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.

PUNC Competence Framework

Literature Review

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Content

Introduction

People live, work and study in a world that can be characterized as VUCA: Volatile, Uncertain, Complex and Ambiguous. In a VUCA world it is evident that not everything can be known on forehand. 'Not-knowing', in its broadest sense, can stir up feelings of uncertainty which can be on the surface or profound, steady or rapidly changing. Feelings of uncertainty can hinder to come into action and disturb a learning-, work- of personal development process. And on the other end feelings of uncertainty can stimulate creativity, reflection, thinking out-of-the-box and other actions. If and to what extent feelings of uncertainty are experienced, depends on how 'VUCA-isch' the situation is experienced by a person and on his personal capability to deal with that experience.

In the PUNC-project we focus on the development of a PUNC competence framework for professionals in education: educators and students, seen as future professionals. The framework supports the development of a Professional Uncertainty Competence, by defining personal learning outcomes tailored to a specific professional situation.

Set up of this literature review in relation to IO.2

This literature review is the first step in defining the Professional UNcertainty Competence (PUNC). We start with a study of the relevant ideas and models derived from the (inter)national literature. All partners have collected relevant national literature on these themes and one partner focussed on relevant international literature:

- Uncertainty (internal/subjective) in HE learning
- Professional uncertainty (internal/subjective)
- Competence design
- Competence development
- Learning outcomes

Per theme the partners were required to use at minimum 3 academic publications and additional (open access) sources. Also all partners collected domain specific literature on the first two themes used for the professional domains that our partners represent: Business, Education, Law, Engineering. The results are collected in the Factsheet (Add I).

After having reviewed the first draft of the literature review, we've constructed the PUNC competence framework that will be presented below, including a "menu" that contains elements of knowledge skills and attitude that constitute the PUNC competence from the theoretical perspective.

Set up of IO.2 in total

The PUNC competence framework is based on three parts of which this literature review is the first:

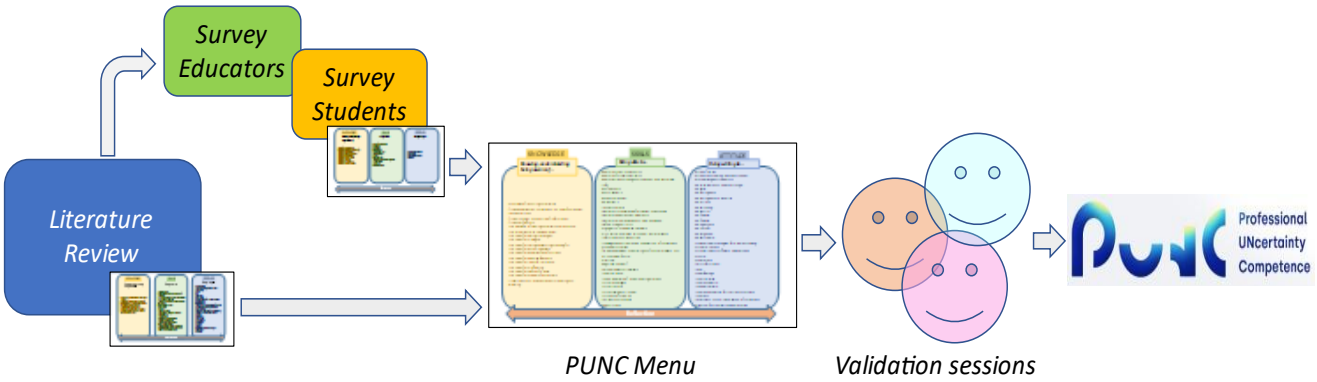
1) literature review

2) survey amongst educators and students

3) validations sessions with educators

As visualized below, this literature review is the theoretical starting point for constructing the survey amongst educators and students of all partners universities. This survey yields practical knowledge of how educators and students think about what knowledge, skills and attitude are needed in order to make the experienced uncertainty productive. The outcome of the survey also includes an specific menu of relevant PUNC elements. Both the theoretical and practical menu's will be combined into the PUNC menu. This menu and the PUNC framework itself will be discussed and validated by

educators from all partners universities in national validation sessions. This will result in a robust and actionable PUNC Competence framework:



In advance we find it important to notice that in university education the role of emotions, like uncertainty, has been neglected for too long. Programmes have focussed primarily on cognitive and rational development (Savijärvi, 2016). Putting the spotlight on uncertainty in higher education can avert whole generations from developing strategies to avoid ambiguous situations, develop a lack of curiosity for what is in stock and what future might bring. The result of which can be: safe clinging to tradition, faith/religion, family and state providing for structures that become the mainstream choice (Majerek, 2018). It is more realistic and fruitful not to want to diminish uncertainty, but to take uncertainty seriously and to approach it as a powerful and productive means for professionals (Joosten, 2021).

1. Uncertainty

In this paragraph we present the main ideas on uncertainty in working and learning, based on the perspectives of all partners. This review is a narrowing-down of the divergence of all concepts and ideas that were shared. This has led to the formulation of sensitizing concepts we find relevant to build upon.

1.1. Exploration of uncertainty

Uncertainty makes up an inherent part of our emotional palette. We often associate uncertainty with anxiety and stress as all these intense and often negative emotions affect our wellbeing (EVA, 2018). It is argued that in higher education students should develop emotional competences in order to handle their emotions and wellbeing in the context of work and profession (Isacsson, et.al,.2019) because acknowledging emotions can help to understand them better and make use of them. Some also argue that "emotional competence" is a skill needed in the working life, that can and should be learnt (Isacsson, et.al., 2019). Others vote for developing "uncertainty competences" (Fazlagić, 2018; Tauritz, 2016)

Like emotions (Savijärvi, 2016), uncertainty can be classified as positive (activating, eustress) and negative (inactivating, distress) and has mental as well as physiological effects (Bigdeli, 2010). Viewed form the negative perspective, uncertainty can be experienced as a source of threat, anxiety and fear (Majerek, 2018) with the result that it can decrease creativity, weaken performance and make people resort to safe work practices or methods (Savijärvi, 2016).

From a positive perspective uncertainty can be interpreted as a growth factor, a driver for creativity and innovation. As a professional skill, it is powerful and productive to be able to view uncertainty as a rich source of opportunities, as it can offer the possibility to create new forms of thinking and acting (Joosten, 2021). Positive uncertainty opens new possibilities for action and thus implies a goodbye to dogmas and limitative normative frames (Jacobs, 2010). It is a prerequisite for developing the ability to deal with open-ended problems in the future (Muukkonen & Lakkala, 2009).

Emotions like uncertainty can differ throughout the learning process and present themselves in waves (patterns): at the beginning, throughout, or even after the learning process (Arpiainen, et.al., 2013). Especially when a student encounters a new threshold (waypoint) in their learning process, it brings about the uncertainty of what lies behind it. Taking the risk of entering this liminal space, enables the student to grow and develop (Osmond & Tovey, 2015).

Not knowing

In working and learning, uncertainty is often interpreted as 'not knowing'. Professionals experience uncertainty when they lack certain knowledge that seems to be needed at that particular moment. Knowledge has many different connotations and in this review not-knowing is used in the broadest sense of knowledge: cognitive, emotional, tacit, explicit, embodied, actionable, etc. (Markauskaite & Goodyear, 2017). Jordan (2015) defines uncertainty as a form of metacognitive awareness in which a person is conscious about one's lack of knowledge. Also, Tracey & Hutchinson (2016) describe uncertainty as a lack of adequate knowledge about events that may occur in the future or that may have already occurred. Hillen, Gutheil, Strout, Smets, & Han (2017) replace 'lack of knowledge' with the broader concept of 'ignorance'. And from the perspective of the learner and professional, they are dealing with problems beyond his expertise (Muukkonen & Lakkala, 2009). As stated above, this "knowledge uncertainty" (Tauritz, 2012) is just one element of the professional and personal emotional palette.

Sources of uncertainty

This lack of knowledge can have different origins. With regard to time, uncertainty is one's subjective experience of not knowing how the future will unfold, what the present means, or how to interpret the past (Jordan, 2015). A teacher for example is never sure about how the results that his pupils show are actually influenced by his interventions (Kelchtermans, w.d.). And an engineer has to design a durable, robust and safe construction without actually knowing how the construction will behave under unknown future circumstances (Havik, et.al., w.d.).

Hillen, et.al. (2017) describe three kinds of sources for the perception of uncertainty: ambiguity, probability and complexity. When something is ambiguous, we are uncertain about whether something is true or not. Lane and Maxfield (2005) define this as truth uncertainty. Probability refers to randomness or unpredictability, as we do not know what is going to happen in the future or cannot predict what the effects are of actions. Complexity relates to situations where it is difficult to comprehend because there is multiplicity in causes, variables, perspectives or different meanings of phenomenon. Hillen et al. (2017, p. 70) argue that 'probability, ambiguity, and complexity each produce uncertainty once individuals perceive them – that is, when they become aware of them as sources of ignorance'. This perception is moderated by individual characteristics like personality traits or different situational, cultural or social factors.

Other sources of uncertainty can be traced to the variability and the limitations of knowing (Van et.al., 2003). Variability points to the unpredictable, chaotic and changeable character of processes, nature, people's behaviour, technology, society, paradigms, etc. Limited knowledge refers to imperfect accuracy, lack of measurements/observations, impracticability, conflicting information and non-reducible ignorance. Some knowledge will never be obtained.

1.2 Uncertainty in learning and working

Uncertainty is as much a part of the learning process as it is of the professional process (Arpiainen, et.al.,. 2013; 2016; Bigdeli, 2010). It is widely recognized across various professionals' domains and it is usually regarded to be connected to knowledge intensive jobs (Danish Technology Institute, 2013). These are jobs in which decision making is central (e.g. education, management, law), jobs that aim for innovation by new (digital) technologies (technique, design, education) (Bahl et al., 2020; Perez-Gomez, 2019) and jobs that focus on the future (e.g. engineering, construction, education) (BYGGERIET 2035, 2018).

Decision making

Through all professional domains the role of decision making seems to be closely related to uncertainty. Decision making is always aimed at creating an outcome that has to be relevant to an unknown future and thus has unknown consequences (Perez-Gomez (2019). Not knowing the consequences means taking risk (Rodriguez & Estévez, 2005). The consequences relate to the amount of (useful) information that is available. Four categories can be defined (Raaphorst, 2017):

- uncertainty of information: uncertainty about whether one can find enough information to support one's decision

- uncertainty of interpretation: especially when 'rules of decision making' give little support.

- uncertainty of action: when one has to act on the spot but doesn't know how, based on the available knowledge.

- uncertainty of result: what will be the outcome/impact?

The example of legal professionals gives us a glimpse of how decision making in uncertainty can occur:

> Legal professionals experience uncertainty in their decision making because they experience uncertainty of proof (not knowing for sure in the present) and uncertainty of prediction (not knowing the effect in the future). Legal professionals call the range in which they can make a decision "discretionary space" (Raaphorst, 2017; Severijns, 2015). Discretionary space is used to create probably effective patterns to handle the limited time and means available. Patterns like rationing, focussing on successful cases or ignoring troublesome cases (Geenen, et.al., 2017). These patterns come into being through heuristics, cognitive schedules and logical deductions for relevant facts (Goderie & Bouttelier, 2009). Heuristics are rules of thumb that allow the legal professional to decide swiftly in case of uncertainty through selective observation and productive omission. They react by collecting information to reduce the uncertainty of information to an acceptable level; examining the rules; examining the organizations handling bandwidth; influenced by personal opinions, experiences and beliefs (Severijns, 2015; 2019). This handling of discretionary space for decision making demands an attitude of staying with uncertainty and of having the patience to suspend judgement (Van Donkersgoed, 2019). And ultimately, a decision is acceptable when it an adequate fit with the context is obtained instead of being just logical or statistical true (Hildebrand, 2011).

With regard to uncertainty and decision making, Tauritz (2012) presents this helpful model (figure 1) that shows the place of and coping strategies with not knowing/uncertainty in decision making and its results:

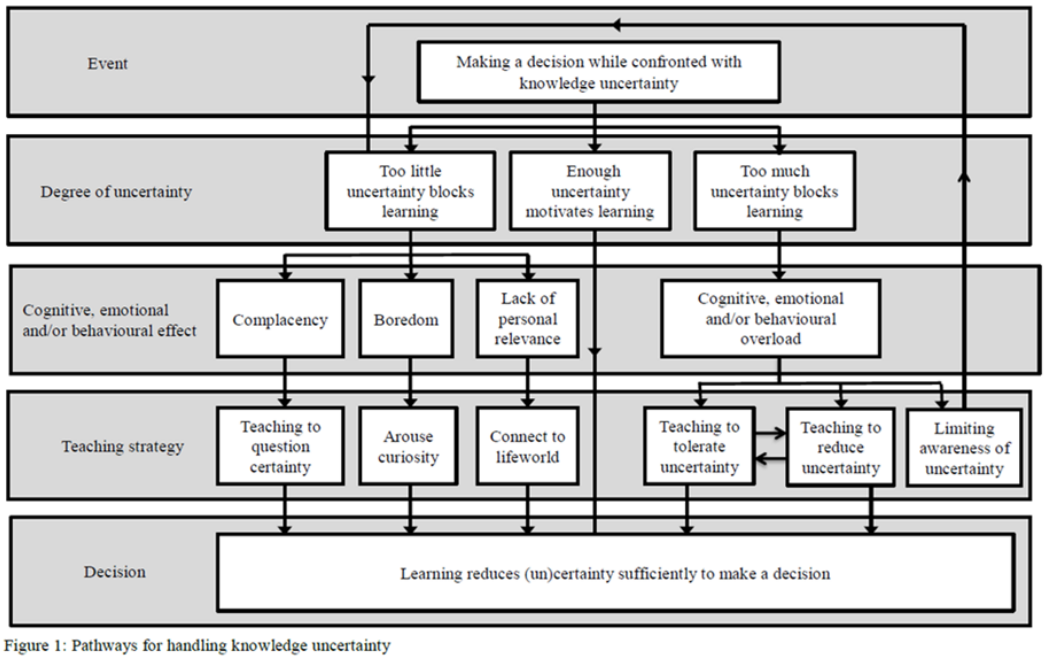


Figure 1: Pathways for handling knowledge uncertainty

Figure 1: pathway to handling knowledge uncertainty (Tauritz, 2012, p.305)

Transition

Another form of uncertainty is encountered during the transition between the world of study and world of work (Saarnivaara & Sarja, 2007.) This transition from study to working life means moving to new social conditions and leaving group membership of same values, beliefs and practices. They are

leaving the environment that has contributed to their socialization and the forming of their (professional) identity. For some this incites much uncertainty as they are only just becoming aware of their own professional identity and on top of that already have to get acquainted with the professional identity that the new work environment demands. This is even a larger source of uncertainty when the new professional identity isn't clearly defined by the work field either (Ropo, et. al., 2015).

Productive uncertainty

Even though uncertainty can be experienced as an unwanted emotional state that many professionals try to avoid or to resolve (e.g. Bar-Anan, et.al., 2009; Nevalainen, et.al., 2010) several authors argue that it also can be an aspect that is most potent for innovation and change and can be considered to be an essential dimension of professional competences (Attard, 2008; Lane & Maxfield, 2005).

Uncertainty incites us to test our premises and hypotheses and makes us assess our capabilities and means available for a particular ambition or action (Fields, 2011). When experienced as doubt, uncertainty can invite us to look for errors or alternatives and therefore transform uncertainty into a source of information (Locke, et.al., 2008). In addition, it is an essential feature of creative processes like writing (Carabine, 2013) and if embraced, it encourages ongoing inquiry by the professional (Attard, 2008). Lingard, et.al. (2003) call this handling of uncertainty 'the art of uncertainty' from which follows that professionals have to learn that certain forms of uncertainty can be useful for the quality of their work. This opens up the possibility for professionals to learn to handle uncertainty in their professional performance in a productive way.

When we define uncertainty as not knowing, it can be a trigger for *sensemaking* (Cramer et.al., 2004; Weick, 1995). When one is not able to understand (make sense of) reality with common routines and mental schemes, one can react in terms of exploration, investigation and reflection (Kommunikation og sprog, 2018; Bollinger & Van Rooijen, 2016). Therefore uncertainty can help to appropriate new beliefs, values, and conceptions and facilitate creative problem-solving (Jordan, 2015). A "dynamic degree of certainty" helps for keeping ethical fibre and developing a critical thinking attitude (Bauman, 2008). In search for plausible answers and relevant knowledge, many other possibilities are discovered (and possibly dismissed) (Attard, 2008) and serendipitous learning is encouraged. In this way uncertainty can become a catalyst for innovation (Kommunikation og sprog, 2018).

Professionals and students that aim for *innovation* are dealing with constant change, risk and unpredictability (Fazlagić, 2018). Students learn that knowledge is needed to reduce the uncertainties that accompany these factors and to make choices possible, even if this knowledge is provisional (Savelsbergh, 2019), especially because they operate between an existing and familiar present and an unknown future (Havik, et.al., w.d.). Thus in the 'meta-field' of innovation one has to provide for adequate results based on inadequate knowledge about the unknown past, the unknowable future and the unpredictability of the present (Marchau, 2013). Innovators experience 'deep uncertainty'. With regard to the future, positive uncertainty supports decision making for an unknown future. Especially when one can accept the fact that the future is. Then uncertainty allows one to be a proactive instead of reactive decision maker (Gelatt & Gelatt, 2003).

So in summary, not knowing has negative and positive effects on the professional. On the whole it is argued that it is important that learners develop a repertoire that helps them to work with uncertainty (Kommunikation og sprog, 2018). So, what is it that actually supports learners and professionals to manage their internal world in order to create the necessary adequate psychological flexibility (De Toro, 2020) to handle uncertainty productively?

1.3 Strategies on how to handle uncertainty

In this part we present a chronological overview of strategies so that we can decide on what elements we find relevant for PUNC in terms of making uncertainty productive. The matter of how to handle uncertainty is broadly addressed in the literature. Various strategies are presented: *tolerating* uncertainty, *reducing* uncertainty, *acknowledging* uncertainty, *accepting* uncertainty, *living with* uncertainty, and combinations of these elements. Also various subdivisions are presented: division in time (in learning, after learning); in competence: knowledge, attitude, action; in sequences of training and with regard to the context in which handling uncertainty is developed best. Based on the above we prefer to aim for a strategy that takes uncertainty seriously and that approaches it "as a powerful and productive means for professionals" (Joosten, 2021).

A precondition to learn to handle uncertainty productively seems to be that this can be experienced in a safe environment (Bollinger & Van Rooijen, 2016), a trusting surrounding where safe elaboration of feelings is facilitated, thus enabling for example giving and receiving feedback (Savijärvi, 2016). Students need a learning space where they can feel at home, learn self-confidence and find their existence meaningful in this uncertain world (Saarnivaara & Sarja, 2007).

In 2012, Tauritz presented a strategy, containing nine elements that help a person to tolerate and to reduce knowledge (un)certainty:

1) "Being able to accept not knowing what will happen;
2) Reflect on one's own or other's beliefs and being able to change personal beliefs;
3) Find and evaluate information;
4) Judge the credibility and cognitive authority of information sources;
5) Reason;
6) Respond in accordance with the underlying probabilities;
7) Assess one's own ability to achieve a desired outcome;
8) Engage a supportive network;
9) Formulate a plan of action to deal with uncertainty"(p.306).

In 2015 Jordan (p.102,103) stated that students that acknowledged uncertainty easily seems to develop a richer set of tactics in managing uncertainty than students that deny uncertainty. Students in robotics showed five propensities for managing uncertainty during their academic tasks:

- "Pause for reflection
- Seek plausible explanation
- Request help
- Take action
- Deny uncertainty"

In 2016, Tauritz redeveloped her 2012 strategy in more detail. In this theory, she supplemented the reduction of uncertainty with cherishing and tolerating uncertainty, adding corresponding abilities.

Cherishing uncertainty	Tolerating uncertainty	Reducing uncertainty
Being able to: - use uncertainty as a catalyst for creative action - empathise with people with different perspectives	Being able to: - accept not knowing what will happen - reflect on and change one's beliefs regarding uncertainty - employ lateral thinking	Being able to: - prioritise ('triage') among many urgent issues - find, evaluate and utilise information (specific knowledge) - judge the credibility and cognitive authority of information sources - reason (inductive and deductive reasoning) - respond in accordance with the underlying probabilities - employ previous experience

- 'entertain' an enquiring mind		- assess one's own ability to achieve a desired outcome - engage a supportive network - formulate a plan of action to deal with uncertainty - work in, and contribute to, teams with mixed skills and experience - use one's intuition as a source of information

In 2017, Hillen et al, presented their "integrative conceptual model" on tolerating uncertainty from a behavioural viewpoint:

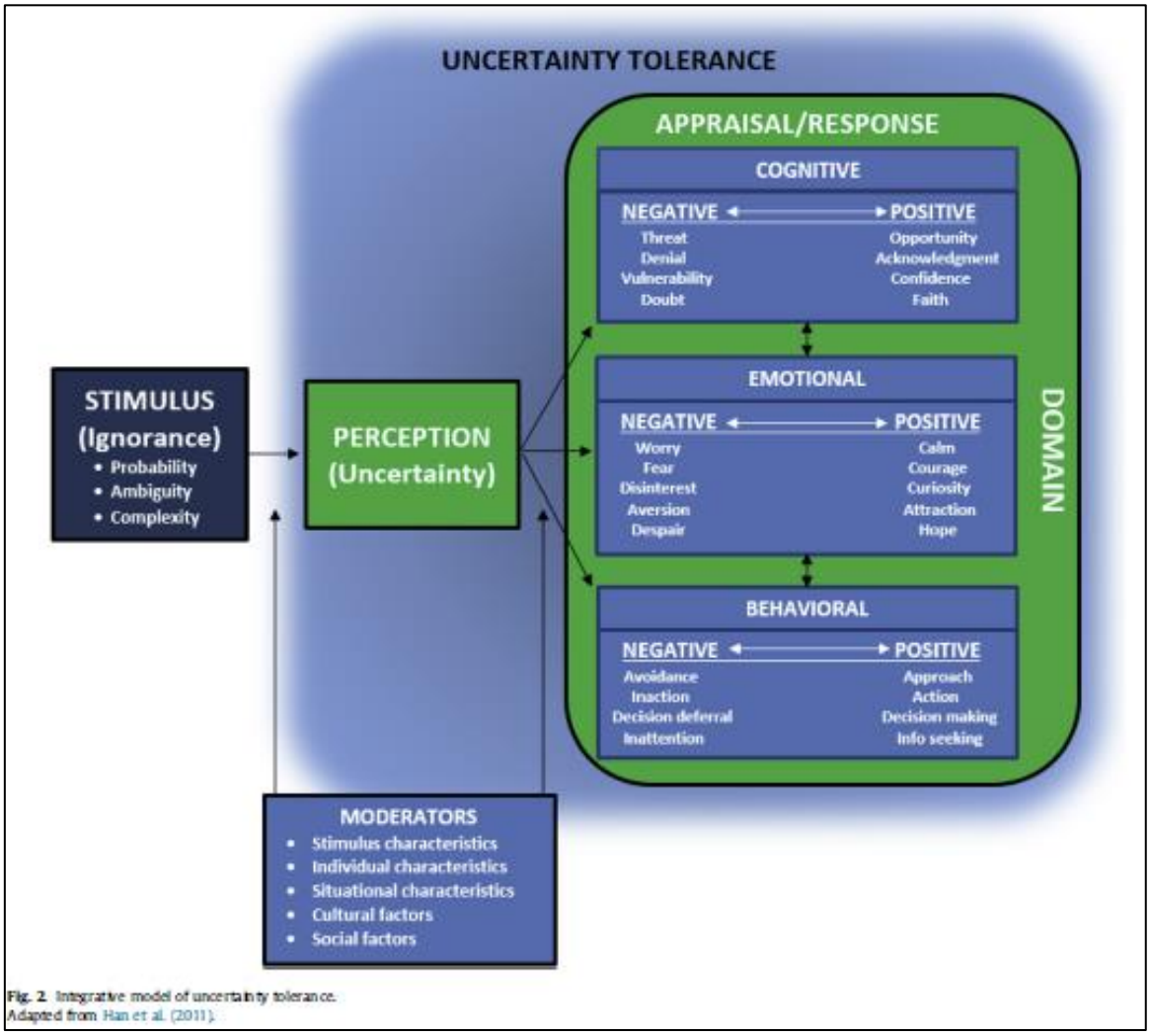


Figure 2: Integrative model of uncertainty tolerance (Hillen, et.al., p.71)

Fazlagić (2018) discerns 3 types of psychological strategies to 'handle' uncertainty with corresponding abilities:

Cognitive	Behavioral	Functional
-Divergent thinking and creative problem solving in teams - Critical thinking and framing reality to be transformed	- Showing courage and resilience when faced with pressure from authority or threat - Risk-taking to discover new strategies for problem solving	- Verbal and expressive literacy for empathizing in professional situations with collaborators (active listening, engaging, affirming, reflecting messages, summarizing, reframing)

- Multitasking and tolerating ambiguity - Finding integrity in making choices between conflicting interests, body of evidence, forced identities - Mindfulness and curiosity in processing unfolding information - Self-determination and self-regulation in adapting to change and designing novel solutions to cope with adversity and surprise	- Visualisation of future for alternative scenarios - Improvisation as working beyond or without an agenda to respond to evolving needs - Strategizing with VUCA or/and SWOT	- Digital literacy for networked resources and co-designing

Analytic / holistic

It is important to notice that also a more holistic approach is argued for in handling uncertainty. Barnett (2004) argued that it is essential to develop so-called human qualities that support 'authentic being'. These qualities are: carefulness, thoughtfulness, humility, criticality, receptiveness, resilience, courage, stillness. Handling uncertainty also means that one has to be able to live with uncertainty. Handling uncertainty requires not only skills and abilities, but also a sense of inner security (Barnett quoted in: Saarnivaara & Sarja, 2007). The (reflective) professional should learn to live with a suspended state of not knowing (Attard, 2008). This touches upon the 'character skills' that Fadel, Bialik & Trilling (2015) present as essential to the development of 21st century proof professional competences.

2. Competences

In this paragraph we present the main ideas on competences and learning outcomes, and on how to develop competences. This is also based on the input of all partners. Like Paragraph 1, this paragraph also is a narrowing-down of the divergence of all concepts and ideas that were shared.

2.1 Competences and learning outcomes

Describing a competence

It is important to clarify what we mean by a 'competence'. That is not an easy job as many authors have conducted literature reviews on the topic (e.g. De Bie, 2002; Wesselink, Biemans, et.al., 2007); Bouw, Zitter & De Bruijn, 2020). One of the conclusions is that "The one and only true competence definition does not exist, nor will ever be" (Stoof , et.al., 2002, p. 347).

Authors use different words or synonyms when they refer to competence, such as: "performance, qualification, capability, ability, knowledge, skill, attitudes, expertise". (Stoof et.al., 2002, p.358). Every concept has its own nuance. Capability and ability seem to have the closest association to competence. Stoof et.al. (2002) introduce the idea of a constructive approach, which focus on viability: This means that a definition of competence should be adequate for the situation in which it is being used" (p. 347.)

A common notion in the description of a competence, is to use the concepts of knowledge, skills and attitudes. Two types of knowledge can be distinguished, namely: declarative and procedural knowledge. Knowledge can be tacit or explicit. Knowledge is about "What we know and understand" (Fadel et.al., 2015, p. 43).

Skills are closely tied to knowledge (Baartman & De Bruijn (2011), can be seen as doing or acting in practice, involving motor skills as well as cognitive skills" (p. 127) and are constructed in interplay with the social world. In the words of Fadel et.al. (2015, p. 43), skills point to "How we use what we know". And attitude refers to behaviour, "can be relatively stable" (Baartman & De Bruijn, p. 131) and/or can be constructed in a specific context. Fadel et.al.(2015, p. 43) use the word Character, which means "How we behave and engage the World".

Knowledge, skills and attitudes are interrelated elements, they are indivisible. This refers to a fourth element, namely meta-learning: "How we reflect and adapt" (Fadel, et.al. (2015, p.43). This element is a the ability to reflect on the application of knowledge, skills and attitude in a useful way in a specific context and supports the transfer of a specific competence in other situations.

Learning outcomes

A competence description should be accompanied by learning outcomes. Cedefop (2017) states the following: 'Competence can be understood as actually achieved learning outcomes, validated through the ability of the learner autonomously to apply knowledge and skills in practice, in society and at work ' (p.31). With the direct relation between a competence and its learning outcomes, we have to be clear about the purpose of the learning outcomes. While focussing on learning from a constructive perspective, the description of learning outcomes are 'process-oriented and open-ended, limiting measurability' (Cedefop, 2017, p.44). In this way a learner, has the possibility to orientate, explore, interpret, monitor and reflect on the development of a competence. To describe learning outcomes it can be helpful to use the ideas as shown in figure 3:

Domain of learning	Levels of sophistication	Common verb associations
Cognitive (knowledge) What will students know?	remembering, understanding, applying, analysing, evaluating, creating	define, identify, describe, differentiate, explain, apply, analyse, resolve, justify, recommend, judge, create, design
Psychomotor (skills) What will students be able to do?	imitation, manipulation, precision, articulation, naturalisation	adapt, arrange, build, calibrate, construct, design, deliver, demonstrate, display, dissect, fix, mimic, operate, sketch, use, perform
Affective (attitudes, values or habits of mind) What will students value or care about?	receive, respond, value, organise, characterise	ask, challenge, demonstrate, discuss, dispute, follow, justify, integrate, practise, judge, question, resolve, synthesise

Sources: Marzano and Kendall (2007); Kennedy et al. (2006); Anderson et al. (2001); Bloom et al. (1956; 1964).

Figure 3: Domains of learning, with example levels of sophistication and common verb associations (Cedefop, 2017, p. 52).

Designing competences

When designing a competence we should take three aspects into account (Stoof, et.al. 2002). First a competence should be designed with different stakeholders, to include more perspectives which can contribute to viability. Second, be conscious of whether a competence is teachable or not. For a teachable competences instruction is needed and it has implications for the learning environment (including the role of teachers) in which the competence can be developed. According to Simons (zd), it is also possible, that competences can only be learned by practical experiences and not by instruction. A third aspect to take into account is to minimize the risk of a wide and vague description, which might result in too many learning outcomes. To minimize this risk, we have to be aware to address the following questions such as: Does it contain personal or task characteristics, is it a specific or generic competence, are there competence levels or not and how transferable is a competence? Those questions refer to the goal of the competence and the way the competence fit with the (learning and professional) context in which the competence is needed.

2.2 Development of competences

Seen from a constructivist perspective, the development of competences is considered as a holistic approach “to overcome the risks of the disintegrative approaches” (Biemans, et. al., 2004, p. 528). In this paragraph we present some ideas about competence development, based on the perspectives from our partners practice. We will discuss a few models, without exploring them totally and deeply.

Four-Dimensional Education

An interesting model with a holistic approach for competence development is the model in this figure:

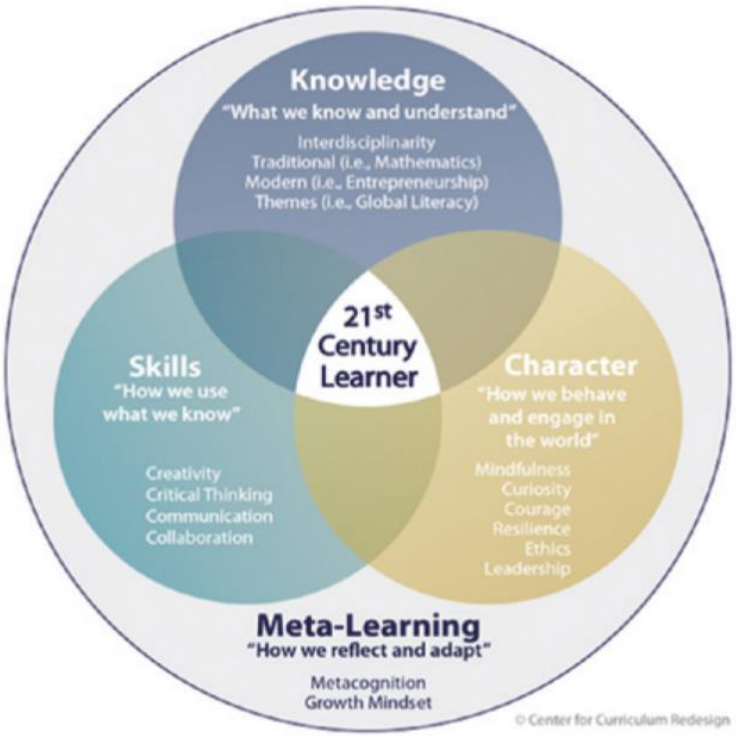


Figure 4 : The foundational framework of the Centre for Currciulum design Fadel et.al. (2015, p 43).

Although the model is developed for redesigning a whole curriculum, it is applicable for the development of competences. The model is based on three important aspects. First the model is adaptive, which means it is "fluid and evolving" (Fadel & Groff, 2019, p. 272). It means there is not a rigid structure or roadmap for the development of competences. The second aspect in the model is balanced, which refers to a variety of perspectives that students supports to develop a competence. The last aspect flexibility, is important in developing competences. Students have different needs, competences should be transferable and be further developed. According to Fadel and Groff (p.278) "these four dimensions can't just be added in and taught independently from one another", which fits with an holistic approach of competence development.

Innovation pedagogy

Another interesting approach for competence development is 'innovation pedagogy' (Innopeda®). (see figure below). It is a strategic learning approach which 'aims to develop innovation competences of individuals and groups' (Konst, 2017, p. 1438). Although the focus is particularly on innovation competences, we think there are aspects in the strategy that are useful for holistic competence development.

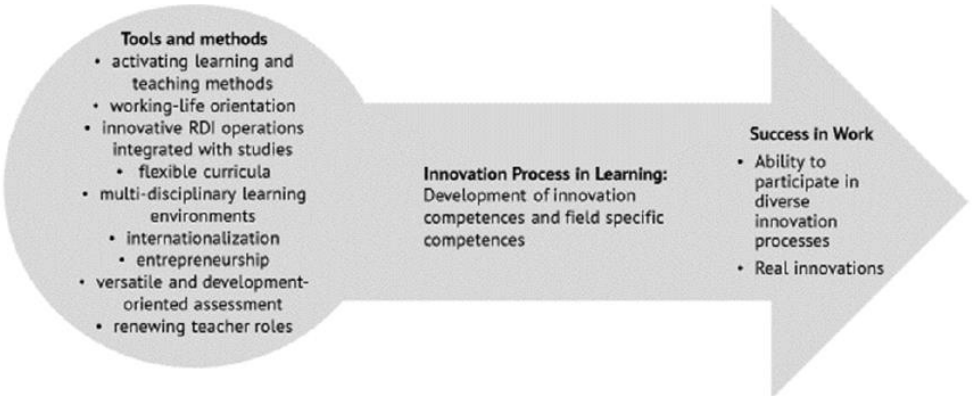


Fig. 1 Innovation pedagogy in a nutshell [15]

Figure 5: Innovation Pedagogy in a nutshell (Konst, 2017, p. 1439)

As can be seen in the figure above, innovation pedagogy puts important elements of the learning environment in the spotlight. The strategy provides many tools and methods for students and teachers, which are helpful for developing competences. One fundament of the strategy is: "to bridge the gap between education and working life" (Konst, 2017, p. 1439). This is a very important aspect of a holistic approach of competence development and rises the viability and transferability of a competence. With the innovation approach the four elements (knowledge, skills, attitude and meta-learning) will be addressed and it will enable students to take ownership of the creation of a competence that is needed.

3. The PUNC Framework

Based on to the above, we've constructed a first version of a framework in order to develop the Professional Uncertainty Competence.[1] Instead of developing an uniform and fixed PUNC competence, the PUNC framework aims to be highly adaptable in order to be able to define personal and context specific PUNC learning outcomes that relate to specific uncertainty experiences in the professional context. Therefore the PUNC framework consists of a set of strategies and a menu of various elements. With these components, context-specific and personal learning outcomes can be composed. Leaning outcomes that help to make experienced uncertainty productive.

3.1 PUNC menu

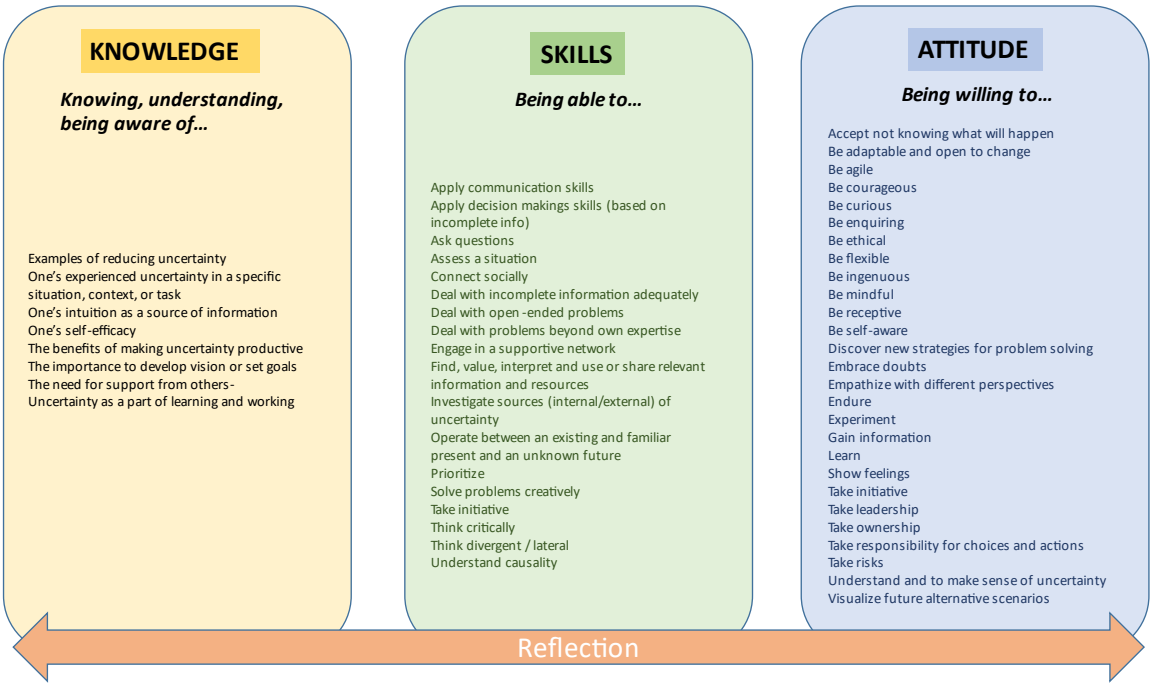
According to a widely accepted view on competences, the PUNC elements that were deduced from the literature review are categorized in terms of knowledge, skills an attitude. We conceive knowledge as a multi-layered concept that includes: cognitive/hard knowledge (knowledge parts), understanding (constructs of various knowledge parts) and embodied/tacit knowledge (e.g. awareness). Skills are seen as abilities (being able to…) and 'attitude' is conceived as a conscious intention (being willing to…). Elements from these three categories can be combined into a specific PUNC learning outcome for a specific situation in which uncertainty is experienced (for further elaboration see 3.2 and 3.3).

[1] As described in the Introduction, this first version of the PUNC framework will be supplemented with the outcomes of the survey amongst educators and students and the validation sessions.

The fourth element - meta-learning by reflection – forms the basis for developing the specific PUNC learning outcome and is the activity that evaluates the effect of the combined elements of knowledge, skills and attitude in a specific learning outcome.

In practice, a competence always consist of the three indivisible components of knowledge, skills and attitude but with regard to the flexibility and the usability of the PUNC framework, we chose present a as rich and specific as possible menu of relevant PUNC elements. Any synthesisation of the separate elements might lead to limitation in choice for the user. We also chose not to define the separate PUNC elements. Concrete definition could lead to possible limitation of meaning as a user might want to attribute another meaning to a certain element than how we defined it. It is therefore also possible that an element can occur on more than one category. For example, based on the theory it is important to both be willing to 'take initiative' and to be able to 'take initiative'.

So both in quantity and quality of the presented elements we aim to remain as inclusive and inviting as possible for the user. This also means that the menu is not prescriptive in any way. A user can make his own meaningful combinations between the three categories and of course not all elements have to be developed in order to develop one's PUNC.



3.2 How to make uncertainty productive by PUNC

We argue that competence development can be interpret as a process of sensemaking. This sensemaking process is ongoing, creative, sensitive and reflexive, in which a person 'makes sense' of his or her experiences in a particular situation (Weick, 1995). Making sense of a collaborative experience will vary among individuals, who creates meaning from his or her perspective, history, culture and context. Instead of ignoring or avoiding uncertainty, it is engaged, explored and maybe even reframed into a new narrative that is fitting and possibly even required in that particular situation or learning experience. By sensemaking, uncertainty is made productive. We subdivide the sensemaking process of uncertainty into three intertwined and flexible strategies:

To *acknowledge* is: to recognize and accept uncertainty (as a given, as an opportunity; a source; a possible drive for action, entrepreneurship or innovation). To resiliently endure uncertainty and wanting to deal with it without panicking, giving up or stopping learning.

To *explore* is: to get acquainted with one's uncertainty, to gain understanding and to learn how to become able to take action on it.

To *handle* is: to continuously develop the ability to deal with uncertainty and to be able to acknowledge, explore and handle uncertainty in other contexts/situations (transfer) by reflecting on the outcome.

1) Acknowledgement of uncertainty

The first phase is to acknowledge that a new competence is needed or an existing competence has to be further developed. In a VUCA-world with new, changing and unpredictable situations students have to acknowledge that they need to get access to knowledge and develop skills to adjust to the situation. They have to acknowledge whether or not they have the ability to do that by themselves, or that they need support from teachers and/or peers. And they also have to acknowledge that 'not-knowing' what, why, how and when to perform, can raise feelings of uncertainty. From the four-dimensional model of Fadel et.al. (2015) we can learn that in this phase of acknowledgment character, especially courage, is an important aspect. According to Fadel et.al. (p. 88) "Courage can be thought of as the ability to act despite fear or uncertainty, in risky situations, or when we are feeling vulnerable". It means that students who experience 'not-knowing' and feelings of uncertainty, don't immediately lay down, sit back, get stunned or get paralyzed, but come into action. From the perspective of innovation pedagogy, a student needs therefore an inspiring and also safe environment, which has lots of opportunities to meet different kind of Peers (e.g. other students, teachers, friends) on a regularly and spontaneously base. The Peers can serve as companions and critical friends, with whom they can collaborate, dialogue, argue and get support from (Konst, 2017).

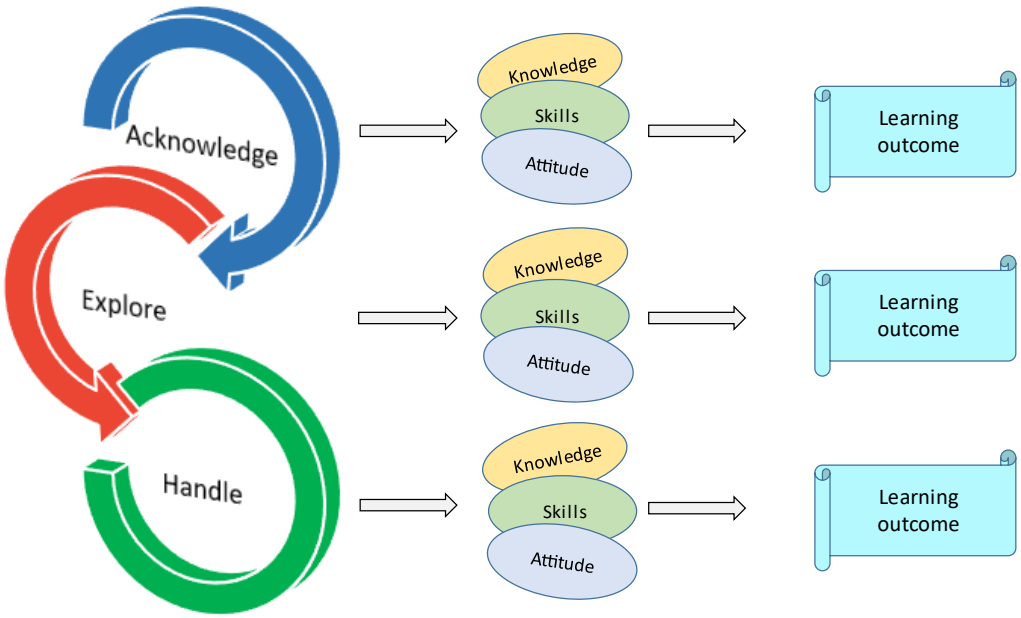
2) Exploration of uncertainty

In the second phase of exploration, the focus is on the sensemaking from 'not-knowing' to 'I know more' and to move from 'I feel uncertain ' to 'What helps me to make uncertainty productive'. Depending on for instance the ability for self-regulation, possibilities , the urge of the situation and need for answers, student's approaches to sensemaking can vary between superficial or more in-depth. Although there is nothing wrong with a 'quick-and-dirty' approach, the questions is whether or not such an approach will result in competences that are viable and transferable. The Four-dimensional- Education model and innovation pedagogy as learning strategy, provides many ideas to equip students for in-depth exploration. An illustration from the Fourth-Dimensional-Education, shows the importance that teaching should aim on making the connection between different knowledge areas explicit: "Highlighting interdisciplinary applications of concepts, meta-concepts,

methods, and tools can be a powerful way of illustrating concepts and making them immediately relevant to student"(Fadel, et.al.,2015, p. 52). Another example comes from Innovation Pedagogy with a focus on the benefits of collaboration that has implication for the guidance of a collaboration process: "Collaborative learning enables different actors to work together in dialogue and in interaction in such a way that their own expertise can be efficiently shared and combined in new ways resulting in something more than the sum of its parts" (Konst, 2017, p. 1439).

3) Handling of uncertainty

The third phase of handling, is the phase in which students continue to exercise and work with the experiences and findings from their exploration phase. In this phase of the sensemaking process, students develop strategies and competences, which can be applied more automatically and at the same time engage students into a process of further development of those strategies and competences. From the Four-Dimensional Education (Fadel, et.al., 2015) we learn the importance of four elements that should be integrated in the sensemaking process. With maybe an emphasis on metacognition, because "critical reflection causes an expansion and deepening of learning" (Wesslink, et.al. p. 42). From the innovation pedagogy (Konst, 2017) we learn that tools and methods can create a learning culture, to provide students with challenging opportunities. In both perspectives we can find focus on sensemaking in authentic, challenging and hybrid environments or contexts. Where students take ownership, and where guidance (e.g. teachers, instructors) is adjusted to the need of the student. This implies that every strategy requires individually attuned elements of knowledge, skills and attitude that pertain to the situation at hand and the personal needs of the learner. And additionally, all elements of knowledge, skills and attitude are developed and validated in practice by specific and personalized learning outcomes:



Also, based on research on tools of 'safe uncertainty', which were designed and tested in collaboration with the actual users (students), Bollinger and Van Rooijen (2018) found that: "Uncertainty can become productive when enough safety is experienced. One way of handling uncertainty and creating safety is by deploying educational tools that help students to make sense of their uncertainty"(p.1). So, these strategies can be fruitfully developed by using specifically designed tools, as educational scaffolds. These three strategies help to make uncertainty productive, especially

when they incite the student/learner into action. In order to strengthen its productivity, these three strategies and their outcome in terms of actions, are supported by the meta-competence Reflection. Reflection is an important driver of professional development and learning. The development of all other elements is very much encouraged by the willingness and quality of self-reflection.

3.3 How to work with the PUNC framework

Here we present three examples of how to come to relevant learning outcomes based on the elements of the PUNC menu. They are based on the process of a student reflecting on his experience of uncertainty within a certain professional context. Based on this reflection the student decides which of the PUNC elements (knowledge, skills, attitude) are relevant for him to develop. Then he combines these in one or more concrete and personal PUNC learning outcomes.

Both students and educators can use this framework – individually and together – to identify and acknowledge uncertainty in a professional situation and to come to practical and developable PUNC learning outcomes that help the person in question make his uncertainty productive.

Example 1	
Uncertainty experience:	A student experiences uncertainty when he is assigned a task that he doesn't understand. He misses clarity as he doesn't know what the results have to be.
Having knowledge of:	where to find relevant information
Being able to:	ask questions
Being willing to:	take initiative, be courageous
Learning outcome:	"I am able show courage to take initiative to ask my tutor for support on where I can find relevant information with regard to my task."

Example 2	
Uncertainty experience:	A student experiences uncertainty while working on a final exam together with a fellow student. The fellow student fails to deliver the material that they agreed on. How to pass the exam?
Having knowledge of:	where to find relevant information
Being able to:	deal with an open-ended problem; connect socially, apply communication skills
Being willing to:	show feelings; be courageous; be receptive; gain information.
Learning outcome 1:	"I am able to deal with this open-ended problem by connecting socially with my fellow student by applying adequate communication skills in order for the problem to be discussed."
Learning outcome 2*:*	"I am willing to deal with this open-ended problem by showing feelings, being courageous and by being receptive in order to gain information about why he fails to deliver."

Example 3	
Uncertainty experience:	A student experiences uncertainty during his first day of his internship at the company of his dreams. He has high expectations of himself and he thinks that his colleagues have high expectations of him too. He feels that he has to succeed in everything and he has to be highly appreciated by his colleagues.
Having knowledge of:	one's intuition as a source of information; one's experienced uncertainty
Being able to:	investigate sources of uncertainty (internal/external); ask questions; take initiative; connect socially, apply communication skills, accept not knowing what will happen.
Being willing to:	embrace doubt; endure; be receptive
Learning outcome 1:	"I am able to trust my intuition by using my former uncertainty experiences as a source of information."
Learning outcome 2:	"I am able and willing to investigate sources of uncertainty (internal/external) in former experiences of uncertainty."
Learning outcome 3:	"I am able to apply communication skills like asking questions."
Learning outcome 4:	"I am willing to take initiative and be receptive in order to connect socially."
Learning outcome 4:	"I am willing to endure and able to accept not knowing what will happen and embrace doubt."

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Addendum I: Factsheet

Search engines used:	Google, Google Scholar, Google Scholar, EBSCOhost, ERIC, SCOPUS, Web of Science, Research Gate, Academy.com, LinkedIn (hashtagged articles) WoS, Dialnet, Emerald Insight, Helda, Arto, Journal.fi, Sage Journals, Aaltodoc
Search terms used:	HU: discretionaire ruimte, - bevoegdheid, recht, jurist, onzekerheid, onzeker, accountancy, onzekerheid, management, commerciële economie, bedrijfskunde, ondernemen/-ing, entrepreneur, sales, leerkracht, leerproces, leren, onderwijs, hoger onderwijs, techniek, Competentie, ontwerp, ontwikkelen, ontwikkeling, leeruitkomst, competentieleren, competence, competence design, competence development, competence learning, learning outcome BAAA: Uncertainty (internal/subjective) in HE learning, Professional uncertainty (internal/subjective), Competence design, Competence development, Learning outcomes, Wellbeing INN: Law: niepewność, VUCA, prawnicy, sądy, adwokaci, wymiar sprawiedliwości; Business: zarządzanie niepewnością, niepewne czasy, ryzyko, kształcenie przedsiebiorców, liderów zmiany, kadry na niepewne czasy; Education: rezyliencja, budowanie prężności, radzenie sobie z niepewnością, edukacja zmieniaczy, changemakers , odporność na porażkę; Engineering: ryzyko, kształcenie innowatorów, inżynierów, zarządzanie zmianą i niepewnością w przemyśle , praca w środowisku VUCA; Budowanie kompetencji zmiany, efekty kształcenia, kompetencje społeczne, UPV: VUCA, Universidad, Incertidumbre, Educación Superior, diseño de competencias, resultados de aprendizaje, TUAS: VUCA, learning outcome, epävarmuus, ammatillinen epävarmuus (incl. Tekniikka, insinööri, liiketalous, opiskelija), yrittäjämäinen asenne, entrepreneurial attitude, entrepreneurial learning, ammatti-identiteetti, insecurity, risk pedagogy/riskipedagogiikka, tunteet ja korkeakouluopinnot, emotionaalinen minäpystyvyys, jännittäminen, itsetunto, riski
Approach on selection:	We used only articles/books with the access to full text mode. After reading of titles, summaries and conclusions a particular article was selected for in-depth analyses through close-reading.
Findings in quantity:	Number of texts before selection: HU 72; INN 36; BAAA 100+ TUAS 90+; UG 65; UPV 23 Number of texts selected: HU 53; INN 15; BAAA 28 TUAS 9; UG 16; UPV 10. Number of texts used in this review: 63