
On the Competence of Futures Literacy

Stefan Bergheim¹

Center for Societal Progress, and FUON Futures, Frankfurt am Main, Germany
stefan.bergheim@zukuenfte.net

Abstract

This note is an attempt to describe the competence of Futures Literacy more clearly. To help create clarity it uses a well-established structure: competence = knowledge, skills, and attitudes. The note touches on neighboring concepts such as future skills and links to measurement. The core of the note are descriptions of six sub-competences of Future Literacy and four competence levels.

Keywords

Futures Literacy, Competence, Knowledge, Skills, Attitudes, Anticipation, Assumptions, Complexity, Collective Intelligence, Emergence, Imagination, Novelty, Reframe

1. Introduction

The competence of Futures Literacy as mentioned by Miller already in 2007 (Miller, 2007) emerged from efforts to ground Futures Studies in complexity theory and especially in the theory of anticipation that was developed by the biologist Robert Rosen (1985/2012 & 1991) with contributions by Aloisius Louie (2010), Mihai Nadi (2012) and others. The sociologist Roberto Poli (Poli, 2019) pioneered efforts to introduce the theory of anticipation to the futures field in the early years of the 21st century.

Futures Literacy is linked to a broad spectrum of futures methods including the highly flexible Futures Literacy Laboratory developed by Miller (2011, 2018) over the past 15 years. There is now a lot of evidence of what specific interventions can do for example in terms of boosting awareness of novelty, building deep connections with other participants, and increasing Futures Literacy (Bergheim, 2022).

However, to be more useful and more easily understood, Futures Literacy as a competence needs to be – in my opinion and experience – described in more detail going beyond general statements such as "to consciously and deliberately 'use-the-future' for different reasons and in different ways depending on the context" (Miller and Sandford, 2019) or my current favorite "to imagine different futures individually or with others for various reasons with a spectrum of methods" or somewhat longer "to anticipate, imagine and explore diverse possible futures and use the resulting insights to make more

¹ Huge thanks go to all those who took the time to interact with me in depth on the draft version of this note and enabled significant improvements: Riel Miller, Ilkka Tuomi, Tamas Gaspar, Sébastien Martin, Valeria Berghoff-Flüel, Lilly Herde, Kenneth Y. Wee, Fabian Bahm, Jasmin Jossin, Hamid R. Sarabadani, Felicitas zu Dohna, and Birgit Freitag.

informed and empowered decisions that enhance our ability to deal with uncertainty and complexity in the present.”

A clearer description of the competence of Futures Literacy may have several benefits:

1. It might make it easier to communicate what Futures Literacy is to people who are new to the topic.
2. It might make it easier to define and focus the learning objectives of trainings and teachings: What is it that participants should learn? And did they learn it? In a higher education context, de Boer et al (2018, p.1) call for “operationalizing underlying skills and measuring improvement” as an important step towards an evidence-based approach.
3. It might open possibilities for measurement of the levels of competences. Karlsen (2021, p.9) points out that “FL must be measurable to qualify as a proficiency, as we require from other forms of literacy (reading, writing, arithmetic, etc.). However, FL lacks measurable criteria.”
4. It might allow the diagnosis of different levels of Futures Literacy to tailor appropriate trainings to specific needs and to evaluate changes. This could lead to entry and exit surveys for trainings.
5. It might make it easier to identify which publications or projects reflect Futures Literacy in its depth and which ones only include some aspects.

These five potential benefits describe the motivation for this note and also indicate what it is not about: It does not include a description of the benefits of higher Futures Literacy. It is also not about how Futures Literacy can be strengthened and how trainings can be structured. This has been described elsewhere in detail, most notably in Miller (2018).

One of the many challenges in this project was that Futures Literacy is not a new competence. Humans have always imagined the future in different ways and for different reasons. What is new is the theoretical basis in the theory of anticipation, This should enable more complete and detailed descriptions of what being futures literate entails. Also, new futures methods allow us to better investigate human anticipatory systems and processes (Bergheim, 2023). And humans are exploring new words and ways to describe and structure what this competence is about. The focus of this note is on the last item.

To describe Futures Literacy as a “competence”, some clarity on terminology appears helpful. The term “Literacy” goes beyond being versed in literature or writing. According to the Merriam-Webster dictionary, it is also a general “having knowledge or competence”. So Futures Literacy is a specific kind of competence, which is why I use upper cases F and L for now instead of “futures literacy”. I do not use the plural “Futures Literacies”, although it obviously consists of sub-competences. Also for clarity, I don’t use “competency” with the y at the end, which refers to more specific areas of competence.

A focus on “competence” links to well-established research. Work by the JRC Joint Research Center of the European Commission was particularly helpful. It had been motivated by a similar issue as mine: a perceived lack of a

“common and consistent conceptual definition” of skills and competences. In their Technical Report 2021/02 on “A unified conceptual framework of tasks, skills and competences” (Rodrigues et al, 2021, p. 12), they define competence as a general ability to do well in a particular task. It consists of three elements:

1. **Knowledge** is the “cognitive outcome of an assimilation of facts and figures, concepts, ideas and theories which are already established.” We know, understand, or remember these.
2. **Skills** are the “ability to perform tasks well” and could be physical, intellectual, or social. A synonym for skill is “ability”. I also treat “capacity” as a synonym for skill and ability. We are able to or can do certain tasks.
3. **Attitudes** are the personality traits of a “psychological, emotional and behavioral nature”, rather than of a cognitive (knowledge) or operational (skill) nature. Attitudes include values, aspirations, priorities, responsibilities, and ethical considerations. Maybe “intuition” can be included here as well, but it is not part of the JRC framework. Verbs used for this element include value, weigh, consider, or concern.

So “competence = knowledge, skills, and attitudes”. This appears sensible as a starting point, even if it may not be able to capture every aspect of Futures Literacy. The EU uses this framework in several fields, one of which will appear later in this paper. Others such as the OECD in their work on Financial Literacy, the Center for Curriculum Redesign, or Next Skills (with “values and motives” for “attitudes”) use it as well. In German, it is usually “Kompetenz = Wissen, Können & (Wert)Haltung.”

This focus on “competence” includes a decision against the term “capability” which is often used interchangeably with “ability”. Capability was used widely in “Transforming the Future” (Miller, 2018). Amartya Sen defined capability as “the substantive freedom to achieve alternative functioning combinations” (Sen, 1999, p.75) with functionings being “the various things a person may value doing or being”. There are some links to Futures Literacy here, but I leave “capability” to the broader meaning and use related to well-being and welfare as promoted by Sen.

2. Related competence frameworks

When describing something, it is often helpful to say what it is not. Futures Literacy is not the same as “Future Skills”. Future Skills include relevant competences such as collaboration, communication, creativity, critical thinking etc., and come under different labels. In Germany, the Stifterverband and several others use the English labels “Future Skills” or “Next Skills”. The World Economic Forum uses “21st Century Skills”. The EU has “Key Competences for Lifelong Learning”, the OECD “21st Century Skills” as well as “Skills for 2030” and other labels. There are also “Transversal Skills” for example at Dublin City University, which includes Futures Literacy as an element. And there are “Key Competencies in Sustainability” linked to education for sustainable development, which includes an interesting element on pictures of the future. And surely many more.

The framework for relevant competences that I find most useful in general is Ulf-Daniel Ehlers' "Next Skills" because it includes among its 17 competences items such as "Ambiguity Competence", "Ethical Competence", "Sensemaking" and "Reflective Competence", which are highly relevant for Futures Literacy as well. And it includes clear statements on what each competence is about.

These frameworks are all important and helpful for discussing priorities for education in the present. But they usually do not include what I am looking for. None of these are explicitly about Futures Literacy, the competence to consciously and deliberately 'use-the-future' for different reasons and in different ways depending on the context. Even complexity competence is usually not mentioned explicitly.

Turning to the futures field, there are some models of competency or maturity, but these focus mainly on what professional futurists do rather than on general human competence. The European Commission's "Competence framework for innovative policymaking" includes "Futures Literacy" as one of its seven competence clusters but uses different elements from those in the present note. There are also efforts to capture Futures Consciousness (Lalot et al, 2020), which includes some elements that map into Futures Literacy, in particular the "openness to alternatives".

3. Different competence levels

One core idea that I like about Futures Literacy is that everybody anticipates and engages with futures. It is a general human competence. Even more, it is a general characteristic of all living beings. Another idea that I like about Futures Literacy is that it can exist at different levels or proficiencies. So it is not the case that you either are Futures Literate or you are not, you get it or you don't. No. It is a matter of degree. Competence is not fixed. Futures Literacy can be trained, developed, or strengthened in a large variety of ways. Future research and practice will provide more detailed insights into which aspects of Futures Literacy can be strengthened relatively easily and which are more or less fixed. Similar discussions have been fruitful in the area of life satisfaction.

A look at other competences illustrates what this thinking in different levels implies. The European Union uses "competence = knowledge, skills, and attitudes" in its "Digital Competence Framework for Citizens" (Vuorikari et al, 2022) and illustrates its approach and the potential for development with the example of swimming: Everybody knows what water is. You can touch it, put your feet into it, step in deeper. At this basic level, some guidance may be needed if you are very unfamiliar, for example as a child. Then, if you like and have the opportunity, you can learn to swim. Usually with guidance. First, you swim in an odd-looking style, but you move forward. As you practice more, your swimming gets smoother. Then – advanced level – maybe you want to guide others as they learn to swim. Or you can exercise your competence for different ends such as a rescue swimmer. And eventually – specialized level – you may create new uses and contribute to the field in different ways. Of course, to demonstrate your swimming competence, you need supportive external conditions such as a pool or a lake.

Such levels can be sketched for other competences such as reading or writing as well. The basic level includes writing letters and words, and then full sentences and short texts. At an intermediate level, one can write different types of texts. Then in different styles. Maybe you show others how to write. And at a specialized level, some people contribute to professional publications, others write poems. There is a link to Bloom's Taxonomy, which is used widely in education settings, with a condensed sequence of remember, understand, apply, and create.

I like the examples of engaging with water and of writing because I see a parallel to Futures Literacy: There seems to be consensus, that a basic competence in all three is important for all humans. As we move higher on the competence scale, we reach levels that are nice to have and – at the most specialized level – may be only relevant for a few people.

4. Impulses from measurement

My academic training and professional history are in quantitative economics and econometrics: data, trends, forecasts etc. So I tend to look at many issues through a measurement lens. Since 2006 this includes attempts to measure and describe well-being beyond money in research notes and in quality-of-life projects such as “The Happy Variety of Capitalism”. In those projects, I often had to defend the use of survey questions such as “On a scale from 0 to 10, how satisfied are you with the life you lead?” against those who only trust monetary measures while they ignored the shortcomings of those.

In the case of Futures Literacy, I think an attempt to measure what we are talking about can broaden the basis for discussion and allow us to be clearer. Some measurement of competence can be useful for diagnosing levels and potential areas for improvement. It can help us identify, which aspects of Futures Literacy are amenable to change, and which are not.

The most inspiring attempt I found on measuring competences is the European Union's approach to Digital Competence. As mentioned above, they use the “competence = knowledge, skills, and attitudes” structure. And they split the overall competence into five sub-competences such as “communication and collaboration” or “problem solving”. And for each sub-competence, they define what people do at different competence levels. The idea here is that if people do something they possess the necessary knowledge and skills.

Finding appropriate metrics is not trivial and will not work for every aspect. But it is worth a try. The EU asks for example “Have you used any website or app to arrange a transport service (e.g. by car) from another private individual in the last 12 months?” in its survey on ICT usage in households. Knowledge, skills, and attitudes combine here, so cannot be separated. But the question can be understood and answered with a clear yes or no. Adding up similar questions provides a picture of the overall competence – including the possibility that people do not do certain things because of ethical concerns. As in the swimming example – and for Futures Literacy – appropriate external conditions need to be in place for someone to demonstrate digital competence: you have to be able to afford a computer, electricity has to be available etc.

Having revealed my current favorite approach to capture competences, I should also mention approaches that I don't find too helpful here. If I ask, for example "On a scale from 0 to 5 how strong is your ability to think critically?" (Likert scale), we get lots of answers of 4s and 5s. My assumption is that the 4s come from the more introverted people, the 5s from the extroverts. However, this does not help me much in capturing the actual competence of critical thinking. Therefore, my preference is to ask what people do, similar to the EU's approach to capture digital competences. Also, since Futures Literacy is a general human competence, we should not measure whether people have had formal futures trainings. I know many natural talents.

5. Six sub-competences of Futures Literacy

The six sub-competences that follow are what I currently think are essential for describing the competence of Futures Literacy. They follow the "competence = knowledge, skills & attitudes" structure and should open the door for the measurement of human practices. They are not intended as descriptions of the sources and functioning of people's anticipatory systems and processes.

I used several sources and several iterations to get there. The book "Transforming the Future" (Miller, 2018) was key. On page 62 it mentions a need for a framework called "Anticipatory Capability Profile" (ACP) – maybe it can be called "Anticipatory Competence Profile". Literature on the Theory of Anticipation played a key role too: Robert Rosen's "Anticipatory Systems" and "Life Itself" as well as the work of Roberto Poli, Aloisius Louie, and others.

Another source was course descriptions with learning outcomes from Futures Literacy trainers around the world, especially by Riel Miller and Loes Damhof. I also looked at descriptions of Futures Literacy used in research papers and I spoke with some futurists about these issues. My interaction with "Artificial Intelligence" on this was not helpful.

My practical experience in running dozens of Futures Literacy Laboratories and offering trainings for designers and facilitators played an important role too. We always ask ourselves and the trainees: What do we want participants to learn and take home from this interaction? What is the essence of this training?

In line with the idea that Futures Literacy is a general human competence rather than something only for experts, my goal is to have descriptions where the words can be understood by many people – even if they do not possess all the knowledge or skills mentioned.

The first sub-competence is not special to the futures field but is important across many disciplines and competences. However, I think it is essential as a basis for working in a futures literate way. Also, it is not included explicitly in other frameworks of competences or future skills. I call it "Complexity & Uncertainty Competence" and tried to include as much of the work of Dave Snowden and Mika Aaltonen as I could (plus awareness of Luhmann, Kauffmann, DeLanda, Cilliers, Rosen, and others):

(1) The "Complexity & Uncertainty Competence" includes:

- The understanding that living systems are complex – as opposed to complicated - as well as of the consequences and the benefits of complexity and the associated ambiguity.
- An understanding of the non-knowability and un-controllability of complex systems plus a resulting attitude of humility.
- Understanding the importance of collective intelligence knowledge creation for sensing and sensemaking. This includes an understanding of the importance of diverse perspectives, of sensors, experiments, pattern recognition, etc.
- The ability to design and run events and processes that include the above aspects.

The second of the six sub-competences is often an entry point for newcomers to the futures field and leads to a clear learning objective for interventions and trainings.

(2) The "Multiple Futures Competence" includes:

- Knowing why multiple possible futures are a feature of complex systems.
- The ability to distinguish different types of futures such as probable and desirable.
- Knowledge about different uses of futures such as planning, optimizing, preparing, and emergence.
- Knowledge about the wide spectrum of elements these futures may contain and the ability to explore blind spots.
- The ability to analyze and critically question the content from a variety of futures on diverse topics.
- An awareness of the ethical dimension of futures, of values, and the ability to deal with unethical elements appropriately.

The third and fourth sub-competences take us to the core of what Futures Literacy is about.

(3) The "Imagination & Assumptions Competence" includes:

- Knowing that futures do not exist but in our imagination.
- Knowledge about the various ways images of futures can be revealed or made visible, such as speaking, writing, drawing, playing, gaming, sculpting.
- An awareness of one's images of futures and their deep roots in the past.
- The ability and willingness to become aware of the images of other people and to identify differences across images.
- An understanding of the importance of assumptions and anticipatory systems behind those images.
- The ability to identify (anticipatory) assumptions of different types in oneself or others and to potentially question them.
- An awareness of the psychological dimension and dangers of revealing deep and personal anticipatory systems and processes – both for the individual and for the group.

(4) The "Reframe & Experiment Competence" includes:

- An understanding of the importance of training and stretching the imagination.
- An openness to getting exposure to strange futures.
- The ability to invent new, alternative assumptions and create new futures from those to expand perspectives.
- The ability to explore and deepen those experimental futures with a variety of creativity techniques such as storytelling, playing, and personas that can also activate non-conscious imagination.
- An awareness of the individual mental limits and the organizational consequences of expanding horizons.

The fifth sub-competence is characteristic of Futures Literacy, but can also be covered by other literacies or competences:

(5) The "Novelty & Emergence Competence" includes:

- Knowledge that novelty emerges in complex adaptive systems.
- The ability to sense the difference across images of diverse futures and assumptions and to make sense of novelty in the present.
- The ability to raise new, powerful questions that can open doors to new quests.
- The ability to cultivate and host situations of unfamiliarity.
- An individual openness to discover new terrain, new thoughts, new issues.
- An awareness of the challenges of getting from emergence and invention to actual innovation in the present.

Finally, the sixth sub-competence is again not unique to Futures Literacy. It is relevant across many disciplines and competences. However, I think it is necessary to complete the description. In the theoretical literature, anticipation is always linked to action – including the option to not act.

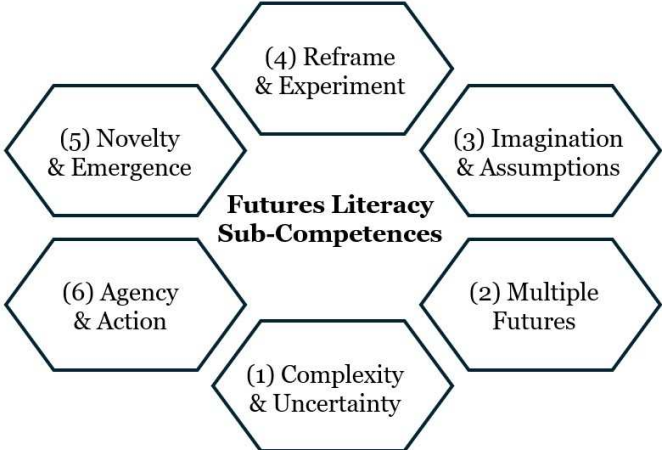
(6) The "Agency & Action Competence" includes:

- Knowledge about the linkages between anticipation, images of futures, and actions in the present.
- Understanding of the possibility as well as the limits of agency in complex emergent anticipatory systems.
- The ability to identify concrete actions that emerge from different images of futures.
- The ability to choose from a menu of possible actions and explore these actions with others.
- Implement actions.

With six sub-competences, one might wonder whether they build on each other, whether one is a necessary condition for the others, whether they can be divided up more, whether there is an underlying "meta-competence", and whether there is a hierarchy. My current view on this: First, the sub-competences are related to each other. They complement each other and ideally build on each other. There does not appear to be a hierarchy. Maybe there is a competence loop, similar to John Boyd's OODA loop of Observe, Orient,

Decide, Act with its many feedbacks. Especially, the connection between (6) “Agency and Action” and (1) “Complexity and Uncertainty” seems to be worth highlighting with a circular arrangement as opposed to a list. This is shown in Figure 1.

Figure 1: Sub-Competences of Futures Literacy

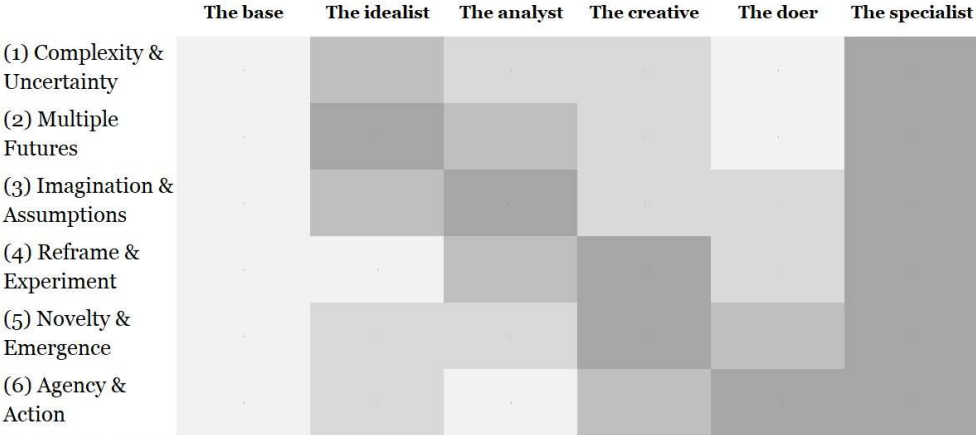


Source: Stefan Bergheim

Second, it is possible to focus more on one sub-competence than on another. To start somewhere. Or to find it easier and more natural to focus on one sub-competence rather than another. As people strengthen their overall Futures Literacy, specific areas for individual improvement may become more visible. Based on the six sub-competences outlined above, appropriately designed questionnaires can help diagnose areas of relative strength or weakness that could be addressed with targeted learning interventions.

Results may look like the hypothetical competence profiles in Figure 2. For example, the “idealist” respects the plurality of futures but is unable or unwilling to think in alternatives. The hypothetical “analyst” can go deep on assumptions but finds it hard to act in line with the analysis. By contrast, the “doer” is very active with limited understanding of complexity and multiple futures.

Figure 2: Hypothetical profiles of relative strengths and weaknesses



Source: Stefan Bergheim

6. Four competence levels of Futures Literacy

As mentioned above, competences can exist at different levels or proficiencies. I suggest the following four levels of Futures Literacy:

A-Basic: All human beings regularly imagine different futures. They plan their day or a vacation. They have wishes for their birthdays, their private lives, or for their professional careers. They also know that the future does not always turn out as expected or wished. But they are able to act in the present nevertheless. They are somewhat open to new ideas and activities.

B-Intermediate: Many humans imagine different futures more consciously. They spend more time than others on thinking and reflecting about futures in a more structured way - often together with others. They are conscious of the reasons why they have certain expectations and wishes. They sometimes stretch their imagination by intentionally thinking about and discussing alternative futures to see more in the present and create new ideas.

C-Advanced: Some people train and practice their Futures Literacy frequently. They read basic texts on complexity, anticipation, Futures Literacy etc. and speak with other practitioners. They regularly contribute to events where different futures are created and sometimes design and facilitate such events. They have developed a strong ethical compass. They are able to imagine different futures and regularly invent relevant new options for actions in the present in collective intelligence knowledge creation processes.

D-Specialized: A few people specialize strongly in Futures Literacy. They write and teach about complexity, anticipation etc. Some of them design and create a wide spectrum of collective intelligence knowledge creation processes about futures suitable for the specific context. Some create new ways and methods to engage with anticipatory systems and processes. Some train others how to do this in an ethical way.

7. Outlook on open issue and next steps

This note offered a way of describing Futures Literacy in line with other competences, even if this may not be all-encompassing: competence = knowledge, skills, and attitudes. It suggested six sub-competences, which I hope are reasonably well separated and easy to understand. It also suggested four different competence levels.

My hope is that some of this makes it easier to communicate what Futures Literacy is to people who are new to the topic. It may also make it easier to define and focus learning objectives of trainings and teachings on Futures Literacy. And it may help in discussing the Futures Literacy of specific projects.

There are many issues around the description of Futures Literacy that this note does not include. Some issues I have not been able to understand or describe in the words available to me today given my specific background. This is probably the case in particular with issues around not knowing, not doing, letting go, embodiment etc. There is probably too little in this note about what Tuomi (2022) calls the non-epistemic competences. Maybe others will add these elements and more over time.

Work in progress is about how to diagnose or measure the different competence levels. While I expressed some sympathy for the EU's path to measure digital competences by adding up how many activities citizens actually do, this does not appear appropriate here. The different levels require different activities. Therefore, my idea is to ask specific questions for each cell in the six-by-four matrix of sub-competences and levels. This could be similar to the EU's swimming example mentioned earlier.

The first sets of questions exist. Each set begins with a very simple question about futures that almost every human being should be able to answer correctly. The idea is to appreciate the normal, everyday engagement with futures. Like: did you speak this week? Then questions get more difficult as they try to capture higher competence levels. For the advanced level, it might make sense to ask for some explanations. And the question on the specialized level should be more difficult to understand and very hard to fulfill across all six sub-competences.

All of this needs refinement and improvement. So, if you are versed in designing and running such questionnaires and want to support this effort, please let me know. Same, if you would like to conduct a special research project around the measurement of Futures Literacy and use my first set as an input.

References

- Aaltonen, Mika (2005). Complexity as a sensemaking Framework. FFRC Publications.
- Bergheim, Stefan (2022): On the Evaluation of Futures Literacy Laboratories. ZGF.
- Bergheim, Stefan (2003): Patterns of Anticipatory Assumptions. ZGF.
- de Boer, Anke, Loes Damhof, and Carina Wiekens (2018): How Futures Literate are you? Exploratory research on how to operationalize and measure Futures Literacy'- Paper for International Conference on Future-Oriented Technology Analysis (FTA) – Future in the Making.
- Ehlers, Ulf-Daniel (2020). Future Skills – Future Learning and Future Higher Education.
- Karlsen, Jan (2021): Futures Literacy in the Loop. European Journal of Futures Research. 9:17.
- Lalot, Fanny & Ahvenharju, Sanna & Minkkinen, Matti & Wensing, Enrico. (2020). Aware of the Future?: Development and Validation of the Futures Consciousness Scale. European Journal of Psychological Assessment. 36(5), 874-888.
- Louie, Aloisius (2010): Robert Rosen's Anticipatory Systems. Foresight, 12(3), 18–29.
- Miller, Riel (2007): Futures Literacy: A Hybrid Strategic Scenario Method. Futures 39, 341–362.

Miller, Riel (2011): Futures Literacy – Embracing Complexity and Using the Future. *Ethos*, Issue 10, 23-28.

Miller, Riel (Ed.) (2018): *Transforming the Future – Anticipation in the 21st Century*. Routledge.

Miller, Riel and Richard Sandford (2019): *Futures Literacy: The Capacity to Diversify Conscious Human Anticipation*. In: Poli, Roberto (ed.): *Handbook of Anticipation*. Springer.

Nadin, Mihai (2012): *Prolegomena – What Speaks in Favor of an Inquiry into Anticipatory Processes?* In: Rosen, R. (2012). *Anticipatory systems: Philosophical, mathematical and methodological foundations*. Second Edition. Springer.

Poli, Roberto (2019): *Introducing Anticipation*. In: Poli, R. (ed) *Handbook of Anticipation*. Springer.

Rodrigues, Margarida, Enrique Fernández-Macías, and Matteo Sostero (2021): *A unified conceptual framework of tasks, skills and competences*, Seville: European Commission, JRC121897.

Rosen, Robert (1991): *Life Itself: A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life*. Columbia University Press. New York.

Rosen, Robert (1985/2012): *Anticipatory systems: Philosophical, Mathematical and Methodological Foundations*. Second Edition. Springer.

Sen, Amartya (1999): *Development as Freedom*. Anchor Books.

Snowden, Dave and Mary Boone (2007): *A Leaders Framework for Decision Making*. Harvard Business Review.

Tuomi, Ilkka. (2022): *Artificial Intelligence, 21 st Century Competences, and Socio-Emotional Learning in Education: More than High-Risk?*. *European Journal of Education*. October.

Vuorikari, R., Kluzer, S. and Punie, Y. (2022): *DigComp 2.2 – The Digital Competence Framework for Citizens*, EUR 31006 EN, Publications Office of the European Union, Luxembourg.



Available in open access under the license
"Attribution-ShareAlike 4.0 International"