futures education actually becoming a permanent part of national curricula. Lack of institutional support for these new initiatives and for teachers, coupled with lack of futures training and teaching materials, are identified as the main obstacles to integrating futures education into educational curricula and practices (Bateman, 2014; Hicks & Holden, 2007; Jokinen & Rubin, 2006; Pauw & Béneker, 2015).

In the case of Finland, for example, the word "future" is mentioned 89 times in the current national curriculum plan for upper secondary schools (Finnish National Board of Education, 2015), but the plan contains no references to the explicit exploration of futures and only very few teachers have the competence or the tools they need to explore futures in more depth. However, a new national curriculum for upper secondary schools is scheduled to take effect in autumn 2021. This curriculum mentions "future" 158 times. Although the dominant futures narrative in the plan is still singular, there are also explicit references, for the first time, to the plurality of futures in the context of multidisciplinary and creative competencies and as part of a dedicated futures course in the discipline of life philosophy. In addition, an introduction to futures thinking and foresight is included as one of the general new contents of career planning studies (Finnish National Board of Education, 2019). It remains to be seen how this will be translated into educational practices.

Table 1 below provides an overview of the research literature on futures education at secondary school level. We specifically explored peer-reviewed research studies focusing on futures education at secondary level, detailing its goals, contents and methods. This helps us gain a sense of existing ways of developing individual futures capacity through education. In addition to the futures education initiatives listed in the table, there is an abundance of literature that discusses futures education on a more theoretical level (e.g. Bateman, 2014, 2012; Paynter & Bruce, 2013; Slaughter, 2008). There are also more practice-oriented futures education initiatives that have not been reported in the research literature. These initiatives have produced practice-oriented handbooks describing methods specifically intended for teaching futures to young people (see e.g. Halinen & Järvinen, 2007; Maristo et al., 2019; Pouru & Tähkäpää, 2018; Teach the Future, 2018).

As the table shows, futures education emphasizes the individual's role as an independent actor who can creatively and critically imagine alternative futures and act towards the preferred option. This capability and ultimate learning goal of futures education is described with different concepts, such as *futures consciousness* (Ahvenainen et al., 2015; Jokinen & Rubin, 2006; Rubin, 1995), *futures literacy* (Bateman, 2012, Emanuelli et al., 2018), *futures orientation* (Hicks, 2012; Paynter & Bruce, 2013), *foresight literacy* (Gidley & Hampson, 2005) and in the Finnish literature also with the concept of *futures readiness* (Mikkonen, 2000) and *futuresness* (Ahvenainen et al., 2015). However, none of the authors define in detail what these capabilities of futures consciousness, futures literacy, futures

orientation or foresight literacy are. In the futures education tradition, Mikkonen (2000, 40) is the only author who has constructed a more detailed theoretical model for the new capacity that futures education aims to develop in students. According to her, futures readiness refers to a broad set of skills, emotions and actions that will help the individual face any kind of future and act on its development. Futures readiness is built through *futures thinking* (a way of communicating with the environment and acquiring, defining and evaluating information regarding the future) and *futures consciousness* (value-rational understanding of how everyday decisions and choices affect the formation of future) (Mikkonen, 2000, vi).

As our literature review indicates, there are no set foundations for futures education, but the idea of integrating the futures domain into education has produced different interpretations. It is also noteworthy that the futures education discourse in the 1990s and early 2000s (Hicks, 2002–2012Hicks, 2002Hicks, 2002–2012; Mikkonen, 2000; Rubin, 1995) is more directly tied to the contents and methods of futures studies, while the initiatives of the 2010s imply a more transformative approach with methods that focus on developing a more active personal relationship with the future (Ahvenainen et al., 2015; Bateman, 2012; Emanuelli et al., 2018). However, what all the initiatives share in common is the notion of open futures and an emphasis on the idea that the future is created through our own imagination and actions. The introduction of the plurality of futures – whether referred to as alternative futures, scenario thinking or the 3P's (possible, probable and preferable futures) – is seen as the core component that will serve to open up students' perspectives towards futures.

4. Transformative nature of futures learning

In this section we elaborate further on the holistic and transformative nature of futures education, which is recognized by most authors in the futures education literature (see e.g. Ahvenainen et al., 2015; Bateman, 2012; Gidley & Hampson, 2005; Hicks & Holden, 1995; Hicks, 2002; Rogers, 1998). According Ahvenainen et al., futures learning is "the process of developing a person's subjective awareness in relation to the future; a process that includes both rational and non-rational aspects of thinking, such as emotions and intuition" (Ahvenainen et al., 2015, 52). Gidley and Hampson also emphasize the importance of understanding the holistic nature of humans. They point out that humans are not only cognitive beings but also ethical, empathetic, creative, communicative, spiritual, kinaesthetic, mathematical, sexual and musical beings – and can learn through all these dimensions. They argue that futures education gives excessive weight to the role of cognitive dimension and individual capability development, whereas the non-cognitive dimensions and collective learning are underrepresented (Gidley & Hampson, 2005, 263–265).

Based on a qualitative study among university students, Rogers and Tough (1996) and Rogers (1998) present a five-step futures learning cycle that students experienced while learning about global futures:

1 *Cognitive:* New knowledge acquisition, new ways of thinking, new perspectives.
2 *Affective:* Emotional response to the gained new knowledge, ranging from sorrow, despair and anger to hope, acceptance and courage.
3 *Existential:* Existential questioning of one's life, values and lifestyles caused by the two preceding phases.
4 *Empowerment:* Sense of personal empowerment and new clarity as one begins to consider how one can contribute to the future on a personal level.
5 *Action:* The sense of empowerment finds concrete manifestation in personal choices and social action for the building of a better future.

This learning cycle has been used in the educational literature as an example of transformative learning (e.g. Siirilä et al., 2018; Sterling, 2010). The theory of transformative learning originates from adult education, but the importance of the transformative nature of education is increasingly recognized throughout the education field. For instance, the UNESCO compilation "Framework for the implementation of education for sustainable development beyond 2019" places great emphasis on the transformative role of education (UNESCO, 2019). However, the field of transformative learning theory is not coherent either, but there are different interpretations of what constitutes the target of transformation in the transformative education process (Illeris, 2014). There are accordingly different "schools" of transformative learning, including a psycho-analytic school, psycho-developmental school, social-emancipatory school, neurobiological school, cultural-spiritual school, race-centric school and planetary school of transformative learning. They differ in various respects, such as whether they think the aim of transformation is to achieve individual or wider societal change (Taylor, 2008, 7–10).

The original author of the theory of transformative learning, Jack Mezirow defines transformative learning as "the process of effecting change in a frame of reference" (the structures of assumptions through which we understand our experiences: associations, concepts, values, feelings and conditioned responses) (Mezirow, 1997, 5). Our frames of reference shape and delimit our expectations, perceptions, cognition and feelings. At the core of transformation, we begin to reflect on our own assumptions that underlie our interpretations, beliefs and habits of mind (Mezirow, 1997, 7). Mezirow's theory has been elaborated upon by others who place greater emphasis on the emotional, spiritual and social dimensions of learning. According to Siirilä et al. (2018, 53), an essential part of reaching a transformative learning experience comes from moving beyond rational thinking and embracing emotions, intuition and the physical body in learning. UNESCO also recognizes the holistic nature of transformative education, describing it as "not only formal, but also non-formal and informal education; both cognitive and socio-emotional learning; and community and citizenship education" (UNESCO, 2019, 5).

But how does a learning process become transformative? According to Mezirow's ten-phased transformation process (2000, 22), transformation often takes place through the following ten phases:

1 A disorienting dilemma
2 Self-examination with feelings of fear, anger, guilt or shame
3 A critical assessment of assumptions
4 Recognition that one's discontent and the process of transformation are shared
5 Exploration of options for new roles, relationships and actions
6 Planning a course of action
7 Acquiring knowledge and skills for implementing one's plans
8 Provisional trying of new roles
9 Building competence and self-confidence in new roles and relationships
10 A reintegration into one's life on the basis of conditions dictated by one's new perspective

The similarities between the learning stages in Mezirow's model and Rogers and Tough's futures learning model (1998) are clear. Both start with gaining of new knowledge of future or other dilemma, which leads to various emotions and self-examination of own assumptions and behaviour, even existential crisis. This can be overcome through empowerment which often happens when one starts finding new roles, relationships and ways to act. Final stage of the process is the action part, when the new way of thinking and acting starts to manifest in the daily life of the individual. Similar learning components are also found in the learning process of futures literacy labs – the method developed particularly for teaching futures literacy. In the core of futures literacy laboratories is the critical examination of one's own anticipatory assumptions and playing with new roles and anticipatory frameworks in order to invent and redefine the way one is using the future (Miller, 2018c). According to Miller the three phases of futures literacy labs build on the Dewey cycle of learning and the S-shaped learning curve (Miller, 2018c, 97–98). The labs consist of three phases (Miller, 2018c):

1 The first phase, "Reveal" focuses on making the personal anticipatory assumptions explicit and opening the participants to question the deterministic way of imagining and using the future. This is often done through exploring predictions and hopes regarding the future.
2 The second phase, "Reframe" introduces the participants with new kind of anticipatory assumptions that "forces" them to imagine the future differently. The participants learn more creative ways of using anticipatory assumptions and the future.
3 The third phase, "Rethink" focuses on reflection between the two previous phases, strengthening the participant's understanding of their own ways and new ways of using the future.

Table 2
Learning theories behind the transformative futures learning model.

Five phases of futures learning by Rogers and Tough 1998	Ten phases of transformative futures education by Mezirow (2000)	Four phases of FLLs by Miller 2018	Three dimensions of transformative futures learning
1. Cognitive: New knowledge acquisition, new ways of thinking, new perspectives	1. A disorienting dilemma	Phase 1a: exploring predictions	**Cognitive dimension** • long-term orientation • futures exploration • temporal change dynamics • systems thinking
2. **Affective:** Emotional response to new knowledge, ranging from sorrow, despair and anger to hope, acceptance and courage	2. Self-examination with feelings of fear, anger, guilt or shame	Phase 1b: exploring hopes	**Motivational dimension** • images of future • assumptions • emotions • values
3. **Existential:** Existential questioning of one's life, values and lifestyles etc. caused by the previous two phases	3. A critical assessment of assumptions 4. Recognition that one's discontent and the process of transformation are shared	Phase 2: testing new anticipatory assumptions	
4. **Empowerment:** Sense of personal empowerment and new clarity as one begins to consider how one can contribute to the future on a personal level	5. Exploration of options for new roles, relationships and actions	Phase 3: gaining better understanding of own ways of using the future through reflection	**Active dimension** • planetary living skills • complexity skills • creativity skills • empathy skills
5. **Action:** Sense of empowerment finds concrete manifestation in personal choices and social action for the building of a better future	6. Planning a course of action 7. Acquiring knowledge and skills for implementing one's plans 8. Provisional trying of new roles 9. Building competence and self-confidence in new roles and relationships 10. A reintegration into one's life based on conditions dictated by one's new perspective	Phase 4: making choices and finding action	

4 The additional fourth phase can be added to the process with emphasis on making choices and finding ways to act upon acquired knowledge.

Table 2 below brings together the learning processes of Rogers and Tough, Mezirow and Miller and illustrates how our conceptual model for transformative futures learning, presented in more detail in the next chapter, builds upon them.

Furthermore, when discussing transformative learning, various authors (Hicks & Holden, 1995; Laininen, 2018; Sterling, 2010) refer to the learning model developed by Bateson (1972). This model describes three different levels of learning and change:

1 *Cognitive-conservative* learning is conformative in nature. It seeks effectiveness and aims at doing things better within particular boundaries.
2 *Metacognitive-reformative* learning focuses on understanding the subjective world: it emphasizes the importance of examining one's own assumptions and values.
3 The deepest level of learning, *epistemic-transformative* learning aims at paradigm change. It involves a radical shift in the way of knowing and thinking that frames one's perception and interaction with the world.

Largely speaking, futures learning can operate at all the above-mentioned levels: cognitive-conservative, metacognitive-reformative and epistemic-transformative. The cognitive-conservative level deals with our knowledge of trends and driving forces that bear significance for the future. Similarly, the metacognitive-reformative level refers to our personal relationship to the world, to the way we lead our own thoughts and emotions about the future. The latest research on neuroscience seems to suggest that our relationship to the future is built on our learning curve to understand the metacognitions we are using. As we learn to know how to stimulate and master our emotions, this new capacity brings in a much more positive outlook on the future (Fabritius & Hagemann, 2018). The third, epistemic-transformative level refers to our capacity to reframe and act accordingly. It builds on the notion of life-wide learning. Continuous training of the ways in which we can transmit the information we receive to new habits helps us use our whole intellectual and emotional capacity to transform our way of engaging with the future. The idea of epistemic-transformative learning is strongly present also in Miller's theoretical framework of futures literacy and anticipation for emergence, as it particularly stresses the importance of recognizing and understanding the anticipatory assumptions as a tool for inventing and redefining the way one is using the future (Miller, 2018b).

5. Model for transformative futures learning

Building on the literature reviews in the previous sections and our own work in the field of futures studies, we have constructed the following model to describe what the components that construct the individual futures capacity are: what an individual should learn in order to become a creative, critical, conscious and active user of the future (Fig. 2). As the literature review indicates, futures learning is not only a cognitive process, but other human faculties of learning should also be considered. This kind of holistic approach is recognized as a key component in creating transformative learning experiences. Therefore the model builds on cognitive, motivational and active dimensions on futures learning,

Cognitive dimension of futures learning refers to gaining general knowledge about the future and the basic understanding of the principles of futures thinking. This is the dimension that is traditionally emphasized in the futures education litearture. *Motivational dimension* refers to a more subjective dimension of futures learning which is in the core of creating a transformative learning experience. This is the dimension that is touched upon in futures education tradition but is more explicitly emphasised in the futures

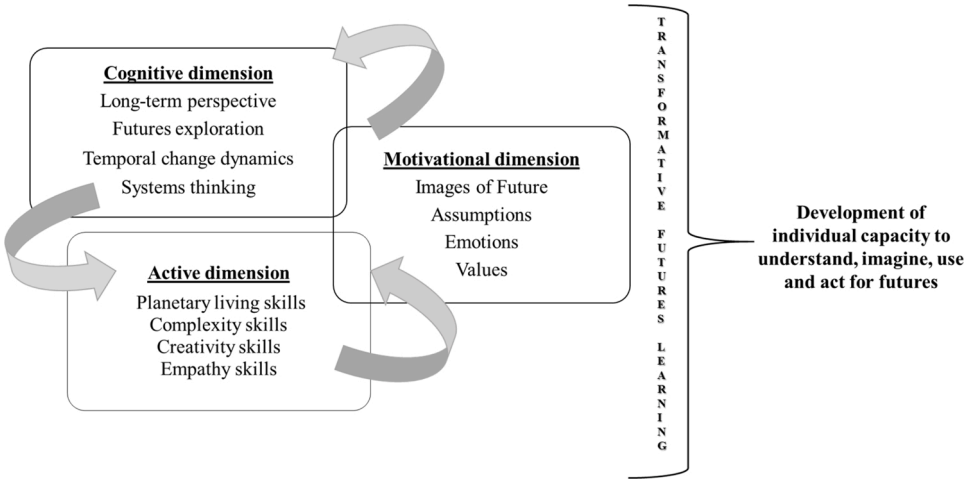

Fig. 2. Cognitive, motivational and active dimensions of transformative futures learning.

literacy tradition. The aim is to provide students with tools for self-examination and reflection on their own relationship with the future. *Active dimension* bring the individual's cognitive and motivational dimensions to the level of action: these are concrete sets of skills that enable to act for a better future. Active dimension encompasses the non-cognitive dimensions of futures learning, including creativity, intuition, somatic engagement and relationships. This is the dimension that aims to empower through finding ways for action, which is mentioned in all the learning processes in the Table 2, but particularly emphasised by Rogers & Tough and Mezirow. It is our proposition that through merging of these three dimensions with continuous self-reflection the individual futures capacity develops. Next, we elaborate on the content of these dimensions in more detail.

5.1. Cognitive dimension

First of all, futures learning includes the gaining of understanding of how the future appears and the basics of our human capability to think about the future. Fundamentally, cognitive dimension develops the capability to recognize change in terms of identifying the shifting factors in our environment that make any of us capable of projecting different futures. The development of cognitive dimension of futures learning has traditionally been seen as the core of futures education, with the main content coming from futures studies. In our model, cognitive dimension consists of a long-term orientation, futures exploration, temporal change dynamics and systems thinking.

Long-term orientation: People tend to think through different temporal horizons (Ahvenharju et al., 2018; Bateman, 2014; Rubin, 1995; Schwartz, 2007). In the process of developing individual futures capacity, it is important to analyse these different time scales of thinking. It is also important to make explicit the cognitive biases that often make it difficult for people to engage in long-term thinking. For instance, there is substantial evidence that people tend to overestimate changes in the short term and underestimate long-term consequences (see Kahneman, 2011).

Futures exploration: At the very heart of futures learning is the idea of open futures that can be impacted with our actions in the present. Furthermore, drawing from scenario thinking and as emphasised in the literature review in the Table 1, it is equally important to learn the idea of alternative futures, some of which can be considered possible, probable, preferable and non-preferable.

Temporal change dynamics: Another fundament is understanding how the future appears. Because the future is constantly open, it is also in a constant state of emergence. There exist certain traceable phenomena, such as trends and megatrends, whose influence on the future can be estimated with some degree of certainty. But there are also disruptions, such as events conceptualized as wild cards and black swans, which have the capacity to radically change the course of the future. Understanding the past and the present and being able to discern different kinds of patterns of how events take shape, builds up the capacity to understand the future. Furthermore, it is crucial to understand the differences between factors that may change rapidly (such as many technologies) and those that remain constant (such as the human need for food, care and shelter).

Systems thinking: Fourth important fundament is the idea of systems thinking, that helps to make sense of and find connections and cause-effect relationships between individual phenomena (Meadows, 2008). Thus, systems thinking refers to processes of change rather than individual events. It supports the building of a holistic world-view and understanding the components of the present and the future as interconnected entities. Systems thinking is also about identifying organisation in the complex environment, thus helping to make it more understandable. It is an approach and a set of general principles that bring it very close to futures studies (Wilenius, 2017).

5.2. Motivational dimension

Futures learning is not only cognitive and rational, but it also involves a wide range of more subjective, personal elements. In our model motivational dimension is aimed at bringing together the subjective components that influence our ways of imagining, using and acting upon the future. Motivational dimension includes contents that support the exploration and development of a personal relationship with the future by examining one's own assumptions, emotions, values and images of futures.

Images of futures: As discussed earlier in the article, our subjective images of futures can significantly steer and influence our actions in the present. Therefore, it is important to become aware of and analyse one's own image(s) of the future. It is equally important to critically examine prevailing images of the future in the wider society.

Assumptions: Moving on from images of futures, next step is to learn to recognize the conscious and unconscious assumptions lying behind our actions and images of futures. Some psychological traditions regard these assumptions as archetypes, collectively inherited ideas and images stored in human cultures (Jung, 1981). These assumptions might impact on our views of what is possible in the present and in the future. Exploring existing assumptions is particularly important for creating a transformative learning experience, as indicated by Mezirow (2000).

Emotions: Not only our assumptions but also our emotions towards the future influence our actions and capability to imagine the future. Futures can raise all kinds of emotions, ranging from excitement to despair. Climate anxiety is a recent example of challenging emotions that imagined futures can elicit (Pihkala, 2019, 3). Acknowledging and sharing these emotions is essential for the mental well-being of individuals, but also a key component of the transformative learning process (Rogers & Tough, 1996).

Values: Values guide our behaviour and choices in different decision-making situations throughout our life (Rubin, 1995). They also guide our perception of what kind of future we consider desirable or non-desirable. Generally speaking, preferences over values are known to change slowly over time, but there are certain patterns of change that have been recognized in global value surveys (World Value Survey, 2020). The critical reflection of individual and societal values is therefore an important part of building up the personal relationship with the future.

5.3. Active dimension

Cognitive and motivational dimensions create the foundation for the third dimension, which we call active dimension or *active skills*. The active dimension consists of sets of skills that are aimed at empowering agency, mobilizing the individual's cognitive and motivational dimensions of learning. There is a long tradition of pedagogical thinking, including Montessori pedagogy that promotes an active approach to learning. Moreover, there is a strong intellectual school of critical social thinking, particularly so-called Frankfurt school, in which the differentiation between the system-world and the life-world has provided a fruitful ground to argue for active human participation in the life-world (Ramos, 2003). Rogers and Tough maintain that in order to overcome the phase of existential crisis in the futures learning cycle, it is necessary to feel personal responsibility and a commitment to doing something for a "better future" (Rogers & Tough, 1996). Therefore, the active dimension of futures learning provides the critical tools for being proactive in the world, instead of passively waiting for events to happen in our life-world. In other words, active skills foster the capacity of the individual to become a change maker in our complex, interconnected society. The following describes four particular skills, each representing what we believe could be described as 21th century metaskills (see Neumeier, 2013).

Planetary living skills refer to the individual's personal relationship with the planet and to planetary resource depletion (Club of Rome, 2019). Global risk perception studies show that people increasingly associate risks with environmental problems. The recent Global Risks Report indicates that for the first time ever, all top five gravest risks identified by the respondents were environment-related (World Economic Forum, 2020). As people today are increasingly spending time in urban and digital environments, it is ever more important to maintain a living relationship with the surrounding physical biosphere. In order to achieve a living and balanced relationship, we need to understand and experience how nature works and affects us, for example, how plants grow and what they offer us. A healthy planetary relationship depends upon an awareness of our immediate impact on the physical environment around us – as individuals and collectively as a society.

Complexity skills refers to the growing complexity of our societies, which is throwing up ever more uncertainties and disruptions (Wilenius & Casti, 2015). The world is becoming ever more connected, and there are more and more people on this planet to connect with. There is ever more technology and information we have to deal with. This calls for a capacity to keep our mind clear and focused, to avoid being overwhelmed by the vast range of impulses (Goleman, 2013). The aim of complexity skills is to improve the individual's flexibility and sense-making capacity to manage uncertainty and their ability to act in complex decision-making situations. By developing their complexity skills, individuals learn to understand the structures of society and discover opportunities to exert influence within that complexity.

Creativity skills are aimed at strengthening our creative and critical faculties of thinking, for instance to use our intuition to unleash our full capacity to learn (Raami, 2015). Creativity itself is recognized as an essential part of the constitution of modern life, particularly in the tradition of positive psychology (Seligman & Csikszentmihalyi, 2000). There is a growing realization that creativity, as the ultimate human quality, becomes all the more important resource for us to use, as machines, robots and artificial intelligence release us from monotonous and repetitive tasks (Neumeier, 2013). Creativity does not necessarily require great flashes of genius; it is more akin to the ability to use one's imaginative capacity for discovering new ways of thinking and new solutions to surprising problems.

Empathy skills focus directly on our capacity to reach out and suppress our innate bias to be self-centred in our thoughts and actions. In a way, the whole cultural history of human civilization can be interpreted as a series of steps towards an increased sense of empathy (Rifkin 2009). In our ever more connected world where people are increasingly moving and migrating, the sources of empathy should be widely cultivated in the face of global problems as we try to find shared solutions. Empathy skills aim at igniting our aspiration in the world by contributing to the well-being of others, particularly those of future generations. Empathy skills nurture the individual's capacity to work with and for other people.

6. Discussion

Futures learning is a complex, holistic and transformative experience, at all ages. It often challenges our existing frames of reference – whether through the introduction of the plurality of futures (as in the tradition of futures education) or through making our assumptions transparent (as in futures literacy labs) – and pushes us to question our own values and way of living. In this article we have proposed a model of transformative futures learning that enables individual futures capacity to develop. By transformative futures learning, we refer to explicit futures education that aims to transform the frames of reference that define how individuals engage with the future.

The model introduced in this article expands the traditional notion of futures education. Transformative futures education, as presented in this article, aims to transform the individual's relationship with the future through the development of cognitive, motivational and active dimensions to engage with the future. Merging futures education theory with the futures literacy and transformative learning theories brings to the core of the learning experience the essential role of 1) critical examination of one's assumptions and emotions about the future, 2) exploration of new roles and perspectives and 3) importance of finding ways to act on new insights. Although the transformative nature of futures learning processes has been implicitly recognized in the previous literature as well, there has been barely any explicit discussion about it. Therefore we consider that the futures literacy theory enriches the discussion on futures education through bringing the transformative component of futures learning to the core.

There have been initiatives to integrate futures education to schools during the past decades, but one of the main obstacles has been the lack of innovative pedagogic tools. During the recent years there has been promising development in the pedagogic field (e.g Maristo et al., 2019; Teach the Future, 2018). When merging with the design principles of futures literacy laboratories the development

of transformative futures pedagogy opens up endless opportunities to borrow from experiential pedagogy and improvisation, arts, play and outdoor education, for example (Kuzmanovic & Gaffney, 2017), or from design pedagogy (Kemp, 2017) or design fiction (Duggan et al., 2017). There is also an interesting Australian study which shows that young people at Steiner schools develop more proactive and positive attitudes towards the future than their peers in regular upper secondary schools (Gidley & Hampson, 2005). Steiner schools are known for their holistic pedagogy that embraces the full complexity of being human. This might be one interesting direction for further research. However, teaching futures and exposing young people to a transformative learning process also involves ethical concerns and careful judgement is needed when planning such education. For example, conflicts of values and the teacher's role and responsibility as a facilitator of the sensitive learning process must be addressed with care (Bateman, 2014).

7. Conclusion

In this article we have discussed how to integrate a 21st century futures paradigm in education and conceptualize futures education at upper secondary school level. While we admit that the topic is not new, we claim that previous research literature on futures education has not discussed the detailed content or the transformative nature of futures education explicitly. The model for transformative futures learning presented in this conceptual article brings together the traditions of futures education, futures literacy and transformative learning. With the model, we aim to synthesize the essence of the learning content and the process that develops the individual capacity to understand, imagine, use and act upon futures. This is the capability that has been referred to with diversity of names in the previous research literature: futures literacy, futures consciousness and futures readiness to name a few. The lack of conceptual rigour is currently confusing the discussion about the development of futures thinking capabilities on an individual level, but with this article we aim to bring some structure to this discussion. We hope that the model presented in this article supports the development of shared theoretical foundations for futures learning in secondary schools. We suggest that further research could focus on developing the model further and on the implementation and validation of the model in empirical studies.

This article has potentially interesting, wider implications for the general field of futures and foresight as well. Paying closer attention to the development of the individual's capacity to engage with futures through cognitive, motivational and active dimensions might help to overcome some of the obstacles in consolidating foresight processes within organizations or facilitating multi-stakeholder foresight processes. Foresight processes often neglect the subjective level of using futures and focus instead on thematic substance, such as producing scenarios on a certain topic. The development of individual futures capacity could be particularly relevant to what is called constructive foresight (Tuomi, 2019), transformative foresight (Minkkinen et al., 2019) or culture-based foresight (Rohrbeck, 2011), as these approaches build on active making and experimentation with the future instead of outcome-oriented foresight processes and therefore require strong competencies to handle futures on an individual level.

It appears that as we enter further to the 21 st century, there is a growing demand for helping individuals to broaden their capacity to imagine, use and act upon the future. As implications for societal level, we suggest that it is increasingly important in the 21st century to step up futures capacity-building efforts not only for rising generations but for us all. Over the past 20 years we have witnessed growing dissonance between human and natural systems, which has pushed our planet to the verge of collapse. Moreover, as discussed in the article, our model of long-term dynamic socio-economic patterns known as Kondratieff waves suggest that growing complexity of the world request a very different kind of resilience. The only way out is to move forward to the next level in our thinking, attitudes and behaviour. For that we need new competencies and skills. Transformative futures learning will help to take those next steps in civilizational evolution towards more harmonious human-nature coexistence and indeed better management of our futures.

Funding

This work was supported by the University of Turku Foundation.

Declaration of Competing Interest

The authors report no declarations of interest.

References

Ahvenainen, M., Jokinen, L., Korento, K., & Ollila, J. (2015). Tulevaisuusoppiminen – jatkoa ajatellen. *Futura*, 46–53, 2/2015.
Ahvenharju, S., Minkkinen, M., & Lalot, F. (2018). The five dimensions of Futures Consciousness. *Futures, 104*, 1–13.
Bateman, D. (2014). Transforming teachers' temporalities: Futures in an Australian classroom. *Futures, 44*, 14–23.
Bateman, D. (2012). Ethical dilemmas: Teaching futures in schools. *Futures, 71*, 122–131.
Bateman, D., & Smith, C. (2004). Futures education in Australian primary and secondary schools: Mapping current principles and practises. In J. M. Gidley, D. Bateman, & C. Smith (Eds.), *Futures in Education: Principles, practices and potential. The strategic foresight monograph series* (pp. 73–87). Melbourne: Swinburne Press. No. 5.
Bateson, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
Bell, W. (2002). Foreword. In D. Hicks (Ed.), *Lessons for the future: The missing dimension in education (xi-xvi)*. London: Routledge-Falmer.
Club of Rome. (2019). *Planetary emergency plan. Securing a new deal for people, nature and climate*. Winterthur.
Duggan, J. R., Lindley, J., & McNoil, S. (2017). Near future School: World building beyond neoliberal present with participatory design fictions. *Futures, 94*, 15–23.
Emanuelli, C., Scolozzi, R., Brunori, F., & Poli, R. (2018). Future-labs in the classroom: The experience of Skopia. *World Futures Review*, 1–9.
Fabritius, F., & Hagemann, H. (2018). The leading brain. *Neuroscience hacks to work smarter, better and happier*. New York: Penguin.
Finnish National Board of Education. (2019). *Lukion opetussuunnitelman perusteet 2019. Määräykset ja ohjeet 2019:2a*. Helsinki: PunaMusta Ltd.

Finnish National Board of Education. (2015). *Lukion opetussuunnitelman perusteet 2015. Määräykset ja ohjeet 2015:48*. Helsinki: Next Print Ltd.
Gidley, J. M., & Hampson, G. P. (2005). The evolution of futures in school education. *Futures, 37*, 255–271.
Goleman, D. (2013). Focus. *The hidden driver of excellence*. Bloomsbury.
Gough, N. (1990). Futures in Australian education—Tacit, token and taken for granted. *Futures, 22*(3), 298–310.
Halinen, I., & Järvinen, R. (Eds.). (2007). *Tulevaisuuskasvatus – passi tulevaisuuteen*. Helsinki: Finnish National Agency for Education.
Hicks, D. (2012). The future only arrives when things look dangerous: Reflections on futures education in the UK. *Futures, 44*, 4–13.
Hicks, D. (2007). Lessons for the Future: A geographical contribution. *Geography, 92*(3), 179–188.
Hicks, D. (2002). Lessons for the Future – The missing dimension in education. *Futures and education series*. London: RoutledgeFalmer.
Hicks, D., & Holden, C. (2007). Remembering the future: What do children think? *Environmental Education Research, 13*(4), 501–521.
Hicks, D., & Holden, C. (1995). *Visions of the future – why we need to teach for tomorrow*. London: Trentham Books Limited.
Illeris, K. (2014). Transformative learning and identity. *Journal of Transformative Education, 12*(2), 148–163.
Jokinen, L., & Rubin, L. (2006). Tulevaisuus kuuluu kaikille – tulevaisuuskasvatus läpäisyteemana. *Futura*, 89–93, 1/2006.
Jung, C. G. (1981). *The archetypes and the collective unconscious*. Princeton University Press.
Jungk, R. (1969). Imagination and the future. *International Social Science Journal, XXI*(4), 557–562.
Kahneman, D. (2011). *Thinking, fast and slow*. London: Penguin books.
Kemp, S. (2017). Design museum futures: Catalysts for education. *Futures, 94*, 59–75.
Ketonen, O. (1985). Tulevaisuudesta tietäminen. In P. Malaska, & M. Mannermaa (Eds.), *Tulevaisuuden tutkimus Suomessa* (pp. 9–21). Juva: Gaudeamus.
Kurki, S., & Wilenius, M. (2016). Trust makes this organisation unique. Looking at the future of work through two human-centric organisations. *European Journal of Futures Research, 4*, 23.
Kuzmanovic, M., & Gaffney, N. (2017). Enacting futures in postnormal times. *Futures, 86*, 107–117.
Lainінen, E. (2018). Transformatiivinen oppiminen ekososiaalisen sivistymisen mahdollistajana. *Ammattikasvatuksen aikakauskirja, 20*(5), 16–38.
Malaska, P. (2017). Futures consciousness and the knowledge of the future. In S. Heinonen, O. Kuusi, & H. Salminen (Eds.), *How do we explore our futures? Acta Futura Fennica 10*. Helsinki: The Finnish Society for Futures Studies.
Maristo, M., Rantasuo, E., Rybatzki, I., Sorvali, E., & Tähkäpää, O. (2019). *Taiteillen tulevaisuuksiin – tulevaisuuskasvatuksen menetelmiä alakoululaisille*. Helsinki.
Meadows, D. H. (2008). *Thinking in systems*. White River Junction: Chelsea Green Publishing.
Mezirow, J. (2000). Learning to think like an adult. Core concepts of transformation theory. In J. Mezirow (Ed.), *Learning as transformation. Critical perspectives on a theory in progress* (pp. 3–33). San Francisco: Jossey-Bass.
Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education, 74*, 5–12.
Mikkonen, A. (2000). *Nuorten tulevaisuuskuvat ja tulevaisuuskasvatus*. Publications in education, 57. Joensuu: University of Joensuu.
Miller, R. (2018a). Introduction: Futures literacy: Transforming the future. In R. Miller (Ed.), *Transforming the future – Anticipation in the 21st century* (pp. 1–12). Paris: UNESCO & Routledge.
Miller, R. (2018b). Sensing and making-sense of Futures Literacy – Towards a Futures Literacy Framework (FLF). In R. Miller (Ed.), *Transforming the Future – Anticipation in the 21st Century* (pp. 15–50). Paris: UNESCO & Routledge.
Miller, R. (2018c). Futures Literacy Laboratories (FLL) in practice. In R. Miller (Ed.), *Transforming the Future – Anticipation in the 21st Century* (pp. 95–109). Paris: UNESCO & Routledge.
Minkkinen, M., Auffermann, B., & Ahokas, I. (2019). Six foresight frames: Classifying policy foresight processes in foresight systems according to perceived unpredictability and pursued change. *Technological Forecasting and Social Change, 149*, 1–13.
Myllyniemi, S. (2017). *Katse tulevaisuudessa. Youth Barometer 2016*. Publications of State Youth Council. Ministry of Education and Culture. No 56. Grano Ltd.
Neumeier, M. (2013). *Metaskills. Five talents for the robotic age*. San Francisco: New Riders.
Pauw, I., & Béneker, T. (2015). A futures perspective in Dutch geography education. *Futures, 66*, 96–105.
Paynter, M., & Bruce, N. (2013). A futures orientation in the Australian Curriculum: Current levels of teacher interest, activity and support in Western Australia. *Australian Education Research, 41*, 73–87.
Pihkala, P. (2019). Climate anxiety. *MIELI Mental Health Finland* (Accessed 26 June 2020) https://mieli.fi/sites/default/files/materials_files/mieli_climate_anxiety_30_10_2019.pdf.
Piketty, T. (2013). *Capital in the 21st century*. Harvard University Press.
Poli, R. (2017). *Introduction to anticipation studies. Anticipation science 1*. Cham: Springer.
Pouru, L., & Tähkäpää, O. (2018). *Opettajan opas tulevaisuuksien tutkimiseen* (Accessed 4 December 2019) http://tulevaisuuspaiva.fi/wp-content/uploads/2019/01/Tulevaisuusp%C3%A4iv%C3%A4-Opettajan-opas-3-4-2018.pdf.
Prime Minister's Office. (2017). *Government Report on the Future, Part 1: A shared understanding of the transformation of work*. Prime Minister's Office Publications 13a/2017. Helsinki.
Raami, A. (2015). *Intuition Unleashed: On the application and development of intuition in the creative process*. Doctoral Dissertation. Aalto University Doctoral Dissertations, 29/2015. Helsinki.
Ramos, J. (2003). *From critique to cultural recovery. Critical futures studies and causal layered analysis*. Australian Foresight Institute. Monograph Series nr.2. Melbourne: Swinburne Press.
Rogers, M. (1998). Student responses to learning about futures. In D. Hicks, & R. Slaughter (Eds.), *Futures education. World yearbook of education 1998* (pp. 203–216). London: Kogan Page.
Rogers, M., & Tough, A. (1996). Facing the future is not for wimps. *Futures, 28*(5), 491–496.
Rohrbeck, R. (2011). *Corporate foresight – Towards a maturity model for the future orientation of a firm*. Berlin Heidelberg: Springer-Verlag.
Rosen, R. (1985). *Anticipatory systems: Philosophical, mathematical, and methodological foundations*. New York: Springer.
Rubin, A. (1998). The images of the future of young Finnish people. *Publications of the Turku School of Economics and Business Administration*. Turku: Grafia Ltd. Series D-2: 1998.
Rubin, A. (1995). *Ote huomiseen – Tulevaisuustietoisuus opetuksessa*. Tulevaisuussarja 5. Tulevaisuuden tutkimuksen seura. Helsinki: Painatuskeskus Oy.
Schwartz, P. (2007). *The art of the long view*. Chichester: Wiley.
Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*, 5–14.
Siirilä, J., Laininen, E., Tikkanen, J., Salonen, A. O., & Pantsar, T. (2018). Transformatiivinen oppiminen antroposeenin ajassa. *Ammattikasvatuksen aikakauskirja, 20*(5), 39–56.
Slaughter, R. A. (2008). Futures education: Catalyst for our times. *Journal of Futures Studies, 12*(8), 15–30.
Slaughter, R. A. (2001). Knowledge creation, futures methodologies and the integral agenda. *Foresight, 3*(5), 407–418.
Sterling, S. (2010). Transformative Learning and Sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education, 5*, 17–33.
Taylor, E. W. (2008). Transformative learning theory. *New Directions for Adult and Continuing Education, 119*, 5–15.
Teach the Future. (2018). *Futures thinking playbook*.
Toffler, A. (1974). *Learning for tomorrow: The role of future in education*. New York: Vintage Books.
Tuomi, I. (2019). Chronotopes of foresight: Models of time-space in probabilistic, possibilistic and constructivist futures. *Futures & Foresight Science, 1*, 1–15.
UNESCO. (2019). *Framework for the implementation of education for sustainable development (ESD) beyond 2019* (Accessed 2 June, 2020) https://unesdoc.unesco.org/ark:/48223/pf0000370215.locale=en.
Wijkman, A., & Rockström, J. (2012). *Bankrupting nature. Denying our planetary boundaries. A report to the club of Rome*. Oxon: Routledge.
Wilenius, Markku (2017). Patterns of the future. *Understanding the next 40 years of global change*. London: World Scientific Publishing.
Wilenius, M., & Casti, J. (2015). The sixth K-Wave and the shocks that may upend it. *Technological Forecasting and Social Change, 94*, 335–349.

Wilenius, M., & Kurki, S. (2017). K-waves, reflexive foresight and the anticipation of the next socio-economic cycle. In R. Poli (Ed.), *Handbook of anticipation*. Cham: Springer International Publishing AG.
World Economic Forum. (2020). *The global risks report* (Accessed 26 June 2020) https://www.weforum.org/reports/the-global-risks-report-2020.
World value survey. (2020) (Accessed 26 June 2020) http://www.worldvaluessurvey.org/wvs.jsp.