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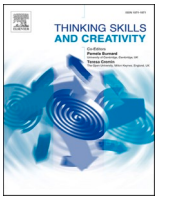

Meta-competences in complex environments: An interdisciplinary perspective

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ABSTRACT

In today's increasingly complex, uncertain environments, disciplinary knowledge alone is no longer sufficient to cope with new societal challenges and real-world problems. Meta-competences, which include advanced thinking skills and creativity, go beyond these domain-specific competences. Along those lines, a methodological question arises regarding how such a complex phenomenon can be investigated and adequately described.

In our research, we applied proposition-based expert round tables, a method developed to analyze complex real-world problems. In a two-year project, eight experts from the University for Continuing Education Krems collaborated in an interdisciplinary approach including system and innovation research, management science, engineering, the arts and humanities, and higher education. Each expert proposed what meta-competences entail from their own perspective, and the different knowledge was subsequently reviewed, analyzed, and integrated following a collaborative approach over the course of several iterative discourses.

As a result, the experts produced an integrative model with four interdependent factors of readiness: (1) iterative learning to continuously expand one's competences, (2) resilient improvisation to deal with unexpected events, (3) dynamic viability to cope effectively with volatile environments, and (4) sustainable innovation to co-creatively innovate. Those factors interact and reinforce each other and should ultimately enhance one's readiness to continually apply knowledge gained in new contexts and communicate that application accordingly.

Meta-competences have, thus far, been discussed only in certain scientific disciplines. In our study we conducted expert round tables to continuously generate in-depth interdisciplinary knowledge that can be applied to other complex, real-world phenomena. The result is an initial

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interdisciplinary model that offers a relatively comprehensive view on the meta-competences required in today's increasingly complex environments.

1. Introduction

As today's globalized world becomes increasingly interconnected, societies now face highly complex challenges and even a polycrisis involving multiple wars, an energy crisis, and the COVID-19 pandemic (Zenk et al., 2020). To cope with such profound challenges, new competences are needed to better understand those complex real-world problems and deal with the resulting uncertainties in complex environments (Risopoulos-Pichler et al., 2020).

In stable environments, about which sufficient knowledge has been developed, future developments can be anticipated to a certain extent (Kirchler, 2011). In turn, societies can develop plans to allocate resources appropriately, set goals, and apply suitable methods to achieve them. Accordingly, attitudes and approaches toward education are also dominated and driven by well-structured, deterministic, straightforward approaches based on experience. However, in more dynamic, volatile, complex environments, such plans for action and education are no longer sufficient (Oppl, 2017; Pausits, 2015; Scholz & Binder, 2011). Indeed, recent political and health crises have demonstrated how interconnected the world has become and how quickly established structures and practices may change dramatically worldwide (Steiner et al., 2020).

In recent decades, societies have increasingly confronted complex environments, sometimes referred to as a "VUCA world": "It's volatile, it's unstructured/uncertain, it's complex, and it's ambiguous. [...] Confusion is part of the game. And actually being frightened is part of the game, too. [...] The ultimate dilemma is to take the VUCA world and change it from a threatening thing, which it certainly is, into a world that is not only threatening but also laden with opportunity" (Johansen & Euchner, 2013, p. 10). Due to the constantly accelerating pace of change, additional competences are needed along with planning and linear skills to cope with new as well as future challenges (Vera et al., 2016).

In the UN's Sustainable Development Goals (SDGs), the quality of education is of particular importance, including at institutions of higher education and within their curricula. In that regard, the SDGs and the Organization for Economic Co-operation and

Fig. 1. Meta-competences: Individuals embedded in organizations and broader systems (Source: Icons made by Parzival 1997 and Eucalyp at www.flaticon.com).

Development's "21st-Century Skills" initiative on innovation have become focal topics of recent discussions on the future of education and the development of new competences (Brockmann et al., 2009; Dilekçi & Karatay, 2023). To cope with uncertain situations in complex environments, it is assumed that a specific set of overarching competences is required, which we refer to as meta-competences (MCs).

MCs primarily pertain to the context of generic work settings because they enable individuals to adapt to an organization's needs and support flexible approaches to complete tasks and meet the organization's goals, including anticipating and creating change (Heery & Noon, 2008). MCs are overarching because they are common to all working environments and because they integrate and promote other competences (Cheetham & Chivers, 1996). In general, MCs encompass the ability to communicate with others, to critically engage in different work settings, to reflect on experiences, and to integrate practices, to name a few (Nurius, 2017). Harden et al. (1999) have also highlighted that MCs integrate different intelligences as a basis for competences, including academic, emotional, analytical, creative, and personal competences. MCs are additionally mentioned in the context of learning (Brown, 1993) and recognized as professional qualities (Kearney, 2005); therein, they often refer to competence developments (Reis et al., 2021)—for instance, to reflect on analysis and judgment in the context of self-development (Talbot, 2004)—or in the context of career development to increased adaptability (Lo Presti, 2009). Although various aspects of MCs have been discussed in diverse ways in recent few decades, a more comprehensive approach that coherently takes multiple disciplinary perspectives has thus far been lacking. Considering global changes in recent years and increasingly pressing societal challenges, the need for a profound understanding and the further development of MCs has become more critical than ever.

For this paper, we therefore posed the following research question: What are the underlying factors for MCs from an interdisciplinary perspective? To begin, we first present the methodological approach of proposition-based expert round tables (ERTs) chosen to study the phenomenon in an interdisciplinary way. In subsequent sections, MCs are discussed from individual, organizational, and systemic perspectives (see Fig. 1), after which we present an initial model of MCs and concisely summarize their essential factors.

2. Research design

Identifying relevant MCs presents a considerable methodological challenge, for MCs represent a complex phenomenon that can be viewed in light of various scientific disciplines. For that reason, experts are needed who have extensive experience and knowledge in the relevant areas and who can offer a high degree of diversity to cover a broad spectrum of knowledge from different systems. Added to the selection of suitable individual experts, the presentation of knowledge and its integration within the expert group is crucial for promoting mutual learning and enabling a shared understanding of a selected phenomenon. Such a high degree of diversity requires a systematic approach to integrating different mental models, technical languages, and theoretical assumptions into a joint learning process able to generate socially robust knowledge (Gibbons & Nowotny, 2001).

To that purpose, we chose the method of proposition-based ERTs for our study. The method was developed in recent years as a real-world, problem-oriented discourse based on knowledge integration and including representatives from all key stakeholder groups and intended to generate socially robust orientations on critical issues related to complex problems (Sugiyama et al., 2017). In our study, the first ERTs in Japan, Europe, and South America were held as in-person meetings at which experts were able to share their perspectives (Scholz et al., 2018; Viale Pereira et al., 2020). However, due to the COVID-19 pandemic, the last ERT in the United States had to be further developed for virtual collaborations over a longer period.

Using the ERT method, we, as relevant experts from the University of Continuing Education Krems in Austria, were funded to conduct a research project on MCs addressing systems and innovation research, management science, engineering, the arts and humanities, and (higher) education (see Table 1).

The experts acted both as key stakeholders and as representatives of specific academic communities. Therefore, emphasis was placed less on personal research interests and more on the underlying assumptions and scientific discourses of the disciplines, which were reflected by continuous discourses. To systematically support a process of mutual learning, each ERT was organized in four

Table 1
Researchers and departments included in the study.

Faculty of Business and Globalization	
Department of Knowledge and Communication Management	Prof. Gerald Steiner Prof. Lukas Zenk
Department of Economics and Management Sciences	Prof. Barbara Brenner
Faculty of Education, Art and Architecture	
Department of Higher Education Research	Prof. Attila Pausits Dr. David Campbell
Department of Continuing Education Research and Educational Technologies	Prof. Stefan Oppl
Department of Arts and Cultural Studies	Dr. Eva Maria Stöckler
Faculty of Health and Medicine	
Department of Economy and Health	Prof. Doris Behrens

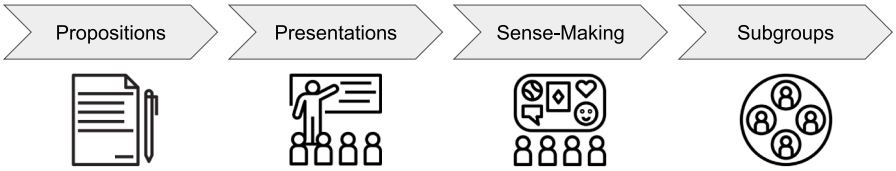

Fig. 2. Phases of the expert round table.

phases (see Fig. 2).

(1) Structured propositions: The experts were provided with an online template in which they described their propositions with an abstract, brief literature review, detailed argumentation, lessons and implications for continuing education, and initial definitions of MCs. All participants were asked to work through all propositions thoroughly, provide written feedback, and reflect on how their own propositions related to the others (see Appendix).
(2) Individual presentations: Each expert presented their perspective to the research group in a half-hour presentation. Afterward, the content of the presentation was discussed, feedback from different disciplines was provided, and initial connections to other perspectives were explored, all of which allowed the speaker to revise and improve their proposition.
(3) Sense-making: After the presentations, the topics addressed were continuously discussed in subsequent virtual meetings through a collaborative sense-making processes with the aims of identifying underlying patterns in different disciplines, discovering analogies and metaphors, and addressing emerging polarities. During those meetings, the arguments were recorded and served as the basis for further elaboration.
(4) Thematic subgroups: For the publication of this article, the relevant topics were identified and further condensed and described in subgroups. Because all experts were experienced researchers in scientific writing, they were able to report their findings in a joint manuscript.

3. Individual perspective: improvising, designing, and (institutional) learning

From an individual perspective, MCs are aimed at coping with complex, rapidly changing situations, which requires thinking skills and creativity to remain able to act in the moment, understand problems, and innovate in real time. In the following subsections, the topics of improvisation (i.e., real-time actions, design research, and innovation pedagogy) are therefore described from the perspective of the humanities, arts, and education.

3.1. Changing conditions and patterns of action

A fundamental challenge for individuals acting in complex environments is dealing with constantly changing conditions under which challenges emerge and eventually have to be addressed in their respective circumstances. When humans act, they usually do so in response to some perceived situation that has implicitly or explicitly triggered the decision to act in a particular manner (Suchman, 1987). In that way, every human action depends on its immediate circumstance and is an improvisation based on what is perceived to be relevant and the repertoire of (re)action patterns available to the individual (Oppl & Stary, 2019).

Individuals need to develop such a repertoire of action patterns—what Suchman would refer to as "plans"—that can be adapted to a situation in which they are instantiated—or a "situated action" in Suchman's nomenclature. Supporting the development of such a repertoire, the ability to deploy but not necessarily consciously choose adequate action patterns and adapt them to the situation at hand is significant.

Situations that people confront are never well-defined or clearly delineated upfront. Acting in an informed way, however, does not necessarily require a comprehensive ex ante understanding of a situation. Instead, it might be pragmatically sufficient to recognize several constitutive aspects of a situation in order to enable initial action and iteratively extend one's personal understanding, thereby leading to a more comprehensive foundation for further action. Such iterative approaches to problem-solving are well-established in both research approaches, usually referred as design-based research (e.g., Anderson & Shattuck, 2012) or design science research (e.g., Gregor & Hevner, 2013), and practice approaches—for instance, using the design thinking approach (Arce et al., 2022), as exemplified by Pande and Bharathi (2020). In all cases, they emphasize an interplay between creativity, the synthesis of partial solutions, and the generalization of findings to enable so-called transfer in the sense of Schön's concept of reflective practice.

3.2. Analogies in musical improvisation

When exploring ways to acquire the thinking skills and creativity necessary to engage in ill-defined activities, individuals can gain knowledge from how people learn to engage in musical improvisation (Nettl & Russell, 1998). Musical improvisation is understood as "an emergent, self-organizing, and adaptive structure, growing through constant adjustments and readjustments by the input from musicians (both learned and spontaneous [re]actions) and the environment (both human and non-human), and resulting in a perpetual negotiating between order and disorder, structure and chaos, free and fixed elements, stability and fluidity, etc." (Cobussen, 2017, p. 84). Because each improvisation is an assemblage of actors, interactions, and settings, each improvisation deals with singularity.

Improvisers explore the musical terrain (i.e., of a single situation) into which they are thrown, investigate possibilities, and try out specific strategies. In an individual's initial steps to engaging in musical improvisation, a key aspect is to not become overwhelmed by the vastness of the musical terrain, the myriad musical and instrumental opportunities, the constantly changing environment, and different ways to play. Avoiding being overwhelmed requires deliberately constraining the space of action in terms of which aspects of the environment to take into consideration when investigating one's options for acting and of the options to act themselves.

To gain the experience of differentiation necessary for improvisation, opening a limited space for improvisers is called for, which offers a sense of security and at once allows freedom within which musical improvisation can arise. The limitation of the musical space can be a rule by which all improvisers may choose only two notes (i.e., limitation) but are free to use different dynamics, volumes, or durations (i.e., freedom). The abundance of possibilities, individual assumptions about expected musical actions (e.g., instrumental competence), and thus the fear of making mistakes are the greatest inhibitors to improvisation. Constraining space is a way to prevent those inhibitors and can consequently be regarded as a form of pedagogical reduction to reduce complexity (Lewin, 2018). That reduction of complexity ultimately enables improvisation (i.e., in situ design activities) for less experienced individuals.

By engaging in improvisation and constantly monitoring the surrounding environment, individuals gradually develop an understanding of which actions are appropriate reactions to different stimuli. Such stimuli are caused by the so-called actants in musical improvisation. Other than human beings with their bodies and their instruments, such actants include the (im)possibilities of the physicality of musical instruments, obvious mistakes in playing that immediately direct improvisation in another direction, broken technology (e.g., amplifiers), the possibilities of technology, acoustic feedback, audience–performer interaction, and even the acoustic properties of the music venue itself (Cobussen, 2017), all of which serve as stimuli for improvisation. Constant monitoring and reaction to such stimuli during improvisation helps to develop a repertoire of action patterns that can be recalled when similar situations of improvisation are encountered in future.

3.3. Adaptive constraining as a pathway to develop MCs

As experience accumulates, constraints can be lifted further to allow more freedom about what to react to and how. The scoping of constraints in that case needs to be adapted situationally to not only avoid overwhelming learners but also leave sufficient space for exploring new options and understanding causal dependencies of why particular actions suit different stimuli. Such adaptive constraining resembles the well-established concept of scaffolding in educational sciences (e.g., van de Pol et al., 2010) and should lead to what is called a "state of flow" (Csikszentmihalyi, 2014). Imposing and lifting constraints are usually the tasks of an experienced learning facilitator but can also be taken over by peers if levels of experience are heterogeneous (Lai & Law, 2006).

The repertoire available for improvisation is challenged with each new musical session that an individual engages in. Action patterns developed in prior sessions might become applicable again and thus stabilize, whereas others may require modification or even be dropped again. At the same time, novel situations and fewer constraints can lead to the development of new action patterns that are added to one's personal repertoire. Experience in diverse improvisation settings also allows an individual to develop a more generic understanding of appropriate responses to certain stimuli and eventually to make more informed decisions about how to act in particular situations.

3.4. Innovation pedagogy in higher education

The development of individual MCs should also be considered from an institutional perspective. However, such aspirations have hardly been anchored in school and university curricula to date, even though they are essential skills for a rapidly changing society. An already significant contribution to the development of MCs in higher education can be found in innovation pedagogy, a field that has pioneered approaches for developing appropriate generalist expertise.

In recent policy debates, the need to develop additional innovation competences, directed toward dedicated teaching and learning processes designed to meet the demands of the economy (e.g., business innovation) and society (e.g., societal innovation), has been addressed (Pausits, 2019). To acquire innovation competence, it seems necessary to experiment with new teaching alternatives associated with active methodologies aimed toward learning MCs. The first step is to define the skills and capacities that comprise generic innovation competence as part of MCs and, in turn, to create an approach for developing and measuring those skills and capabilities (Silva Pacheco & Iturra Herrera, 2021; Watts et al., 2012). In the context of higher education policy, recent pedagogical approaches have been geared toward enhancing students' innovation-related competences and contributing to their personal and professional growth.

Although studies on measuring competency in education have largely dealt with either the assessment of students' competences (Bjornali & Støren, 2012; Cuenca et al., 2015; Zlatkin-Troitschanskaia et al., 2015) or teachers' technological pedagogical content knowledge (Schmidt et al., 2009), studies on innovation pedagogy and faculty abilities in cultivating students' innovation-related competences have been remarkably few and far between. One of the most significant theoretical contributions was made by scholars at the Turku University of Applied Sciences in Finland, who developed the concept of innovation pedagogy with a view to improve the relevance of university training and foster the link between education, research, and the labor market. Such a broad approach to teaching and learning "defines in a new way how knowledge is assimilated, produced, and used in a manner that can create innovations" (Penttilä et al., 2013, p. 7). The approach may be viewed as being dedicated to not only teaching innovation but also highlighting methods that may also improve MCs.

Innovation pedagogy embraces the organizational setting and climate (e.g., interdisciplinary cooperation and internationalization), flexible curricula, learning and teaching methods, research and experimental development operations, entrepreneurship, and

service activities (Kettunen, 2011). Itincorporates methods for teaching and learning that enable the transmission of tacit knowledge in the context of working life (Kettunen et al., 2013). Within that framework, teachers' performance is regarded as a tool for fostering capabilities for creativity and innovation. It calls for the use of existing teaching and learning methods in creative, value-increasing ways while at once inspiring generations of new teaching methods while ensuring that students take responsibility for their own learning. It also emphasizes immediate applications of knowledge in problem-solving during the learning process (Penttilä et al., 2013). As a result, students graduate with professional skills and qualifications that are both innovative and oriented toward development.

4. Organizational perspective: dynamic capabilities and organizational improvisation

In this section, we venture beyond individual thinking skills to consider how such skills are embedded in the social systems of organizations. From an organizational perspective, MCs aim to enable organizations to adapt quickly to changing market conditions in order to continue to innovate and grow. To that end, they have to be able to perceive and understand the changes. In that effort, the ability to engage in organizational improvisation is pivotal, especially when unexpected changes arise, to remaining capable of acting outside routines.

4.1. Dynamic capabilities: adapting and innovating in complex environments

As shown in the previous section, individuals need to deal with increasingly dynamic environments. Likewise, today's organizations face increasingly complex, ever-changing external environments that fundamentally differ from those organizations in the 20th century (Taylor & Van Every, 2000). Today's fast-paced, technology-driven competitive environment calls for a more dynamic, organic, systemic, and adaptive approach as well as an understanding of organizations and their members. According to Johansen and Euchner (2013), VUCA worlds may be perceived as unpredictable and dangerous in regard to organizational resilience. At the same time, they offer new opportunities for innovation, which becomes the essence of organizational growth and survival. Organizations have to be prepared to respond to sudden external triggers, including unlikely but high-impact events. Such triggers and other disruptions can not only jeopardize the very existence of organizations but also serve as a vital impulse for adaptation and innovation (Brenner, 2018). Internal triggers, including the desire for change and a proactive organizational renewal, may also drive intentional transformation and innovative endeavors. Against that background, the question arises as to which organizational capabilities and (individual) MCs are needed, not only to survive in complex environments but also to thrive within them.

From a resource-based view, MCs echo the essence of dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997, p. 516). The dynamic capabilities framework helps to explain MCs by identifying (a) continuous learning, (b) iterative updates by exposure to the dynamic external environment, and (c) impacts on the external environment on both an organizational and individual level. In essence, it underscores the need to sense (i.e., identify developments) and to subsequently make sense (i.e., of information) of potential threats and/or opportunities (Weick, 1998). That process includes elements of the rational (i.e., doing market research) and the irrational and emotional (i.e., dreaming up new ideas and improvising). It also allows for developing provisional hypotheses about "what's going on," so to speak, and the quasi-validation of certain events and futuristic what-if scenarios (Baden-Fuller & Teece, 2020).

While exploring complex, uncertain future possibilities and exploiting present opportunities, organizations need to engage in many potentially incompatible activities at the same time. Such activities can include innovating for novel solutions while improving existing offerings, serving existing customers' needs while addressing potential future needs, hiring top talent in new areas while retaining current staff, and introducing new processes while improving operations, among others. Those dual-focused tasks require a particular subset of dynamic capabilities that O'Reilly and Tushman (2004) have termed "ambidexterity." Such dynamic capabilities also involve a combination of organizational routines and entrepreneurial leadership and management (Teece et al., 2016; Teece, 2007). Creative managerial and entrepreneurial acts (e.g., creating "blue ocean markets") are, by their nature, often disruptive and non-routine or even improvised. Indeed, "Many strategic actions and transformations require actions that one may never replicate" (Teece, 2012, p. 1397).

At core, dynamic capabilities enable organizations to learn how to learn, which becomes the essence of their competitive advantage and long-term survival. The more volatile, unpredictable, and complex the environment becomes, the more promising flexible, higher-level approaches to organizational learning become as well, which are constantly and iteratively updated and help to manage change. In a VUCA environment, high-performing organizations have to successfully balance exploration (i.e., transformability) and exploitation (i.e., efficiency) to survive and, ideally, thrive. An increasing number of ecosystem firms have shown that learning can occur within and beyond organizational boundaries (Parker et al., 2017).

4.2. Organizational improvisation: dealing with the unpredictable

The discourse of dynamic capabilities clearly illustrates the challenges of dealing with constantly changing environments. Along with continuous change, highly dynamic environments also increase the likelihood of sudden, unexpected events that require immediate action: the need to improvise, as described in the previous section, from an individual perspective. In recent decades, the search for novel approaches to better deal with those unpredictable disruptions and sudden changes has arisen. In 1995, the first Academy of Management Conference was held with the theme "Jazz as a Metaphor for Organizing in the 21st Century," which Dell (2012) called the beginning of the "improvisational turn." The focus of such research is the improvisational capacity of individuals and organizations resulting from the demand for short-term, exogenous change and the need for endogenous emergence (Tsoukas & Chia,

2002). From those challenges, the field known as "organizational improvisation" (OI) emerged, generally defined as short-term action in response to unanticipated events (Abrantes et al., 2022).

As described above, organizations provide the means, in the form of recurring patterns of behavior, standardized processes, and routines, to establish a stable, predictable world (Cunha & Clegg, 2019). However, traditionally developed stabilizing processes may no longer be sufficient in light of singular, unprecedented events. On the contrary, rigid structures and detailed plans may lead to inertia, thereby making organizations more unstable and fragile. Dynamic environments therefore require adaptable organizations that can effectively cope with the unforeseen and manage the unexpected in the sense of improvisation (Weick, 1993).

To make organizations more capable of acting even in short-term crises, various agile methods and thinking patterns come into play. The roots of such agile approaches reside in different domains. For example, design thinking emerged from the recognition that designers take an empathetic, customer-centric approach to iteratively discover and respond to customers' needs. Scrum, meanwhile, originated from the realization that software should be developed iteratively at shorter intervals instead of following long-term waterfall models. Lean management and, in time, lean startups were also inspired by automotive factories, where obstacles were removed to develop products as efficiently as possible (Zenk et al., 2023).

In those contexts, improvisation became another fundamental aspect of forms of agile organizations. Although improvisation as a thinking skill can be applied in different domains, the roots are historically found primarily in improvisational theater and improvised music, as described above. In theater, classical and improvised theater can be differentiated in a way analogous to classic hierarchical and agile heterarchical organizations. In classical theater, clear hierarchies and roles as well as predefined processes are specified. After the rehearsal phase is completed (i.e., planning), the play is performed in the same routine (i.e., execution). Changes are considered to be errors, and all attempts are made to avoid them; in addition, interaction with the environment (i.e., audience) is not intended. In improvisational theater, actors also prepare but do not plan a specific performance and do not follow an existing script. Added to basic acting skills, creative and cooperative competences are rehearsed, along with structures and underlying patterns of storytelling. On stage, the actors allow stories to develop from moment to moment without knowing how the story will progress. Compared with other agile forms, translations of relevant aspects into the organizational context are needed. Applied improvisation uses those methods and techniques to train improvisational competences beyond the arts, including real-time creativity and thinking skills as well as specific mindsets (Zenk et al., 2022).

In relation to increased scientific discourse on the topic, OI has emerged since the beginning of the 21st century, and the number of publications addressing it has grown rapidly (Cunha et al., 1999; Hadida et al., 2015). For example, Ciuchta et al. (2021) reviewed 186 peer-reviewed scholarly articles on the subject of OI from the past 25 years and presented an organizational framework for improvisation. Their framework illustrates that people and organizations first need to identify relevant triggers in order to subsequently perform improvisational actions and refer to them as a learning process. Doing so requires improvisational capabilities (Vera et al., 2014, 2016) in order to be able to step away from routines and best use currently available resources to solve problems and/or seize opportunities. In that sense, improvisation does not imply acting arbitrarily or only spontaneously. Instead, long-term preparation is needed to develop those aspects of MCs in order to be able to develop something new at a certain point in time or to respond quickly to a changing environment (Fisher & Barrett, 2018).

5. Systemic perspective: dealing with complex problems

In this section, we explore fundamental systemic approaches. From a systemic perspective, MCs aim to understand and solve complex problems, which requires inter- and transdisciplinary methods to overcome disciplinary boundaries and enable co-creative innovation. In addition to an underlying scientific–theoretical perspective, practical methods for solving complex problems are presented.

5.1. Inter- and transdisciplinary approaches

A useful metaphor for understanding unknown and complex phenomena is the well-known parable of the six blind men and the elephant (Daigneault, 2013). The blind men had heard of elephants but of course had never seen any. One day, an elephant was being led down the road, and intent on examining it, the men asked to touch it in its entirety. Its great size meant that each man could explore only a part of the animal at a time. Depending on the specific part explored, each blind man perceived and imagined the elephant's physical appearance very differently. The man who touched the side of the elephant claimed that it was a kind of wall, whereas the man who touched the animal's tusks insisted that the elephant was similar to a spear. Ultimately, they could not agree on a coherent picture of an elephant, because each of them had only understood one part of the animal, not its entirety.

That story illustrates a multidisciplinary approach that provides a richer collection of perspectives than a disciplinary approach can but does not integrate those different perspectives. A more comprehensive, shared perception of the elephant can emerge only through the interplay of the different perspectives. That perception relates to interdisciplinarity, which involves integrating concepts and methods of different disciplines. However, the desired integration can be challenging when terminology, rationales of reasoning, research traditions, and validation are essentially incompatible across disciplines (Scholz & Steiner, 2015).

Transdisciplinary approaches go a step further to address even more complex challenges, which can be divided into mode 1 and mode 2 transdisciplinarity. In the 1970s, mode 1 transdisciplinarity emerged in Europe (Jantsch, 1972) and the United States in pursuit of the coherence of disciplinary or "inner" science to better understand the increasingly complex challenges of industrial societies (Nowotny et al., 2011). The incompatibilities within the disciplines called for a new, consolidated, consistent science able to integrate all types of knowledge as a goal of a transdisciplinary process (Nicolescu, 2014).

Going a step further, mode 2 transdisciplinarity aspires to combine knowledge from science and practice (Gibbons & Nowotny, 2001) so as to mitigate the loss of information between disciplines regarding practical solutions. It aims to cope with the often ill-defined, complex, and societally relevant problems of interest more effectively in both science and practice (Scholz & Steiner, 2015). Integrating scientists' and practitioners' knowledge requires reflecting on and mitigating the conflicts of stakeholders' values, needs, interests, and goals. Therefore, it highlights the importance of integrating knowledge between science and practice that emphasizes consensus- and capacity-building, mediation, and the legitimization of diverse types of knowledge. In that context, a multistakeholder discourse is not only conducive to mutual learning but also requires MCs to integrate knowledge from science and practice to address specific real-world problems.

5.2. Competences and methods for dealing with complex problems

To remain capable of acting and adapting within the complex, rapidly changing environments described earlier, it is necessary to have the competence to accurately assess current situations. In terms of the Cynefin framework based on complexity theory, systems theory, and leadership theories, among others, it is vital to be competent in discerning whether a situation is clear (i.e., known knowns), complicated (i.e., known unknowns), complex (i.e., unknown unknowns), or chaotic (i.e., no consistent cause–effect relationships) according to Kurtz and Snowden (2003).

Although the steps required to make effective decisions in a complicated (predictable) situation are taken to sense the environment before analyzing and responding to it, complex (unpredictable) situations demand, first and foremost, the act of probing (Snowden & Boone, 2007). In a complicated situation, the availability of domain expertise can lead to mastering the situation by identifying a good strategy and subsequently implementing it using cause–effect relationships that are recognizable by experts. The course of action differs in a complex situation when the whole is different from the sum of its parts. Because the relationship between cause and effect becomes clear only in hindsight, launching a sequence of safe-to-fail experiments, observing what happens, and responding accordingly is advised to avoid unintended consequences (Sommersguter-Reichmann, Rauner, & Behrens, 2023). Doing so requires an experimental management style with people and organizations that are competent in continuous, structured learning.

The readiness to continuously learn is also the prerequisite for managing what Snowden and Boone (2007) have called "chaotic situations." In risk management, Hollnagel et al. (2017) have referred to such situations as "disasters" (e.g., the terrorist attacks on September 11, 2001, or Hurricane Katrina, which left most of New Orleans inundated for weeks in the summer of 2005). Learning has to happen rapidly in a chaotic situation and begins with doing, not with sensing, analyzing, or testing. In that context, no consistent relationship between cause and effect exists. Decision makers have to act first, observe what happens, and subsequently respond so as to transform the situation from being chaotic to merely complex (Snowden & Boone, 2007). The corresponding transformative competence includes combining and integrating different forms of knowledge. In other words, planners have to comprehend the current availability of resources (e.g., what is lacking), where the system does not function properly both conceptually and geographically, and what goods and services are expected to be needed for a resilient system (e.g., Behrens et al., 2022).

The ultimate goal of solving complex problems is to sufficiently understand the specific system and take appropriate actions. In that context, joint representations and collaborative processes for generating innovation and assessing its potential future implications are crucial. To transform a chaotic situation into a complex one, different methods support the process of coping. One way to acquire transformative competence is to apply problem-structuring methods from operations research (Rosenhead, 1996) and establish them before a crisis. We allude here not to problem-structuring skills per se but instead suggest that the consistent, ongoing use of problem-structuring processes may generate the skills and behaviors necessary for understanding and engineering a network of interconnected entities (e.g., an organization, a cluster, or a society) and for developing the readiness to respond to an unforeseen situation or event in a complex environment.

Problem-structuring methods facilitate transdisciplinarity and identify and structure "messy and wicked problems" (Pidd, 2009) within a collaborative group process to arrive at something that is well-defined. Even when the latter fails, the problem-structuring process itself can facilitate dialogue (i.e., but not necessarily consensus), generate and convey transdisciplinary knowledge, provide a chance to apply the knowledge, internalize (mutual) learning and, possibly frame a problem as a learning opportunity instead of a performance problem. By using cognitive mapping, for instance, problem-structuring can serve as a platform to gradually develop translators within organizations and society as well as an opportunity to establish translation (i.e., a dictionary, glossary, or lexicon) for use across disciplines and professions to further succeed in complex environments.

6. Discussion

How do people approach complex problems? In the history of the sciences, mostly disciplinary approaches have been and continue to be followed to investigate well-defined subproblems. Multi- and interdisciplinary approaches, on the contrary, perceive advantages in combining different disciplinary perspectives to investigate more complex problems. Transdisciplinary approaches focus on complex, societally relevant problems for which science has to collaborate with practice on an equal footing. To integrate scientific and practical knowledge to resolve real-world problems, MCs are needed that provide an approach different from disciplinary methods. Instead of initial analyses, probing activities are needed in which safe-to-fail experiments are conducted, their impacts observed, and iterative responses made. That experimental approach ensures continuous learning and a progressive understanding of various aspects of a complex phenomenon. To develop the readiness to respond to complex and uncertain environments, the required thinking skills need to be developed in advance. One way to develop those skills is to apply problem-structuring methods, which rely on the skills and competences of problem analysis, iterative learning, and information distribution.

Along with that historical, scientific, and societal perspective, the need for additional competences to deal with increasingly complex, ever-changing environments is apparent from an organizational perspective. Organizations fundamentally strive to optimize performance, but how they achieve that objective depends on the nature of the external environment in which they operate. Whereas steady-state environments call for robust organizational routines, structures, and processes, highly dynamic environments call for transformative and more flexible organizational capabilities and structures. In dynamic environments, organizations need to simultaneously exploit opportunities as they emerge and explore uncertain future potential possibilities. To tackle that juxtaposition, they need to constantly build and hone their dynamic capabilities, which require sensing to comprehend dynamic environments, and to make sense and interpret such information in a meaningful way and respond to it. In turn, the process promotes the ability to learn how to learn in organizations, which is vital for innovation, organizational transformation and renewal, and long-term resilience.

Along with the ongoing transformation, singular, unprecedented events require improvisational competences in addition to established processes in order to remain capable of acting outside routines. As a crucial aspect of agile approaches, organizational improvisation enables organizations to remain capable of taking action even in unexpected situations and to make the most of currently available resources. As described in problem-structuring methods, doing so requires both the identification of the situation in order to decide whether improvisation is necessary and long-term preparations to be able to act rapidly at a given moment.

From that systemic and organizational perspective in which individuals are embedded, certain thinking skills can be elicited. Dealing with unexpected changes in real time requires the ability to improvise. Suchman (1987) has called that ability "situated action, " in which the repertoire of patterns of action at hand is applied to a specific situation. That process illustrates how improvisation does not correspond to an arbitrary action but to a key aspect of MCs that has to be learned and continuously applied in the long term. The example of musical improvisation demonstrates that dealing with singularities—namely, a constantly emerging piece of music—can lead to overload due to constant change and the inherent possibilities. An iterative, intentionally limited approach reduces the unmanageable complexity and makes improvisation possible in the first place. Improvisational competence builds on years of experience with action patterns that can be reapplied to a novel situation in the moment. Thus, as described above, the iterative and collaborative discovery and exploration of new spaces is an approach to proactively addressing rapid change.

From those different contexts, long-term learning and experimentation have been emphasized as the generalist expertise to apply MCs appropriately to corresponding situations. Those skills should have been learned in higher education in order to be applied in different professional fields. The field of innovation pedagogy, already dealing with that field, emphasizes flexible curricula to foster capabilities for creativity and innovation. The aim is not to develop specific innovations but to learn a productive approach to uncertainty. For that purpose, real-world problems that students attempt to solve autonomously are the focus to learn essential aspects of MCs.

7. Conclusion

7.1. Model on MCs

What are the underlying factors for MCs from an interdisciplinary perspective? In our study, we have attempted to explore MCs from different disciplines and systemic levels. From an individual perspective, we have discussed aspects of improvisation, design, and (institutional) learning. However, individuals are often embedded in an organizational context that requires dynamic capacities and collaborative improvisation in order to cope with dynamic disruptions in the environment. From a systemic perspective, transdisciplinary approaches are called for to systematically understand complex systems. Using various disciplinary lenses and the resulting theoretical propositions, different aspects of MCs in various domains were identified in our study that describe knowledge, (thinking) skills, and experiences in terms of more effective coping with complex, uncertain environments. Following the method of proposition-based ERTs, a scientific discourse was conducted over the course of a year to pinpoint essential elements of MCs. Based on the various propositions and discourses, the following model was co-developed, which includes four key factors for acting in complex, uncertain environments (see Fig. 3).

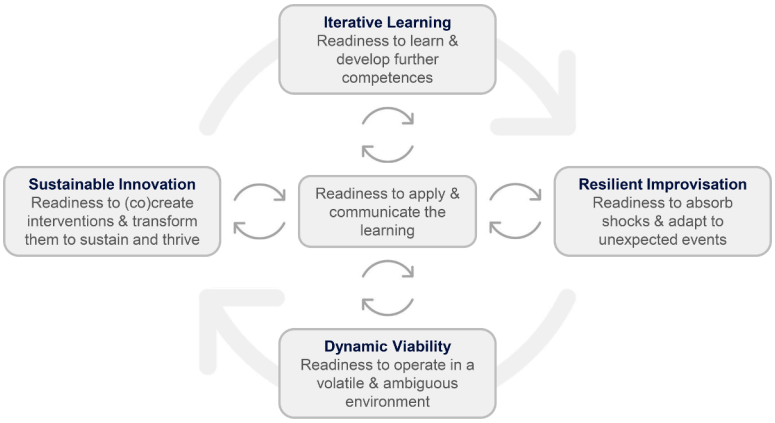

Fig. 3. Model of MCs from an interdisciplinary perspective.

Applying an interdisciplinary lens, we found that the readiness to apply and communicate the learning underlies all four identified factors of MCs. It emphasizes the application of personal experience, knowledge, and (thinking) skills to be able to understand and solve real-world problems. As seen in several propositions, collaboration is the key to integrate different areas of knowledge and thus communicate personal perspectives to others and reflect on one's own perception in the sense of mutual learning. Particularly in emergencies and crises, we depend on what we have already learned, adapt those learnings according to an unprecedented event, and distribute the novel information efficiently. That underlying driver is embedded within four factors that we consider to be essential for MCs. As indicated by the curved arrows in Fig. 3, those factors are not organized hierarchically but interact and reinforce each other.

Iterative learning comprises the readiness to learn and develop further competences. In the same way that successful interdisciplinary research builds on disciplinary knowledge, MCs entail essential domain-specific competences. However, the step has to be taken to go beyond one's existing competences, learn new ones, deploy them in real-world situations, and, in doing so, recognize basic patterns that are potentially evident in other domains. Especially in dealing with complex problems, we need different points of view, which in turn have to be integrated for a collective understanding, and to that purpose, an expansion of one's area of competence is critical. Such collective understanding is also crucial to move beyond the development of individual competence and facilitate organizational learning.

In rapidly changing situations, it is necessary to absorb shocks and adapt to unexpected events. Resilient improvisation combines both the short-term ability to act based on previously existing experience and the long-term orientation of sustainable systems. As discussed above, improvised actions are based on long-term preparation, the learning of methods, and the development of specific mindsets that enable one to remain capable of acting in sudden events. However, those actions go beyond spontaneous or arbitrary ad hoc responses. Well-trained basic routines that are adapted to different situations and aligned with larger development goals should further enhance resilient systems.

Dynamic viability emphasizes that in complex environments, people do not merely assume sporadic unexpected situations that can be easily resolved by specific interventions. On the contrary, MCs are needed to continuously operate in a volatile, ambiguous, and highly unpredictable environment. The COVID-19 pandemic, for instance, has shown that societies have to constantly monitor and re-evaluate current situations and unexpected changes. The hope of returning to a previous state of a system after such a sea change does not correspond to our understanding of complex, interdependent relationships, however. In that respect, viability expresses dealing with continuous dynamic changes and corresponding adaptations.

VUCA worlds reveal not only a concern about losing an established reality but also that it is possible to positively change this reality and let a new reality emerge. Sustainable innovation therefore exposes the reverse side of the coin as a means to (co-)create interventions and transform them to sustain and thrive. Innovation niches can especially emerge in profoundly changing systems that foster innovation and entrepreneurship in economic systems, for example. However, identifying such niches requires joint observation along with specific interventions to exploit them.

7.2. Limitations and outlook

In our study, we attempted to illuminate the complex phenomenon of MCs by following an interdisciplinary approach including individual, organizational, and systemic perspectives and following the method of proposition-based ERTs. The result was by no means exhaustive but should inspire further investigation into MCs in order to better deal with complex and uncertain environments. Although we sought a broad interdisciplinary approach, our study included experts from only one university in Austria due to the scope of the research project. In a further step, an international perspective is being emphasized so as to integrate culturally different aspects as well. Furthermore, for a transdisciplinary approach, we have planned to invite international experts from the industry to combine experiences from science and practice.

Although disciplinary approaches still dominate scientific discourse and have their own legitimacy, we consider an inter- and transdisciplinary approach to be essential for dealing with real-world problems. Thus, in our study, we aimed to contribute to elucidating the phenomenon of MCs from different perspectives, both methodologically and in terms of its content. Due to the current polycrisis and the presumption of even more complex challenges such as climate change, we see the need for a deeper understanding and education of MCs as being crucial for jointly understanding and solving real-world problems.

Today's educational institutions confront the dilemma of having to educate graduates simultaneously in reference to current but also future labor market requirements. If successful, then graduates are prepared well for the coming waves of automatization and digitalization, for they have the capability and capacity to either meet new work requirements or innovate and create new job profiles and work content (Bast et al., 2018). In that way, the future of education is intrinsically linked to MCs, for those foundational skills are essential to preparing students to thrive in a rapidly changing world. As artificial intelligence reshapes the job market, the ability to think critically and from different perspectives, adapt to new situations, collaborate across cultures and disciplines, and engage in lifelong learning have become more critical than ever. Education systems that prioritize MCs are equipping students not only with knowledge for today but with the adaptive skills needed for tomorrow. That shift toward fostering viability, improvisation, and communication skills ensures that learners can navigate complex challenges, innovate in the face of uncertainty, and meaningfully contribute to society. By embedding MCs into curricula, teaching strategies, and assessment methods, education is evolving to meet the demands of the future, to ensure that students are prepared for careers that may not yet exist, and to enable them to take the lead in creating a more equitable, sustainable, interconnected world.

Concerning teaching and learning, future curriculum design should cultivate adaptability and flexibility in order to prepare students to navigate change and uncertainty. Beyond that, ensuring that educators have access to continuous professional development opportunities focused on MCs is key to successful implementation as well. Such opportunities could include workshops, courses, and

collaborative learning communities that enhance teaching skills and strategies. Moreover, educators should model MCs in their teaching and interactions and, in that way, demonstrate the value of lifelong learning, adaptability, and improvisation, thereby inspiring students to develop such essential thinking skills and real-time creativity. Encouraging self- and peer assessments fosters a culture of self-regulation and critical reflection that empowers students to take ownership of their learning journey. With the MCs that they have learned, they should ultimately be able to face the even more dynamic, complex systems of the future with confidence.

CRediT authorship contribution statement

Lukas Zenk: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Attila Pausits:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Barbara Brenner:** Investigation, Writing – original draft, Writing – review & editing. **David F.J. Campbell:** Investigation, Writing – original draft, Writing – review & editing. **Doris A. Behrens:** Investigation, Writing – original draft, Writing – review & editing. **Eva Maria Stöckler:** Investigation, Writing – original draft, Writing – review & editing. **Stefan Oppl:** Investigation, Writing – original draft, Writing – review & editing. **Gerald Steiner:** Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Data availability

We have included a proposition in the manuscript as Appendix to illustrate, how propositions were articulated.

Appendix

Example of a proposition for the expert round table on meta-competences

Name

Lukas Zenk

Department/Institution

Department for Knowledge and Communication Management

Website
Please include your website or social platform

www.improvisation.science

Contact

lukas.zenk@donau-uni.ac.at

Your **background**
What is your background (discipline or expertise) to observe this phenomenon?

Organization science (computer science, psychology, sociology, social networks), creativity and innovation research, organizational improvisation, expertise in improv theater

Key factors
Please include up to 10 key factors that, in your opinion, are of relevance regarding meta-competences.

• Dealing with uncertainty • Iterative process of discovery • Real-time creativity • Situational awareness • Perspective taking • Empathy • Deep listening • Identification of patterns

Propositions

Please identify and describe one or two propositions.

Proposition 1

Proposition (approx. 20 words)

Improvisation is a general human behavior that can be applied to various professional areas. (Selected parts of our recent publication (Zenk et al., 2022) are summarized below.)

Abstract (approx. 50-100 words)

The dynamics and complexity of the challenges of our work and lives create numerous unpredictable situations. Improvisation is the phenomenon of dealing with unexpected situations while creating new solutions in real time. Although the literature extensively addresses the topics of improvisational theater, improvisational music, and improvisational creativity in product design and project management, the underlying factors and characteristics of improvisation as a general human behavior have not been systematically analyzed

Brief literature review with references (approx. 200 words)

Please briefly describe current concepts and publications in the field.

Improvisational behaviors have been studied extensively in specific domains, particularly theater and music (Barrett & Limb, 2019). Several studies have demonstrated that such thinking skills affect not only domain-specific expertise but also more general cognitive abilities. For example, Alfonso-Benlliure et al. (2021) found that experience with drama generally promotes higher levels of fluency, flexibility, originality, and self-perceived creativity. Felsman et al. (2020) have also demonstrated that training in improvisational theater can improve divergent thinking, the tolerance of uncertainty, and individuals' affective well-being. Meanwhile, Lage-Gómez and Cremades-Andreu (2019) found that group-based improvisation leads to the emergence of group flow and positive emotions, while Freitag Granholt and Martensen (2021) have concluded that "looking past the performative aspect, the skills and mindset of improvisers are highly desirable in other contexts like collaboration, idea generation, being flexible, listening and accepting failure" (p. 7). Against that background, it is unsurprising that improvisation has already been a focus of study in other fields, including entrepreneurship, change management, and organizational strategy (Ciuchta et al., 2021), and in the context of events such as wildfires, hurricanes, and terrorist attacks in emergency operations (Mendonca & Wallace, 2007; Roud, 2021). Thus, we assume that (1) improvisation is a general human behavior in the context of situations characterized by uncertainty and volatility and (2) is based on sets of thinking skills, competences, and mindsets that can be applied in different domains (Findling et al., 2020).

Detailed argumentation (approx. 200 words)

What is the need for your proposition? Who is the target group?

Traditional theories of human action consider that humans set goals for themselves, identify the means available for achieving the goals, develop a plan within that orientation framework, and carry out the actions accordingly (Kirchler, 2011). That process, following the idea of the rational homo economicus, refers to planned actions (Straub, 2006). Considering the unforeseeable (Latin: improvisus), however, complex problem-solving in real time or reacting adequately to unexpected situations and events without a predesigned plan cannot be properly explained within those assumptions (Baran & Woznyj, 2020). Situations often happen differently than planned, particularly because all relevant aspects of a given situation cannot be considered in our plans due to cognitive limitations of information processing. Unpredictability, uncertainty, volatility, and temporal urgency all have their own quality of action, and if challenges and the implementation of solutions have to be addressed concurrently, then improvisation is the main framework for action (Cunha et al., 1999).

Lessons and implications for continuing education (approx. 200 words)

How does the proposition affect the need for further training and education?
Which competences should be learned and how?

In the UN's Sustainable Development Goals (SDGs), quality education (SDG4) is of particular importance, and guidelines for promoting lifelong learning opportunities are provided for Agenda 2030. The SDGs and the Organisation for Economic Co-operation and Development's 21st-century skills initiative on innovation have become central to recent discussions about the future of education and new skills development (van Laar et al., 2020). Although the development of improvisational competences to deal with unexpected situations plays a particularly important role in today's rapidly changing societies, appropriate learning and training activities remain available only in highly specialized training programs. Thus, more research on (professional) improvisational behavior as an essential 21st-century skill is needed to deeply investigate such a complex behavior. Based on an improved understanding, better learning and training programs and appropriate frameworks for organizations could be developed to better prepare individuals and groups for the unforeseen and unpredictable challenges of increasingly dynamic, complex societies.

Meta-Competences

Proposals: Definition of meta-competences or already existing definitions

- Meta-competences as an additional theory of action
- Meta-competence as a set of competences to proactively and reactively deal with unforeseeable situations in a short time

Barriers

What are the major barriers to implementing your proposition?

- The term improvisation is associated with improv comedy and unprofessional behavior.
- The concept of improvisation research remains in its infancy.

Potential interventions

What are the potential solutions for implementing your proposition?

- Investigating the improvisational competences of experts and non-experts in various domains
- Conducting systematic reviews on the topic

Proposition 2

Proposition (approx. 20 words)

Improvisation is a learnable and teachable behavior.

Abstract (approx. 50-100 words)

Improvisation, similar to the ability to plan, is understood as a way of acting and thinking. From that perspective, improvisation is not a talent but a skill that can be learned.

Brief literature review with references (approx. 200 words)

Please briefly describe current concepts and publications in the field.

With few exceptions (e.g., Krueger et al., 2017; Seppänen et al., 2019; see also Proposition 1), empirical research on people's improvisational skills in organizations remains lacking. In that regard, Ratten (2016) has stated, "Although there has been a wide ranging discussion on improvisation in the business literature, little of this has focused on the effects of improvisation training on workplace outcomes. The literature that does exist provides a helpful starting place for researchers to move improvisation training from the realm of theory to the empirical testing of practice" (p. 153). One of the founders of the applied improvisation network, Paul Z. Jackson, confirmed upon request the scientific and systematic research still needed to empirically prove the expected effects of the applied methods.

Detailed argumentation (approx. 200 words)

What is the need for your proposition? Who is the target group?

In teaching improvisational skills, specific methods and principles of improvisational theater are primarily used because of their transferability to situations in everyday life (Vera & Crossan, 2005). In improvisational theater, actors go on stage without prescribed dialogue, receive inspiration from the audience, and decide on the particular action in the moment. Historically, improvisational theater is rooted in therapeutic and educational concepts to develop or train certain skills in people. Moreno, a psychiatrist who has applied improvisational theater, wanted to enable his clients to overcome stuck patterns with the help of spontaneity (Moreno & Moreno, 1995). Spolin (1999) has encouraged actors to focus on the here and now on stage and in everyday life, while Johnstone (1981) challenged his students to make mistakes and fail with fun. Improvisational theater therefore trains skills that fundamentally benefit people's improvisational abilities beyond the stage. In the 1990s, the field of applied improvisation developed, and in early 2002, the international Applied Improvisation Network was founded for that purpose. Applied improvisation draws on methods, practices, and tools of artistic improvisation from jazz and theater to teach improvisational skills to people in business (e.g., at Google and McKinsey; Rats, 2016), health, and education.

Lessons and implications for continuing education (approx. 200 words)

How does the proposition affect the need for further training and education? Which competences should be learned and how?

See Proposition 1.

Meta-competences

Proposals: Definition of meta-competences or already existing definitions

- Potential skills
  - Creativity and ideation
  - Collaboration
  - Co-leadership
  - Cognitive flexibility
  - Adaptation
- Potential mindsets
  - "Yes, and"
  - Failure culture
  - Let your partner shine
  - Minimal structures
  - Embrace uncertainty

Barriers

What are the major barriers to implementing your proposition?

- In which curriculum should the proposition be embedded?
- What would the name of the course be?
- Who are experts in practice or science who could teach the course?

Potential interventions

What are the potential solutions for implementing your proposition?

- Integrate improvisational competences with other better-known and documented competences
- Acquire fundings for a new research project

Feedback (from other participants)

Please provide your feedback on the author's propositions.

Your name: Barbara
@Proposition1:
It seems too general. I would argue that the context determines the effectiveness and applicability of improvisation. In highly stable (or standardized) contexts and environments, routines may be superior. In uncertain, complex, and volatile contexts, improvisation may be helpful.

Your name: Attila
@Proposition1:
It is not clear how "behavior" can be linked to meta-competences. I would assume that further conceptional work is needed in order to (a) find a proper wording and (b) linkages between knowledge, skills, attitudes, and improvisation.
@Proposition2:
See my comment on behavior above. Maybe rephrase it to "Improvisation skills and competences can be developed in teaching and learning settings and be used to foster the development of meta-competences in general as an attitude to act in different and diverse unforeseen situations accordingly."

Your name: Eva@Proposition1:
- There is a difference between musical composition and improvisation not only in the factor of time but also in the fact that a composition is very much related to notation and the aim to keep the music over time and distance. That requires planning a compositional project that differs from planning an improvisation.
- One of the biggest obstacles of musical improvisation is that previously learned routines and procedures have to be abandoned. So, for many classically trained musicians (except organ players), improvisation is an unknown field. Some change instruments (e.g., a professional cello player in an orchestra plays saxophone in a non-professional jazz ensemble).
- Improvisation in music (i.e., the arts) follows an aesthetic perception, which is different from improvisation in business.

@Proposition2:
- Because improvisation is a core ability in jazz and popular music (and in classical organ playing), there are several different pedagogical methods and concepts for teaching improvisation. Whereas organ improvisation has a very long history, jazz improvisation, as a relatively young academic field, arose in the mid-20th century and is still a field of academic and pedagogical discussion and artistic practice.

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