SOCIAL INNOVATION IN EDUCATION

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SOCIAL INNOVATION IN EDUCATION

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EDITORIAL
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Editorial: "Social Innovation in Education"

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Editorial on the Research Topic

Social Innovation in Education

The education sector was increasingly confronted with reform and innovation initiatives across relevant fields during the last years. Education reports and international assessments are used by day-care centers to implement early childhood education and to open up to the primary sector. National and international demands confront schools with new concepts of school development. In Higher Education, the effects of international education innovations seem even more obvious. In social education and social work a renewed interest in emerging needs and resources in local communities has led to a rise of social entrepreneurs who promote innovative solutions. In this Research Topic, we discuss educational reforms against the theoretical background of the debate on social innovation and examine how individuals and organizations in the educational sector respond to risks and challenges with innovation. The concept of innovation as a motor of social and economic development was taken up in the sociological discourse of the 1990s, which led to increased public interest in the concept of social innovation. Zapf (Zapf, 1989, 177) argued for a broad understanding of social innovation as "new ways to reach certain goals, particularly new organizational forms, new regulations, new lifestyles, which change the direction of social change and which better solve existing problems than previous practices". Over the last 2 decades, concepts of social innovation have included normative (Moulaert et al., 2013), functional and pragmatic positions, ranging from increasing social justice to identifying feasible (often technical) and novel solutions to social problems (Phills et al., 2008). Others see the core of social innovation in the explicit recombination of social practices (Howaldt and Schwarz, 2010). The impact of individuals, organizations, societies, and education policies, as well as the social dimensions of innovation have long been treated as secondary; however, due to the increasing awareness of both the significant social consequences and the impact of social innovations (Chesbrough and Di Minin, 2014), a growing number of researchers have begun to study the social science aspects of this problem. Recently, scientists have begun to analyze innovations in relation to social issues (Chesbrough and Di Minin, 2014). Particularly in the context of digitization, we find a lively discussion of technical innovations on the one hand, but on the other hand this is closely linked to attention to accompanying social innovation processes. Recent literature on (open) innovation emphasizes the importance of cross-sectoral cooperation, networking and linking different knowledge bases for the creation of innovations (Chesbrough, 2006). Overall, we can observe that the debate distinguishes between more critical and more positive perspectives. This may be related to the perspective from which the dynamics of social innovation are perceived. On the one hand, we find in the education sector a specific debate on government-driven reforms, which are top-down strategies for reorganizing social structures and practices. On the other hand, in the economic context, social innovation is seen as an organizational process that results from specific organizational practices and needs and can thus be described as bottom-up processes of social innovation.

In this Research Topic, we would like to contribute to the further development of the debate on social innovations by opening it to the topic of educational reforms. We understand social innovations as "new

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ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations" (Howaldt and Schwarz, 2010). Our position is supported by recent empirical studies, which identify education as an important field for existing social innovation initiatives worldwide (Howaldt et al., 2018). Social innovations in education therefore imply processes of knowledge resources, constellations of actors, pedagogical and organizational practices and educational discourses. From the editors' perspective, there are many good reasons why a critical debate on social innovations in education is appropriate and necessary at this time: Ambivalent experiences with reform projects must be analyzed in a differentiated manner and their implications examined.

Technological innovations in education, such as distance learning, learning software and cloud-based collaboration, continue to change educational practice worldwide, even today. Crises, such as the current pandemic, are likely to further fuel these processes of change. There is an increasing need for bottom-up solutions to social problems worldwide. At the center of the debate is often the search for (new) sources of funding. In the literature on management and organizational learning, too, we find a growing interest in the phenomenon of social innovation, especially in the questions of the supporting and inhibiting factors for the development of social innovation in organizations. It is therefore an ideal time for the bundled publication of highly topical research articles. The Research Topic brings together contributions from renowned researchers in the field who are systematically addressing the question of what contributions social innovations in the field of education make or can make worldwide and, conversely, how education research can enrich the study of social innovations.

The ten articles in this unique Frontiers Research Topic are not reduced to empirical debates and new findings alone. Rather, they also focus on conceptual analyses and theory developments. They raise the topic of social innovation in education from different conceptual points of view, as a process of co-construction (David; Ehmke; Kohlgrüber) or social-dynamic interaction (Wendt) as well as a concept of networking (Kallio; Schuster). Moreover, they discuss social innovation in education from the perspective of the overall discursive and political knowledge (Luthardt et al.; Resch et al.) on the one hand and as a result of individual and organizational learning on the other hand (Semper et al.; Schröer).

Schröer provides a conceptual analysis and discusses furthering and hindering aspects to promoting social innovation in social and educational organizations. The paper examines social innovation through an education research lens and reveals the close relation between learning, creativity, and innovation. Wendt analyzes digitalization in organizations and emphasizes the role of digital transformation for structural automatization and but even more so, for structured structurelessness in organizations. Resch et al. discuss service learning as an innovative and socially responsible teaching methodology and therefore as social innovation in the context of Austrian Higher Education. The article analyses how the strategic development of service learning as social innovation contributes to the policy goal of strengthening the so-called "Third Mission" of Austrian universities. Kohlgrüber et al. describes a software co-creation process, which involves software developers and users, and analyze how technology serves as enabler of social innovation. Based on this example the authors deduct new skills of employees as key competences for digital transformation and emphasize the importance of mutual learning in the innovation process. Straub and Ehmke present the results of an empirical teacher education study on Transdisciplinary Development Teams (TDTs). In addition to presenting results on knowledge integration and mutual learning, the paper offers a concept to frame interorganizational, boundary-crossing collaboration in teacher education. Schuster and Kolleck analyze Twitter communication networks related to inclusive education. Their findings of a social networks analysis indicate how the online communication tool Twitter plays an important role for the global diffusion of social innovations in education and effect education policies, norms and systems at the global, national and regional levels. Krüger and David analyze the rare practice of entrepreneurial education for persons with disabilities through a social innovation lens; they argue for entrepreneurship and entrepreneurship education as empowerment and discuss opportunities of an inclusive entrepreneurship education within an inclusive learning ecosystem. Semper et al. discuss three models of human development, autonomous self (AS), processual self (PS) and inter-processual self (IPS), with respect to their implications for understanding of cognition and their respective educational consequences. This conceptual analysis particularly informs the design of innovative programs in teacher education and training. Kallio and Halverson analyze Networked Improvement Community (NICs) as a social innovation for orchestrating sustained change in education. Their particular focus lies on emergence and building of trust in collaborative design activities within these networks. The results of their qualitative, case-based study contributes to research on measuring effects of networks on participants and their practices and deepen the theoretical conversation on how colloborative practice and design activities contribute to long-term development of relational trust. Finally, the paper of Luthardt et al. is based on the assumption of a discursive production of knowledge on the application of an innovation across different levels of the education system. It analyses an innovation's "journey" from educational policy over training providers to teams of professionals in early childhood education and care. The findings enrich the debate on obstacles to social innovation, such as the lack of a common language across the levels of the innovation process.

In this way, the research topic brings together contributions in an increasingly internationally relevant field of research and provides answers to the questions of whether and how educationally motivated interventions 1) generate social innovation through the mobilization of actors and their knowledge and pedagogical practices or 2) provoke persistence and thus lead to a consolidation of knowledge stocks, actor constellations and pedagogical practices.

AUTHOR CONTRIBUTIONS

CF, NK, AS, and IT contributed all to the conception and design of the Research Topic. They invited authors and organized the reviews. All authors contributed to manuscript revision, read, and approved the submitted version.

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CONCEPTUAL ANALYSIS
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Educational Implications That Arise From Differing Models of Human Development and Their Repercussions on Social Innovation

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Social innovation aims for creating social value primarily while it recognizes that not all technology-based progress amounts to social progress. We think that this calls for a paradigm shift in how we understand education. No one doubts that education requires intense cognitive effort, but educational proposals certainly vary depending on how cognition is understood. In this article, we suggest that different ways of understanding human development are related to different ways of understanding cognition. Thus, these different conceptions of human development affect their resulting educational proposal. While not an exhaustive account, we sketch out three models of human development, the so-called autonomous self (AS), processual self (PS), and inter-processual self (IPS). Each has different implications for education depending on their particular understanding of cognition. The AS and PS models understand cognition as a primarily rational mastery exercise, with the difference that PS uses relationships and diverse psychological faculties for the subject's cognitive development, whereas AS relies more on the subject's rational agency. On the other hand, IPS understands cognition as a relational act that, when it arises from interiority, affects all dimensions of the person. In the present article, we explore the educational consequences of these different ways of understanding cognition with the assistance of interdisciplinary dialogue from philosophy, psychology, and neuroscience, and their repercussion on social innovation with the intention of opening up reflection in the field of education and of inspiring its practitioners to rethink the model they assume. We will conclude with reflections informing educational implications for the design of programs and teacher training itself.

Keywords: cognition, human development, educational models, inter-processual self, innovation

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INTRODUCTION

The concept of "social innovation" has primarily emerged from humanities and social sciences scholars rather than from literature and debates on innovation within economics; consequentially, not all innovation theory scholars from economics agree that it captures a conceptual aspect that differs from (any other sort of) innovation (Pol and Ville, 2009). However, theorists from social economics and from the social sciences and humanities suggest that it is a distinct concept and

captures important pro-social motivations toward offering social value and growth (Pol and Ville, 2009)[1].

Existing definitions coincide in that they stress that, insofar as innovation is conducive to enhancing human welfare, it is social and distinct from other forms thereof (Pol and Ville, 2009). Hence, social innovation *intends to* innovate such that social needs are met (Moulaert et al., 2005, p. 1976). Historically, social innovation arose from the fact that technological innovation through competition does not guarantee social development and can even be counterproductive to it (Meadows, 1972). Of note, society is here understood as an agent, not as a sum of individuals and education is recognized as one of social innovation's most important fields of action (Moulaert et al., 2005, p. 1970).

We argue that the concept of social innovation can aid our understanding of education. By starting with an educational model focused on competition, we reproduce errors that necessitated social innovation in the first place. In the same way that technological development does not in itself imply truly sustainable improvement of society, teaching to skills does not in itself mean developing an education in the service of society. Education studies have indicated that solely focusing on the development of skills can be counterproductive (Delors et al., 1996, pp. 16–18). In this sense, the concerns found in the literature on social innovation coincide with those of Delors, whose goal for education is learning to live together. The latter focus may even feed into social inequalities.

We need another way of understanding education since innovation in education cannot merely focus on increasing efficiency and effectiveness when it comes to skill acquisition. For that, we must employ a social understanding of education from the very beginning. This article thus proposes a social model of human development called the "inter-processual self" (Akrivou et al., 2018) and applies it to education "centered on the interpersonal relationship" (Orón Semper and Blasco, 2018). It further provides an adequate conceptual framework for education in service of social innovation, suggesting that education that does not have a social foundation will not successfully integrate social aspects later.

Since social innovation is highly interdisciplinary (Mulgan, 2012) and this issue focuses on education, we have reviewed the basics of cognition and human development as they relate to education in dialogue with philosophy, psychology, and neuroscience. Thus, we arrive at an educational model that is coherent with social innovation.

Every educational proposal is based on various theoretical assumptions, which naturally come from other disciplines that serve as the source for a conceptual framework. In particular, the natural sources for education are psychology and philosophy because one's view of the person and her development structures the resulting educational proposal. Obviously, this does not resolve the work of education; rather, as an autonomous discipline, it has its own field of study. A new source of influence on the field of education materialized with neuroscientific developments at the beginning of the twenty first century, providing a contrast to verify if certain pedagogical dispositions are congruent or not with neuroscientific discoveries. In the present article, we go into a theoretical discussion centered on the person and her development. To do this, we put philosophy, psychology, and neuroscience in dialogue with the intention of opening up reflection in the field of education and of inspiring its practitioners to rethink the model they assume.

Since organizational education has been well-defined as a field of study (Göhlich et al., 2018), it has been acknowledged that educational such as the school and the university (and broader organizations), in order to learn and to influence learning in society, must be protagonists within the wider learning context through cooperative practices at micro, meso, and macro levels. Hence, a main research concern in organizational education is ways in which learning in (educational) organizations can be understood and explored. Within this context, there is an interesting stream of research in organizational education that aims to share data and build theory on how best social value, learning, and innovation ensue from educational programs that develop relations and networks of exchange within their wider community as a distinct strategy for social innovation (for example, Grogan and Fahrenwald, 2019 in Weber et al., 2019).

In previous research (Akrivou and Orón, 2016; Akrivou et al., 2018), we have identified two major competitive lines in human development today, the so-called Autonomous Self (AS) and the Inter-processual Self (IPS); now, we intend to show their influence on education. Our aim is to contribute on the organizational education stream of work concerned with how to elevate educational relations to positively influence learning and growth involving wider forms of community and "polis" (the superordinate socio-political organizations wherein schools and educational institutions are situated). The focus of our contribution is to share new theory on these contrasting educational paradigms (AS and PS—which is a sub-category of AS—vs. IPS), which allows us to reflect on how their conflicting or incommensurable anthropological approaches ("mindsets") regarding the self and action involving relations are understood, and to derive educational implications to be utilized in the context of designing different learning interventions and informing teacher training too.

Our published work introducing these incommensurable paradigms of self and action has been inspired by the neo-Aristotelian Spanish philosopher Polo (2012, p. 281), who synthesized the key ontological concerns in the history of philosophy regarding being human and proposed the following three main fundamental roots that inform what is involved in being human throughout different philosophical and historical systems of thought: (1) A rootedness in "nature," which captures the classical philosophy and Aristotle's basic proposal (that we are constituted by our shared and distinct biological, cultural, and

Abbreviations: AS, Autonomous Self; PS, Processual Self; IPS, Inter-Processual Self.

[1]While it goes beyond the scope of this article, it is worth mentioning that, within the scholarly debate on definitions of social innovation, many authors focus on new idea generation that, according to Heiskala (2007), constitute "social innovation" insofar as they bring about "change in at least one of … three social structures: cultural, normative and regulative." Pol and Ville (2009) have criticized this definition as too broad. Upon reviewing the literature, they believe that social innovation exists if the novel idea(s) involved can potentially improve quality or quantity of life.

traditional sources); (2) the rootedness in the modern "subject-agent" fundamental, which expresses modernity's emphasis on the human drive to create novelty and to succeed in its mastery over the wider human and non-human environment via rationalistic agency, with a focus on results; and (3) the predicament involved in the fundamental of "personhood" (or Christian fundamental root of human civilization); this latter emphasizes personal singularity and uniqueness as well as that at the heart of being and growing as a human being. Accordingly, we characterize the AS paradigm on the self and action as the mindset that comprises the different modern and post-modern proposals on the self and action. This model (AS) conceives human growth as a result of individual productive activity aiming to dominate and "master" the environment as a focal object, according to the wishes of the actors-subjects. The PS model is presented as a variation or maturation of the AS model because it gives value to relationships; however, in this mindset, relation is understood in a rather instrumental fashion, i.e., a relation with another person or a community or a network is seen as a focal object and just like in AS the aim is to master the object according to the wishes of the actors-subjects.

Conversely, we suggested that IPS is an integrative mindset, uniting Polo's "personhood" with the classical root of "nature" and the modern approach of the "subject-agent." Who we are and how action is understood from within IPS involve an ontology of relation from the very constitution of our being. Accordingly, in IPS, growth is not understood as success via mastery, but it is understood as the "intensification of the relationships that constitute the human person in what she fundamentally is."

Depending on which of these two corresponding paradigms—AS/PS or IPS—is taken as a point of departure to characterize the person, there will be different ways of understanding cognition and education (Akrivou et al., 2016).

This classification can be enriched thanks to the current neuroscientific debate, led by Kahneman (2011), who presents two brain systems that are related to various psychological processes: system 1—also called rapid system—which results on a more emotional character, and system 2—also called slow system—which is more cognitive. He maintained that many human mistakes are a result of system 1 being decisive in decision-making, whereas more accurate answers are given when decisions are made from system 2. From this, we hypothesize that the AS model corresponds to a person acting according to system 2, the PS as a synthesis of models 1 and 2; and the IPS does not enter into this way of understanding decision-making (and its related way of approaching cognition) but rather in a different form of understanding the most dynamic and systemic cerebral operation that does not admit this association of cerebral modules to psychological processes. As a result, the PS is presented as a superior stage to the AS—an integration of systems 2 and 1, but IPS does not respond to this classification.

We suggest that new research introducing the IPS (Akrivou and Orón, 2016; Akrivou et al., 2018) critically argues that *who/what we really are* as humans involves being and growing as an integrated person, which requires integrating the three aforementioned fundamentals that are cross-culturally important for understanding the self, human action, and meaning, in other words, human nature, each personal and singular reality, and the capacity to produce new realities. The IPS proposal is related to another way of understanding the brain and mental functioning that pressuposes a systemic and dynamic approach (Kelso, 1995; Sporns, 2011, 2014; Pessoa, 2013; Anderson, 2014). According to this systemic and dynamic view, by synchronic processes, the whole brain is unified in each mental action, and the modular vision that relates brain modules with psychological functions has already been put in relation with the different ways of understanding emotional education (Orón et al., 2016). This opens a wider hypothesis that relates the three models of self-development (AS, PS, and IPS) with different neuropsychological models (dynamic and modular). This relationship between different understandings of the self and neuropsychological models will strengthen the conceptualization offered, allowing us to better conceptualize the different ways of understanding cognition and its subsequent application to pedagogical reflection, and social innovation.

In this article, we will proceed as follows: first we will introduce the AS, PS, and IPS models in relation to our topic. Then, we will relate these contrasting paradigms to different proposals that arise from research in neuropsychology and then we shall relate these to inform and reflect on how each influences how networks and educational relations with wider social communities may be understood.

THE MODERN PERSPECTIVE UNDERLYING THE AS AND PS MINDSET

The two contrasting proposals regarding the "mindset" assumptions on the self and action that characterize the AS/PS proposal and the IPS naturally express two distinct conceptualizations regarding action with moral maturity and how the self relates to others in any action. The AS and the effort to overcome AS's limitation through a transition to a PS capture a modernist approach relating human cognition and congruent action with maturity. The difference between AS and PS lies mainly in their view of cognition, which once explained will also allow us to understand why IPS is a revolutionary approach.

Behind the AS and PS cognition is the idea that cognition (mental models) drives action, which is also influenced by the individual-context interaction (Blasi, 1980, 1983; Trevino, 1986; Jones, 1991; Aquino and Reed, 2002). For example in descriptive individual factors that drive persons to act ethically in the face of various ethical and performance challenges, the main assumption is that the stronger a person's cognitive capacity regarding the domains of moral awareness and meaning making (Aquino and Reed, 2002), the higher the individual's capacity to act effectively facing moral dilemmas in the real world (for example, in Kohlberg, 1969 and in Murphy and Gilligan, 1980). So action (in this case, ethical action is seen as a domain of individual behavior) is understood as driven by individual cognitive growth that is rooted in the Piagetian human development stage hypothesis (Piaget, 1962).

This assumption shapes the understanding of wider human development theory regarding action with maturity in broader

life domains; hence, different models have been proposed on the same assumptions that understand individual action with maturity facing intellectual and social challenges in the world under a uni-linear stage hypothesis, for example, different post-Piagetian stage theories of human development (such as Harvey et al., 1961; Flavell, 1963; Loevinger, 1966, 1976; Perry, 1970; Kegan, 1982, 1994; Lahey Laskow, 1986). Such theories share a common biologically based assumption rooted in Werner's (1948) orthogenic principle (Johnson, 2000), which suggests that action under the human developmental "modern" paradigm is an idealized upwards progression movement following a notion of stages when temporarily equilibrium has been reached; this is marked by an increasing degree of cognitive complexity. So, equilibria are expressed in terms of specific cognitive stages. Each hypothesized equilibrium motivating cycle of action is fueled by a certain quality and dynamics of cognitive (and moral) maturity (Akrivou, 2008). Increases in cognitive complexity are thought to enable motivational mechanisms in the self to synthesize complexity, which is thought to allow the progression toward the highest levels of hierarchical growth where in all these theories is the only moment possible for human action to be characterized by integrity. Integrity is seen as a concern to respond ethically to the social world without only one's own interest resolution in mind[2].

A key assumption of all the modern paradigm on the self and action with integrity vis-à-vis the social world is the idea that individual autonomous cognitive development lies at the basis of development until about the end where the concerns of the subject-agent is basically how to succeed in forms of tactical and strategic action, which allow the mastery of the object world. The same authors however recognize their very key assumption as a weak hypothesis at a late stage of development in their models, when a dualistic switch is proposed to a more intuitive, dynamic, and adaptive kind of action that does not follow a cognitive rule but is mainly about reacting effectively to external stimuli. This is the PS proposal that, however, does not substantially overcome the assumptions and limitations of the AS (main model) as it is still mainly concerned about how the subject can lead successful autonomous "authorship" via cognitive mastery of the object world. The only difference here is that action is mainly through dialectical relational responses, whereby relations and the object world at large are being used as means for the acting subject's own cognitive growth via a more open, fluid, and dynamic response capacity. In this version of the AS (i.e., the PS), the ethical dimension of action disappears as a key concern behind action, which is replaced by the ideal of freedom of the autonomous will at the base of the PS proposal. However different these two models—which we summarized as the AS and the (post-autonomous) processual self (PS)—have been, they have quite congruent basic assumptions; hence, PS in the majority of models appears as the end stage following the highest forms of action characterized by AS.

We suggest that, across AS and PS models in different lines of work in modern psychology and human development models, there are the same key premises as the anthropological assumptions driving their notion of self and action. To show the commonalities involved in how AS and PS are theorized, we utilize social cognition theory to summarize the cognitive dynamics of the AS and the PS. We show that AS theoretically relies on the mastery of a critical, detached, and rationalist knowledge and is comfortable with system 2 ("slow") analytical cognitive processing. Its moral psychology requires reason to operate cleanly and detached from (moral) feelings. By contrast, PS relies on a synthesis between system 1 ("fast") and system 2 ("slow"), and this (Kahneman, 2011) requires PS to rely more heavily on moral intuition and adaptive (more relationist) cognitive processing responses as dominant modes of actions. However, in PS, rationalist processing is secondary, and often serves *post-hoc* rationalization of intuitive responses that do not ultimately overcome self-autonomy. PS's moral psychology is attuned to inner focusing; it applies moral relativism and relationism while it is adaptive to context[3]. For some authors (for example, in the stage literature of adult development), PS is often a negation or disavowal of AS. Other authors, however, accept some kind of dualistic coexistence or a synthesis between AS and PS; trying to "correct" AS makes these authors fall into a dualism, accepting both modes without a clear rationale of how their opposing assumptions can be combined. We suggest that the limitations of AS and PS are based on their assumptions surrounding self-autonomy and a modular view of the brain (for greater clarity on the contrast between AS and PS, see **Table 1**).

It should be noted that regarding the conflicting cognitive preference bases distinguishing AS (relying on abstract/rationalist) and PS (relying on a cognitive functioning more akin to intuitive and emotional basis in cognition), AS does not mean a lack of emotion or intuitive functioning, but rather a preference for rationalism in the face of choices and dilemmas related to action (Haidt, 2001). Both admit the presence of rationalism and its influence, but, in the end, decision-making in AS is based on rationalist cognition and that in PS is based on intuitive and emotive cognitive preference. A summary of the most important authors and models will help us to highlight the links between AS and PS and the idea that they share the main premises (for a comparison on the evolution between AS and PS in moral development, see **Table 2**):

[2]This assumption supporting a uni-linear cognitive stage type of development has received criticism (Hannah et al., 2011). One of these critics highlights that the origins of behavior associated with the human organism's capacity to maintain integrity have not been sufficiently explained (Bandura, 1991). Others point to the empirical finding that the so-called "higher cognitive moral capacities" have only been found in 10% of the overall population that performs moral reasoning at the highest (the so-called post-conventional) levels of cognitive moral maturity in the self (Kegan, 1994; Cook-Greuter, 1999). Finally, a third line critically reviewing these theories notes that the modern assumption in all these modern theories that inner moral cognitive maturity capacity predicts moral behavior has found weak evidence based on empirical data (Ford and Richardson, 1994; O'Fallon and Butterfield, 2005; Treviño et al., 2006).

[3]In the literature of reference, we have found that the same authors that propose AS as an idealized path for the self and human development in earlier adult life subsequently propose PS in later stages. This is because, although all dominant modern self- models in psychology contain fundamental assumptions that are premised on a universal idealization of self-autonomy, their limitations as an ideal for human action and growth are acknowledged.

TABLE 1 | Two ways of knowing: two kinds of integrity based on the self-autonomy paradigm.

	AS (autonomous self) Integrity and meaning making	PS (post-autonomous processual self) Integrity and meaning making
1.	Believes in the capacity to align behavior with one's values, principles, and beliefs	Responds to the reality as it emerges via ongoing processual adaptation and flow
2.	Pursues ideals and principles in alignment with a moral superior rule (e.g., human rights, duties, justice, acting with concern for others)	In all roles and relationships is able to be authentic and express feelings genuinely
3.	Trusts and effectively applies a decision process based on analytical rationalist thinking to analyze "hard facts" aiming to reach "objectively" ethical decisions and outcomes	Trusts and effectively applies decision processes acting on what "feels right" facing a certain particular in a given moment and time
4.	Is principled; commits to the importance of fair universal rules and duties externally given and wants explicit, clear, common and normative frameworks with which autonomous agents can align their behavior	In all roles and relationships, one authentically expresses feelings as they appear at a given moment
5.	Devoted to a view of integrity based on specific sets of values, principles, commitments, and duties	Approaches integrity as an emergent natural process that can be maintained subjectively via "decentered subjectivity"
6.	Believes a person must maintain high-level ethical ideals and a principled character to maintain integrity	Values autonomous authorship of one's life story as important, creative and authentic action in the world
7.	Is committed to maintaining a principled character in accordance with an externally valued moral universal framework, without questioning it	Is committed to acting autonomously as it feels right in any given moment as action that makes the world a better place based on the subject's beliefs
8.	Resolves conflicts of interests by autonomously applying principles and perceived duties according to each agent, to reach an "ideal state of affairs" in accordance with a given moral framework. Negotiates on the basis of social contract principles	Trusts others to relate, talk and respond directly; seeks consensus via direct subject–object relationships. Negotiates via mutual adjustment on the basis of dialectics that invite bargaining and/or synthesis of approaches
9.	Is willing to question previous stances, choices and actions only after the conclusion of a deliberative process.	Is willing to inquire, and critique previous stances, choices, and actions with natural openness to reframe and modify them in any way/direction
10.	Is focused on achieving the goals and foci and outcomes of a deliberative process; believes that, when it comes to happiness, achieving one's goal is what one should seek	Believes that, when it comes to valuing the achievement of happiness, the process is more important than the destination

A. **Piagetian and post-Piagetian** cognitive development psychologies share a common heritage with Pol and Ville (2009) unilinear stage theory of cognitive development (Flavell, 1963). It "borrows" a structural genetic epistemology marked by a universal assumption of growth in cognitive terms influencing overall human growth. It is assumed that cognitive meaning making in the inner self drives stances to life and action. Indeed, in all of the Piagetian and post-Piagetian stage models, cognitive moral maturity is seen as associated with a dualistic hypothesis, whereby initially an autonomous (AS) and subsequently a processual (PS) kind of cognitive meaning making underlies two opposing modes of human maturity. For example, two key works that are consistent are:

B. **Kegan.** The post-Piagetian theories of cognitive development, proposed by Kegan (1994) and (Lahey Laskow, 1986), adopt a subject–object relation psychoanalysis oriented in answering the question how to best deal with all mental demands of life, and here relations are also understood as one of these. These theories trace qualitative changes in how people make meaning from experience in the cognitive affective, interpersonal, and intrapersonal domains, with an emphasis on the cognitive rationalism domain, despite its multi-dimensionality (Creamer et al., 2010, p. 550 and 552). These stage models describe a subjective framework in which a person is embedded that operates in the "assessment" of an object (which refers to a person, an act, or a situation in these works). Its basic assumption is that the entire latter (weaker in cognitive terms) way of understanding becomes the "object" that is critically evaluated by higher frames of mind (cognitive domains). Each person's mind is thus seen as capable of developmental shifts in meaning making structures and qualities until a shift reaches a new mental equilibrium (Kegan, 1994). For this author (Kegan, 1986)[4] and related feminist-inspired versions (Lahey Laskow, 1986), PS emerges at the end and previous assumptions in line with an idealized AS mode of the self and human integrity are rejected.

The challenge of PS is found in how to respond to the transcendence of one's "mind"—how to adaptively and reflexively respond without relying on rationalist judgment on the basis of positions, principles, and ideologies as seen in the previous stage of AS. Hence, PS here emphasizes a valuation that chooses a dynamic Hegelian type dialectic.

C. **Cook Greuter**. Another seminal post-Piagetian piece of literature in this genre comes from Cook-Greuter (1999) extension of Loevinger's (1966), Loevinger (1976) theory. For this author (Cook-Greuter, 1999), PS emerges at the end, rejecting previous assumptions in line with an idealized AS mode of the self and human integrity. Human development toward integrity and maturity in the self in Cook-Greuter (1999) is seen not just as a cognitive challenge. It is rather mainly understood as a challenge of ego; hence, Freudian ego development is the basic underlying

[4]Kegan introduces AS meaning making in "the self-authoring mind" stage ("fourth order, or modern mind") (1994). He illustrates that the AS autonomously defines one's value system(s), identities, goals, and destiny using critical reason, while it enables the subject-author to independently "author" personal moral choices, actions, and decisions that are detached from feelings as the particulars of each relationship are approached with skepticism (Kegan, 1994). Kegan's model introduces PS as the highest post-autonomous stage, using the labels "the self-transforming mind" (Kegan's fifth order, or post-modern mind). Processually, the latter operates dialectically in a direct fashion (Kegan, 1994).

TABLE 2 | Constructivist cognitive moral developmental theory.

	Autonomous Self (AS) = Modern Autonomous	**Processual self (PS)= Post Modern Autonomous**
Kohlberg	**Stage 5—Prior rights and social contract or Utility:**	**Stage 7** ***(In Kohlberg, Stage 7 is acknowledged as a duality compared to Stages 5–6, i.e., a second pole of moral maturity, for persons to acknowledge and practice both AS and PS)***
	It is right to uphold a society's basic rights, values and legal contracts, even when they conflict with concrete rules and laws of the group	Answering the question **"Why be moral? Why be just in a universe that appears unjust?"** with a self-directed commitment to ethics as a way of life
	Laws and duties are based on rational calculation of overall utility ("the greatest good for the greatest number")	Natural law theory holding that individual responsibilities, duties and rights are **not arbitrary, or dependent on social convention** but are objectively grounded as laws of nature
	Stage 6—Universal Ethical Principles:	Experience is of a non-egoistic or non-dualistic variety. The essence of this experience is a sense of being part of the whole of life. Experience of ethics in the process of life, as a whole
	Assumes guidance by universal ethical principles: justice, equality of human rights…	Taking a cosmic perspective that begin with the realization of the finitude of our individual self: ethics as a feature in interdependent moral inquiry
	When law violates the principle, one acts in accordance with the principle	
	The perspective corresponds to a rational individual recognizing the basic moral premise of respect for other persons as ends, not means	
Kegan	**4th Order: Self—Authorship: Self-Formation, Identity, Autonomy/Individuation:**	**5th Order: Self—Transcending Mind,** Interpenetration of Self and Other, Relationship between forms.
	Good working of the self and its recognition by the other begins with the shared premise that each brings a distinct and whole self to the relationship	Capacity for a new trans-system or cross-form way of organizing reality. Refuses to see oneself or the other as a single system or form. Taking relationships as a process that itself creates its form or elements. The relationship is a context for sharing and interacting in which both parties experience their multipleness
	The relationship is a context for the sharing and interacting of two whole, distinct, self-possessed and self-authoring selves (p. 312)	In the face of difference (5th-order selves), stops to see if they haven't in fact made the error of identifying themselves wholly with a foreign culture of mind that gives rise to their position (which shows up as a kind of ideology or orthodoxy) and identifying their partner wholly with a foreign culture of mind that gives rise to their partner's position
	People consider themselves at their best; when in the face of difference, they do not disdain the other, but seek to discover how the other's point of view arises out of a "culture of a mind" with its own coherence and integrity	
Loevinger and Cook Greuter	**Individualistic Stage (E7)**	**Integrated Stage (E9)**
	Beginning to attend to context and point of view	**Construct Aware—** Recognizes fundamental ego-centricity as an obstacle to growth. Being a witness to oneself as an experiencing being. Concepts of self and world are subjective and continually changing. Humility and deep tolerance for others. Cyclical systems view of causality
	Understanding assumptions behind conventional stages	**Unitive—** Immersed in immediate flow of ongoing experience. Views others from multiple points of view. Tolerant, compassionate and feel an affinity with all life. **Dual knowing, accessing reality directly and through symbols**
	Reality is not "out there," but connected to personal interpretation	
	Truth is relative	
	Multiple sometimes contradictory selves	
	Autonomous Stage (E8)	
	Integration of conflicting sub-identities	
	Self-determination, self-actualization, and self-definition	
	Believe they have realistic view of self and world	

theory, evolving via nine stages—three of which come at the post-conventional level and are relevant to this article[5].

[5]The first is the "Individualistic/Autonomous" stage, which captures AS. Here, the person masters his ego via critical reason and it is Cook-Greuter who herself criticizes the overly analytic use of reason whereby moral disagreement (often without conscious processing) is approached "… as a mere technical problem to be solved" (1999: 24). Instead, the seminal theory which predates this modes is Loevinger (1966). This captures PS via the "integrated stage" (1976); in Cook-Greuter (1999) model— that she arrived to upon empirical testing of Loevinger's stage— PS is "broken down" in two integrated stages: the Construct Aware and the Unity "Integrated Stages." Here, PS requires the dissolution of the notion of self altogether as a meaningless conception that is dominated by the ego (Cook-Greuter, 1999).

D. **Kohlberg.** Kohlberg's cognitive moral development theory critically displays the interplay between AS and PS and particularly focuses on how intellectual capacities affect the quality and kind of moral meaning making, so it is a theory with a special concern for the moral action as a domain[6]. It is not initially clear for academic reviewers if Kohlberg goes from AS to PS via a "rejection" of AS (AS is aligned with Kohlberg's theory premises) or if he finally proposes that a dualistic way supporting a synthesis between AS and PS is possible (which would mean a non-rejection of AS in agreement with Kohlberg, 1969; Colby and Kohlberg, 1987). We suggest that he has a rather dualist proposal (Kohlberg and Mayer, 1972): his earlier body of work looked at the cognitive moral maturity of AS (Kohlberg, 1969, 1981; Colby and Kohlberg, 1987), while his later works attempted to lay a foundation for an alternative processual "mode" of human maturity or PS (Kohlberg and Mayer, 1972; Kohlberg and Ryncarz, 1990)[7]. Kohlberg's work helps us to uncover and theoretically describe the differences and interplay between AS and PS (Kohlberg and Mayer, 1972). But even these authors' latest revised theories do not help transcend AS and PS's conflict or being understood as a dualism.

E. **Ryan and Deci.** Considered the key modern psychology scholars in the tradition of mainstream psychological theory (Ryan and Lynch, 1989; Deci and Ryan, 1991, 2013; Ryan, 1995; Ryan and Deci, 2000, 2004), their theories echo similar grounding assumptions on a universal model of self and cognitive integrative dynamics. Like in all stage theories, these works also purport that self-integration is an aspirational ideal. This understands human maturity as a goal that can be globally achieved and "mastered" via more mature states (not stages, in this case) of human development. The main theoretical premise therein seeks to uncover what promotes motivational integrative dynamics in the self (Deci and Ryan, 1991). Hence, there are many commonalities between these theoretical assumptions and the modes of AS-PS in the stage-based adult development theories included[8]. The focus here is psychological dynamics that activate inner tendencies, striving to cover various needs and domains and gradually aiming to establish higher unity in the self (Ryan, 1995). Self-development, in our view, relies upon a dynamic–synthetic (influenced by a Hegelian synthesis view) system view of the self-striving toward gradual self-unifying processing and the achievement of autonomous processing (Ryan, 1995). This is premised to be possible via two opposing or conflicting modes of processing, i.e., either via more rationalist-cognitive processing (relevant to AS, as shown), or via a more emotive and intuitive mode of processing in the self (relevant to PS, as shown).

THE IPS MINDSET: INTEGRATION OF THE PERSONALIST, THE MODERN, AND THE NATURALIST PERSPECTIVES AND A UNIFIED UNDERSTANDING OF THE PERSON AND ACTION

Specifically, IPS presents a different paradigm of understanding the self and action, which influences how action with maturity is understood. It consists in considering human beings and human development not in an idealized way, but as they really are, respectively, abandoning altogether the hypothesis of self-autonomy as a precondition for self, human action and meaning making, and moral and cognitive maturity itself.

This model is based on an interdisciplinary dialogue between philosophy and psychology (Akrivou et al., 2016, 2018). The key philosophers for understanding this proposal are Aristotle, Leonardo Polo, Alfred N. Whitehead, and Wang Yangming, as well as the psychologists Carl Rogers, Erik Erikson, and Viktor Frankl. The proposal's basic assumption is the integration of the personalist, the naturalist, and the modern "mindsets," so its theoretical premise foundation starts from Polo's three radicals (fundamentals) that describe the different main approaches to being in the history of thought. The radical (fundamental root) of *nature*—based on classical philosophy—states that the human being has a nature to develop with psychological and biological dimensions, and that a person is naturally a dependent rational animal; hence, our reason is chosen by each person based on a teleological concern (the common good). Secondly, the radical of the person—based on the Christian philosophy—affirms that the human being has a singularity due to its intimacy and uniqueness, and that we can rely on our intimacy to lead action with a particular kind of freedom, which is "freedom for" affirming a relational ontological basis for the self and a transcendental anthropology regarding what is to be human, i.e., that the person is a unity that pre-exists action and life itself. Thirdly, the radical of the subject—based on modern philosophy—is focused on the result or end products of our action; it affirms that the human being can produce new things instead of developing what (s)he receives.

IPS captures therefore Polo's work main assumption as the philosopher proposes that all these three "radicals" are present in

[6]Until his sixth stage of moral development, Kohlberg closely follows Piagetian scientific rationality epistemology (for which he is often misunderstood as a quintessential Piagetian thinker despite the evolution of his work near the end of his life). Kohlberg's (1969), Kohlberg (1981) stages 5-6 clearly conceptualize the cognitive processing of AS, which is expressed via an idealistic introduction of an autonomous and principled will that displays a concern for universal standards of justice and fairness— fifth Cognitive Moral Development stage— followed by an autonomous rational definition of personal values in consistency with justice, human dignity and human rights, sixth CMD stage (Kohlberg, 1984; Colby and Kohlberg, 1987).

[7]Within cognitive moral development models, it is Kohlberg's seventh stage (Kohlberg and Mayer, 1972; Kohlberg and Ryncarz, 1990) that "turns its back" on all previous epistemological assumptions of the above models (Akrivou, 2013). Kohlberg seems to have had a breakthrough in his research when he published -shortly before his suicide- an empiricist, processual kind of moral psychology. Abandoning rationalism and the idea of detached abstract knowing (Akrivou, 2013), Kohlberg (Kohlberg and Ryncarz, 1990) argues for an organismic, contextually sensitive, fluid and adaptive response mode in his seventh stage. Kohlberg acknowledges both "modes" of moral psychology as important for ethics, but his work does not add any theoretical solution or hypothesis for the possible reconciliation of AS and PS.

[8]Ryan is in agreement with Kegan and Cook-Greuter's understanding of the self as lacking unity and operating with conflicting premises across various domains (e.g. in Ryan, 1995). Ryan aims to find how to reach a state of autonomous integrative processing, as well as the key purpose of these theories, which are mainly concerned with how to effectively perform and cope such that the organism can function with autonomy (Ryan, 1995).

each action, integrated by the person. Therefore, human action is an action that is by constitution integrated but different forms, qualities, and kinds of integration exist, which are available to us based on the choices we make and how to relate to others and act. Applying these to integrative human growth, Akrivou et al. (2018) suggest that being and growing as a human being involves the systemic integration of these fundamentals from within a person as a unity, which means that knowledge and action are by definition one in the constitution of the self. It also means that, in this model, the self is understood as a relational self by its very constitution (which pre-exists even action) and that there is a unity across cognitive, affective, practical, and ethical aspects of action.

So, based on this last idea, personalist moral psychology is very well-harmonized with virtue ethics' normative philosophy (Koehn, 1995; Solomon, 1999; Akrivou, 2013). According to these scholars, (a) personal growth is meaningless outside of the notion of acting for the common good in the frame of relational interpersonal growth concerned for the overall growth of specific others (freedom for) as much as one's own; in fact, the idea that growth happens via autonomous individualist action or capacities is meaningless in the IPS theory. Secondly, according to this model, (b) human growth is shaped by assumptions characterizing free and open systems, such that growth can go in any direction and evolves in processual and responsive moral dialoguing terms (Akrivou and Orón, 2016).

Integration in IPS needs to happen from within the person: only by being able to acknowledge everyone as a transcendental and unique human being with the capacity to be free to love other human beings (not for logical reasons) is it possible for our relationships to limitlessly grow. Combining (a) and (b) leads to the idea that in the IPS model, the personal action is not chosen neither from within self-interested concerns, nor from within a duty and obligation as the logic of exchange but instead it is the logic of gift which is the driver of action (Akrivou et al., 2018). The authors (Akrivou et al., 2018) also show that, in fact, the twin model of AS and PS is a dualistic understanding of the same fundamental root of humanity because they both capture assumptions with a focus on the mastery of the outcomes of action (production) in the world that are part of the subject-agent's modern "radical." Thus, the pathway for human cognitive maturity from within the subject-agent's self-system ignores (or weakly respects) the "radical of the person" and the "radical of nature." As a consequence, the pathway for human cognitive maturity is narrower and unsustainable.

Broader human learning and development theory outside the key theories of development in modern psychology reviewed earlier in this article, including the works of Rogers (1951, 1961, 1964) and Erikson (1994), are particularly relevant to illustrate *how action with integrity and* moral maturity is led from within the IPS mindset operates. IPS is concerned with relations as a gift freely chosen with a concern to help the entire whole person emerge as opposed to instrumental relations within a mastery perspective. Indeed, how this helping–psychotherapeutic relationship works can be understood via the work of Rogers (1961) who illustrates our argument that IPS does not present a model of maturity that simply synthesizes, or technically integrates (Akrivou and Orón, 2016), system 1 and system 2 cognition. From the very beginning of the therapeutic accompaniment, Rogers seeks that the client enters into his interiority and makes a growth path from there. This happens by gradually trusting in how one's humanity is manifested via an experiential path that frees the *inner experiencing focus*, and a gradual trust of the immediacy of experience within the person's organism to free the integrity we all naturally share as persons (Rogers, 1961, p. 131).

This reference to inner experiencing process that is only facilitated through the logic of gift in relations is a journey to inner virtue and it is precisely here that Rogers shows that it takes time, and one has to live and reflect on various experiences and feelings. IPS agrees with Rogers that growth is only possible through mutual growth in the relationship (Akrivou and Orón, 2016), but Rogers' humanistic relational psychoanalysis provides the IPS a useful theoretical pathway toward turning "modern autonomous selves" into the IPS mindset when a human personal relationship is deprived of the secure distanced approach of the Cartesian observer and ceases to master the other while maintaining cognitive control and mastery.

To illustrate, Rogers (in stage six) purports that the journey toward higher IPS maturity requires the experiential learning that also includes the capacity for acceptance of "both a feeling and what constitutes its content" (1964, p. 146–8), which involves the entire abstract and emotional–intuitive cognition of a person without censoring this from outside-in, but while utilizing human relationships as the basis of personal growth. At stage seven of Rogers's framework (Rogers, 1951, 1961; Rogers and Dymond, 1954; Gendlin, 1962, 1969, 1978), personal growth is completed by accepting one's own contradictions and full humanity with "a growing sense of ownership of the changing feelings (bringing about), a basic trust in one's own inward … total organismic process" (Rogers, 1961, p. 151).

SUMMARY ON THE NEUROPSYCHOLOGICAL DEBATE ON LIGHT OF AS-PS, AND THE IPS MINDSETS

We think that the whole discussion about AS/PS models and their evolution correspond naturally with Kahneman's exposition of the two systems. However, we observe a great evolution in current neuroscience that—besides their differences—surpasses the division of Kahneman's system 1 and system 2 thanks to a more dynamic and systemic conception of the brain. Based on that, we will present another way to understand human development according to the IPS paradigm.

Systematic review of the broad and fragmented theory and literature on dual processing models of higher (social) cognition (Evans, 2008) helps to ground AS and PS's distinct cognitive mechanisms. Current accounts of dual-processing support the idea of two distinct cognitive autonomous processing systems that are distinct in both evolutionary terms (looking to the history

of the development of the human mind) and the architecture of cognition (Evans, 2008)[9].

Evans (2008) suggests that evidence explicitly associates system 1 cognition with emotion and is capable of utilizing rationalist cognition as secondary (Evans, 2008, p. 258). We believe this indeed supports our argument that PS primarily relies on synthesis of system 1 and 2 that allows to be not just rationalistic but also more dynamic, while reason is utilized as a follow-up cognitive mechanism. Research in psychology suggests that there is also a self-protective "bias" here, as reason is required to offer *post-hoc* rationalization of what is primarily an emotive and intuitive subjective action (Haidt, 2001). This would confirm that, although it is more relational, PS remains focused on the self.

We will now focus on current neuroscience evolution. The proposed systems 1 and 2 are inserted into the line of modular vision of the brain. Modular vision, in its strictest version, associates each brain module with a cognitive function. The main reference of the defense of modular thought is the philosopher of the mind Fodor (1983). Although his statements are currently subject to nuances, his proposal has received continuity from both philosophers of the mind and scientists, and they are applied in many fields, such as Gardner's multiple intelligence (1998) and emotional intelligence (Goleman, 1998, 2008; Rolls, 2014). However, this neuroscientific vision has been seriously questioned, and other models of understanding the brain functioning are being explored.

A neuroscientific analysis exceeds the claims of this article, where we just show this current debate. The first criticisms against the systemic approach that opt for a dynamic vision that requires synchronizations of the whole brain, but also considering external relations to the person, will come from the "dynamic systems" proposals (Thelen and Smith, 1994; Kelso, 1995; Juarrero, 2002). We can consider the works of Pessoa (2008, 2013), Anderson (2014, 2016), and Sporns (2011, 2014), Shine et al. (2019) as a point of inflection since they disqualify the claim that a brain module can be associated with a psychological function (for a detailed account of the evolution of neuroscience, see Blanco, 2014, and Orón Semper, 2019 in the field of emotion). From neuroscience, the debate is open but what seems more accurate in the understanding of emotion is that it is an information of the global estate of the system and, in the case of human being, an effect of human action and his or her history (Orón Semper, 2019, p. 299). Different ways of understanding brain functioning leads to different understandings of human reality as well as different educational proposals (Orón et al., 2016).

This new vision of neuroscience is congruent with the main assumptions of the IPS proposal: that relationship is constitutive of the persons but each person's singularity is a complicated process of how each person acts as a unity of virtue to grow with the other(s) one chooses to offer gifts to (freedom for), albeit relating as a free and open system. Affective processes in the self and other relations are informed by each person's unique identity and history, while a two-way feedback processing informs the neuroscience of IPS mindset. There is also a clear vision of the organism as a system that does not allow one part of the brain to act independently of the others, but rather it is a unified orientation in only one direction. This would be related to the IPS conception of human action, as a unifying movement that arises from within the person and aims to act with/for others albeit in ways which provides to the acting person opportunities to integrate and improve their life according to who they are and their calling. So, action is always both personal and social at the same time in IPS and is not marked by the duality between self-interest versus duty to others's good but seeks mutual virtuous growth via personal relational action. In IPS, growth happens this way, while the motivation for growth is for each person the striving to intensify and improve the quality of relation to the others involved in an action.

IMPLICATIONS FOR EDUCATION

According to our research on the self and action (Akrivou and Orón, 2016; Akrivou et al., 2018), each "mindset" offers a different assumption and vision on how to understand and lead educational relations and networks to positively influence learning and growth involving wider forms of community. Regarding the existing antagonistic functioning between AS and PS in the self-autonomy paradigm of human growth, PS does not abandon AS because PS keeps the cognitive approach to education, which is supporting a system/module mentality (in cognition and forms of action undertaken in education) and is always concerned with a choice between educational approaches that serve either the cognitivist or the more active-responsive-emotivist two systems (constantly falling into a dualistic fallacy)[10].

[9]The same idea, although in narrower, more specialized terms, has been published in other influential works in psychology, namely the idea that there are two opposing kinds of social cognition i.e., Kahnemann's fast and slow brain (2011; Kahneman and Riis, 2005) and the premise of an antagonistic conflicting relationship between analytical reasoning (corresponding to AS) and socio-emotional cognition (corresponding to PS) in the opposing domains theory from Jack et al. (2012). These works show differences associated with dual systems of thinking as follows: The first cluster focuses on consciousness, where system 1 is less conscious, implicit, automatic and holistic (perceptual), while system 2 is conscious, explicit, highly controlled, and analytic (thinks/reflects) (Evans, 2008). The second cluster distinguishes systems 1 and 2 in evolutionary terms, where system 1 is old in evolutionary terms, with a focus on an evolutionary kind of rationality that is shared between animals and humans and that is more holistic/non-verbal. System 2 is evolutionarily more recent, with a focus on individual, autonomous reasoning processing; it is uniquely human and mainly linked to language. The third cluster is based on the assessment of the two systems on the basis of their functional characteristics, where system 1 is associative, domain specific, contextualized and more pragmatic; system 2 is rule based, domain general, universal, abstract, non-contextualized and sequential. Finally, the fourth cluster of classifications of prior studies on system 1 and 2's distinctions is based on individual differences. According to this focus, system 1 is independent of general intelligence and working memory and is thus more shared/universal across the human species, whereas system 2 is highly dependent on a person's general intelligence and limited by one's working memory capacities and thus is less universal and more particular.

[10]Specifically, in AS, system 2 (slow) has to take control of system 1 (fast), while in PS, the subject-agent needs the (higher capacity of) synthesis to maintain a "flow" behavior. But, this is not always as simply done as is idealized, as Kohlberg shows, knowing that reason in system 2 is quite dominant. Hence, the highest stages in stage theory need to idealize a final stage whereby only then a technical

IPS theory is not an alternative view on how to balance or integrate systems 1 or 2. IPS implies a new hypothesis of human cognitive processing by suggesting that there are no modes and no modular view of the brain; indeed, from a neuroscientific perspective, IPS is not concerned with the technical integration between two modes. IPS altogether transcends/abandons the mentality/hypothesis of autonomous system functions in the brain and a different notion of the human being emerges. For this reason, IPS is not a proposal/model of how to *technically* integrate system 1 and system 2. Good examples of published educational work that seem more consistent with IPS is the first published cases of educational program that developed relations and networks of exchange within their wider community as a distinct strategy for social innovation by Grogan and Fahrenwald (2019, in Weber et al., 2019). Indeed, the development and nurturing of human and communal level relations and networks in these examples have multiplied effects of positive social virtuous growth and influence through the very action of students and teachers, which seems closer to the IPS model.

Naturally, as a theory of human beings and action, it claims to transcend the dualism of AS-PS that relies on the autonomous self-subject's agency by bringing back the person as the systemic integrator of the two modes (rationalist or affective or intuitive faculties). The question is not if reason guides (mature) human action (with integrity) or if moral feelings and intuitions are better premises. We suggest instead that it is the person who acts, which is supported by our altogether different interpretation of the human brain and its cognitive architecture. In general terms, we state that while AS is aligned with an education based on rational and memoristic exercise, and PS is aligned with the proposal of education in competencies that dominate today, IPS is asking for a change of paradigm that put interpersonal relationships and personal growth in the center. Both PS and IPS consider relationships, but while for PS relationships have an instrumental value, for IPS, they have a final value, or value in themselves. The instrumental view of relationships can be found in some proposals (Hughes and Cavell, 1999; Frymier and Houser, 2000) that study the effect of the interaction between the teacher and the student, as well as motivation and learning in the school environment.

This debate is not new, for instance, the UNESCO report "Learning: The treasure within" (Delors et al., 1996) shows that the four pillars of education (including learning to do, learning to be, learning to live together, and learning to know) must be unified to the service of "learning to live together," which places interpersonal relationships as an end and not as a mere means. A similar discussion is found in Peters (1966, p. 34, 1967) who warns not to be confused between an educated student and a trained student, and that the school should seek for educated people (for a more detailed study of this debate, see Orón Semper, 2018, and Orón Semper and Blasco, 2018).

This open debate helps us to enter the educational discussion about the different ways of understanding cognition according to the different models, but now we will just give some suggestions to reflection at the educational level. For AS, cognition is a psychological act reduced to a mere rationalistic exercise and whose activity is fundamentally theoretical. Personal relationships are almost accessory to the act of learning, because in the end, the main student's relationship is with the book. For PS, cognition is still a psychological act whose activity would be theoretical and practical. Cognition remains an eminently rationalist act but is enriched by other psychological faculties such as will and emotion that are added. These other psychological acts as well as personal relationships have an instrumental value for the person to control their surroundings thanks to the acquisition of some skills.

For IPS, cognition as a psychological act is initiated from the interiority of the person as a way to interact and position herself in the world. That psychological cognition is activated from the person's interiority means that when the person expresses herself from within, the various psychological faculties are born integrated. The person's end is not properly to dominate the object that seeks to know, but rather the interpersonal relationship, an encounter with another person. While PS instrumentalizes the relationship to reach the object, IPS instrumentalizes the object to reach the person as an end. In both cases, the object is mastered and the relationships are present, but in a very different way. Another difference between PS and IPS is the role of the educator. For PS, the educator is a coach, who facilitates or helps the student to attain her goals, which does not imply that the educator as such has to change, and the process rests fundamentally in the learner's action. For IPS, the educator is, in some way, being also educated, because he or she also has to grow. The action is fundamentally a cooperative action and not a sum of individual actions. We think that nowadays the sensitivity toward the IPS model and its educational involvement through pedagogical proposals is growing, as can be seen, for instance, in the new trend of "service learning."

Having clarified the anthropological and psychological assumptions for AS, PS and IPS, and seen how these involve two different educational and relational models, its application to innovation appears as very suggestive. AS and PS grow as they manage to expand their mastery and control, domain after domain, understanding innovation as a key to adaptation and efficiency. According to these models, any change that helps the best realization of the person's purpose (that is, any improvement in efficiency) will be considered an innovation. In the IPS model, innovation acquires broader perspectives: the object is at the service of the interpersonal encounter. This change proposes an education centered neither on the object (AS) nor on the subject (PS), but focused on the relationship (IPS) (Orón Semper, 2018).

Innovation in the IPS is also associated with the growth of the subject, but as the subject is understood differently, the sense of growth also changes. If personal growth is unrestricted (Polo, 1997, 2007a,b), the human being attempts to transform the world as an opportunity for growth. Our biggest project is the one

integration ("synthesis") happens. This is an idealized notion of human growth. It is not possible to say that PS is system 1 because it implies one involution. System 1 is present in animals and humans and system 2 proper to human beings. As shown earlier, if in PS human beings learn to abandon system 2 to focus on system 1, then this implies an involution in development.

we develop with regard to ourselves and our processes of self-determination. This means that anthropology and motivation are intrinsically linked because the main motivation for action corresponds to becoming more aware of and enjoying one's growth, rather than extrinsically seeking to grow one's financial or career prospects. Moreover, as various authors have shown (Ariely et al., 2009), when a task includes a cognitive skill, greater economic reward leads to poorer performance and less creativity. Thus, innovation is not merely determined by environmental stimuli, but rather rests on the fact that the human being—in light of freedom—is always capable of introducing novelty.

Human growth for IPS is the intensification or maximization of the interpersonal constituent relationships. Innovation will be associated with any creative act that manages to improve the relationship in the real world in which this relationship takes place. In the case of the human being, adaptation, efficiency, and even competence do not justify by themselves, but rather they are at the service of a life of quality, that is, a life that allows us to live better together. In the best case, adaptation, efficiency, and competence will be means, along with many others, to serve a purpose. As Delors himself indicated, lighting a warning light on the development of competencies (Delors, 1996, p. 14, 16–18), separated from their purpose, they can become even degraders of humanity. In this case, "How can I transform the world around me to improve interpersonal relationships?" should be the question that precedes innovation.

In IPS, there is a richer environment than those already mentioned: the relationship itself. The interpersonal relationship, being an end, can also be a medium. An interpersonal encounter is the medium in which innovation best emerges. An example of this is Lipman's proposal (Lipman et al., 2002) to make "research communities" that values interpersonal encounter as the best means for innovation and thought creation. We think that this can be developed in pedagogical proposals such as "cooperative work" and "service-learning," which does not rule out the possible goodness of other proposals—such as "learning through problems" among others—but warns us to put them in a proper anthropological context. Indeed, within the context of practical teacher education nowadays, cooperative work, one of the main inter-organizational learning challenges (Boer et al., 2018), fits perfectly with IPS mindset because in both cases personal growth happens thanks to the personal encounter.

The IPS model can help immensely when applied to different aspects of education. For example, it understands leadership in education not as successfully applying strategies but as knowing how to make sense of education and promote cooperation among colleagues (Simkins, 2005) and students (Orón Semper and Blasco, 2018). On the whole, when applied to education, we believe that the IPS model can aid social innovation in a profound and sustainable way since it shifts education toward an act focused on social renewal starting with its very foundation.

AUTHOR CONTRIBUTIONS

KA, JO, and GS contributed conception and design of the study and wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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ORIGINAL RESEARCH
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Designing for Trust-Building Interactions in the Initiation of a Networked Improvement Community

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Networked Improvement Community (NICs) are increasingly recognized as a social innovation for orchestrating sustained change in education. NICs are one type of a research-practice partnership that provides a model for researchers and educators to bring insights about what works locally to scale. A critical aspect of NIC success is the emergence of relational trust across the participant network. At initiation, therefore, NIC leaders must create the conditions for long-term development of relational trust, which can be operationalized to be the existence of reciprocated, help-based interactions. To understand how NIC leaders foster these reciprocated, help-based interactions, this paper leverages social network and qualitative data to explore how the core activities of a NIC might foster help-based interactions amongst participants. This paper is a case study of how social network and qualitative data analysis might be applied to the design and development of NICs, and social innovation more broadly. We apply social network and qualitative data analysis in the context of the Personalization in Practice-Networked Improvement Community, which brought together 21 educators from five schools around a common challenge. Focusing on the initial activities that took place over 3 months, we use social network analysis to connect the patterns and progressions of interactions with design activities and qualitative data to examine the quality of those interactions. Our paper highlights how collaborative design activities created the three conditions for relational trust to emerge: sparking interactions around shared practices, creating situations for participants to ask for help, and encouraging reciprocated, help-based interactions. The application of social network and qualitative data allows us to capture (1) the creation of meaningful ties amongst educators across schools and strengthening of ties between same-school colleagues, and (2) instances of reciprocated, help-based researcher-educator and educator-educator interactions. These findings demonstrate how specific collaborative design activities can foster the kinds of trust-building networks necessary for NIC success. This paper presents an applied case of using analytic research methods for the design of social innovation. The triangulation of social network and qualitative data provided insight into the internal dynamics of the partnership and has implications for development measures of network health. We found that the social network data described that interaction changed, but did not indicate which activities led to these changes. Triangulation with qualitative data was necessary to understand the quality of the interactions that were possible as the social network emerged. This case contributes to emerging research on how

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to measure the effects Networked Improvement Communities on participants and their practices. In doing so, we demonstrate, on a practical level, how social network and qualitative data might be used to generate network-level data for improvement, and we contribute theoretical insight into the way collaborative design creates the conditions for the long-term development of relational trust.

Keywords: networked improvement community, relational trust, collaborative design, social network analysis, personalized learning, network initiation

INTRODUCTION

Solving the complex problems of educational systems requires rethinking how researchers and educators work together. For many years, education researchers and policy makers devised technical innovations to improve learning at scale, and formulated processes to ensure the appropriate implementation of these programs (Slavin, 2002). In recent years, however, the education policy and research community has come to realize the promise of social innovations, particularly through including educators in the change process (Cohen-Vogel et al., 2015). This realization is seen in the emergence of research-practice partnerships as a promising pathway to engage in systems-level change (Coburn and Stein, 2010).

One type of research-practice partnership is the Networked Improvement Community (NIC). NICs are a social reorganization of traditional research and development activities that leverage data-informed, collective action for social innovation (Bryk et al., 2011). When the first NICs achieved outsized success, NICs became an increasingly popular model for reform (Bryk et al., 2015). Toward this end, research on models for NIC initiation (Russell et al., 2017) and execution (LeMahieu et al., 2017) have focused primarily on identifying the organizational structures, methods, and tools that support NIC progress. What is less clear is how NICs foster the social capacities, such as relational trust, that are needed for sustained reform.

This paper focuses on designing for interactions that build social capacities for sustained reform. Relational trust describes the capacity for successful, professional interaction (Bryk and Schneider, 2002) and has been promoted as an indicator of research-practice partnership effectiveness (Henrick et al., 2017). Relational trust springs from recurrent, reciprocal help-based interactions that, over time, build communities of practice where participants can take risks together and experiment with new practices. If relational trust is a key capacity for long-term change, then how can a NIC act as a catalyst to move practitioners toward the kinds of interactions that can spark relational trust?

To this end, this paper answers the question, *how do NIC collaborative design activities foster reciprocated, help-based interactions?* Focusing on the first 3 months of NIC initiation, we illustrate how the collaborative design activities sparked help-based interactions among NIC participants. The paper begins with a review of collaborative design, relational trust, and social network theory. We then provide a narrative of the early stages of PiPNIC, a NIC with educators around the challenges of implementing personalized learning. Next, we detail the applied research design. The findings trace (1) the creation of meaningful ties amongst educators across schools and strengthening of ties between same-school colleagues, and (2) instances of reciprocated, help-based researcher-educator, and educator-educator interactions. The paper concludes with an exploration of how the findings from this analysis inform an understanding of designing NIC initiation and the use of social network and qualitative data to inform the development of social innovation efforts.

Collaborative Design

Collaborative design[1] is a user-centered problem-solving approach that emphasizes the inclusion of users in both what problems to solve and how they will be solved (Schuler and Namioka, 1993; Muller, 2003). NICs appropriate many collaborative design ideas, such as problem-identification, iterative testing, and reflection cycles (Bryk and Gomez, 2007). NICs begin with identifying a common problem of practice important to the educator participants and leverage collaborative design as a core interaction mechanism (Dolle et al., 2013). Through collaborative design, a NIC invites practitioners to examine how problems occur in local contexts and identify measurable goals, develop robust data pathways to iteratively inform design process and outcomes, build and test solutions, and create a theory of action that reveals the problem and possible solution paths (LeMahieu et al., 2017).

Successful collaborative design requires help from other people. In a successful NIC, problems are solved when researchers ask for design help from educators, and educators are open to research precedents and design options. The perspectives of researchers and practitioners are then integrated into the collaborative design of an artifact that addresses the problem of practice. As a result, participants feel mutual ownership over the process and product, and recognize why each kind of expertise included in the design was necessary for the resulting solution.

While the design process is aimed at creating a useful solution to a shared problem, collaborative design research also focuses on how interaction is coordinated to support authentic participation (Ehn, 2008). The connection between the collaborative design activities and interactions is labeled infrastructuring (Penuel, 2019). Infrastructuring describes the "network of tools, relationships, standards, and protocols on

[1]Co-, collaborative, and participatory design all have their roots in Scandinavian tradition (Sanders and Stappers, 2008). We choose to use collaborative design as a term that is more commonly used in education research in the United States.

which an individual or group relies to carry out day to day tasks and accomplish particular goals" (Penuel, 2015, p. 5). From a social perspective, NIC initiation is infrastructuring, where the collaborative design activities foster the kinds of social capacities that will support long-term partnership success.

Relational Trust

Relational trust is a specific form of social capacity that has been studied extensively in organizational theory (Mayer et al., 1995) and education (Tschannen-Moran, 2018) and associated with successful school reform (Bryk and Schneider, 2002). Relational trust is a critical resource for solving organizational problems as it supports asking and answering hard questions, risk taking, and the collaborative vetting of proposed solutions (Levin and Cross, 2004).

Bryk and Schneider (2002) defined the concept of "relational trust" as a form of social trust[2] that is built through the interactions amongst educators over time within a community. Relational trust develops between two individuals when they ask each other for help, and the bid for help is fulfilled by the other, repeatedly, over time. When people ask for and receive help from one another across an organization (or a partnership), trust networks begin to form that can support participants to engage in tasks that require more risk (Mayer et al., 1995; Halverson and Kelley, 2017). Distributed relational trust emerges when there are redundant, reciprocal trust-networks develop in an organization around key professional tasks. Tracing the development of a network of reciprocated, help-based interactions across the participant community operationalizes the conditions for relational trust to emerge in the long term.

The role of trust in building successful research-practice partnerships is well-known. Henrick et al. (2017), for example, propose five indicators under the category of "building trust and cultivating relationships": researchers and practitioners (1) routinely work together, (2) establish routines that promote collaborative decision making and guard against power imbalances, (3) establish norms of interaction that support collaborative decision making and equitable participation in all phases of the work, (4) recognize and respect one another's perspectives and diverse forms of expertise, and (5) decide partnership goals that take into account team members' work demands and roles in their respective organizations. Identifying these indicators is an important feature of partnership research. The next step in partnership research is then to identify the kinds of activities that promote collaborative decision-making and the strategies leaders use to build capacity for participants to recognize and respect one another's perspectives. This paper is aimed making this connection between NIC activities and the patterns and progressions of interactions that might yield these indicators of long-term development of trust.

[2]There are other many other dimensions and factors of trust that may impact long-term development of relational trust, such as perceived trust/mistrust of research organizations, universities, schools, parent groups, or individual propensity to trust others, especially those of the same profession, etc., however these dimensions of institutional, contractual, and individual trust are beyond the scope of this investigation.

TABLE 1 | Theoretical connection between help-based interactions, the facet of trust they align with, and related research.

Aspect of help-based interactions	Facets of trust	Theory
Asking for and receiving help	Willingness to be vulnerable, honesty, openness, benevolence	Teacher collaboration and trust (Penuel et al., 2006; Moolenaar and Sleegers, 2010) Helping (Nadler, 2018)
Quality of interaction	Competence	Knowledge transfer through weak ties (Granovetter, 1973; Levin and Cross, 2004) Social capital (Coleman, 1988) Quality of ties (Lin, 2002; Borgatti et al., 2014) Structural holes (Burt, 2017)
Reciprocation over time	Reliability, integrity	Positive history of experiences (Tschannen-Moran, 2001)

Social Network Theory

The patterns and progressions of interactions during NIC initiation can be traced by social network analysis tools, which are built from social network theory. Social network theory provides a method to track the patterns and progressions of interactions amongst members of a group (Daly, 2010). Social network theory foregrounds the overall structure of the group, the ties between actors, and the quality of the ties as important factors in understanding actor and network outcomes (Lin, 2002; Borgatti et al., 2014).

Networks and trust have been studied extensively, with higher network density associated with greater network cohesion, trust, and capacity for change (Mohrman et al., 2003; Moolenaar and Sleegers, 2010). Strong ties are correlated with benevolence-based trust (Currall and Judge, 1995) and with trust and trustworthiness (Glaeser et al., 2000) (see **Table 1** for a summary). Trust is typically examined for its impact on interactions, rather than as an outcome of interactions (Liou and Daly, 2014).

In education, social network theory has been used to explicate how ties among network members evolve during reform efforts (Daly and Finnigan, 2010), mediate professional learning (Penuel et al., 2012), and support principal innovation (Moolenaar and Sleegers, 2010). Recent work to apply social network methods to NICs has examined how knowledge is transferred across the network (Cannata et al., 2017a,b) and how organizational positions affect NIC participation (Sherer and Feldstein, 2018).

Social network theory allows for collecting data on the shape and intensity of the network of help-based interactions that characterize a successful NIC. NIC initiation typically brings together people who have limited prior connections. Limited prior connections is part of the NIC strategy to learn from implementations across contexts of practice. The lack of relational trust between people who have few shared connections could limit participation in NIC activities. In this scenario, interaction may be centralized among the small number of actors who had prior connections, which could result in a one-way network where certain actors provided help to a

large number of participants. Even though the NIC may be organized around shared design activities, the patterns of help-based interactions may come to be unevenly distributed across participants. The application of social network and qualitative analytic tools to examine the network as it is forming can be used to provide insight into the patterns and progressions of emerging connections among participants.

In the next section we provide a narrative of the larger research and practice context for the NIC presented in this paper.

A NETWORKED IMPROVEMENT COMMUNITY AROUND PERSONALIZED LEARNING

The Personalization in Practice (PiP) research group was formed in 2014 to study school-wide efforts to design and implement personalized learning strategies in K-12 schools (Halverson et al., 2015). PiP is a research alliance between the University of Wisconsin-Madison School of Education, the CESA 1 Institute for Personalized Learning (IPL), and the Wisconsin Department of Public Instruction. The partnership is supported by the Joyce Foundation and by the US Department of Education Institute of Education Sciences. The goal of PiP was to document how public schools engage in personalized learning, then transform these insights into opportunities for professional learning for interested educators through a NIC.

There is a strong and growing network of personalized learning schools in Wisconsin, and IPL has been a regional and national leader in designing, supporting, and scaling this grass-roots movement since 2009 (CESA1, 2011). IPL defines personalized learning as,

> an approach to learning and instruction that is designed around individual learner readiness, strengths, needs and interests. Learners are active participants in setting goals, planning learning paths, tracking progress and determining how learning will be demonstrated.

The PiP research team conducted ethnographic studies of 20 IPL schools engaged in personalized learning. They identified three key personalized learning practices:

- Educators designed *cultures of agency* to engage students as active participants in their learning;
- Educators acted as facilitators of learning by regular *conferring* with students to construct learning pathways and set learning goals; and
- Schools developed *socio-technical ecologies* of digital tools, such as productivity tools, learning management systems, computer adaptive testing and curriculum tools, and digital media and design tools to coordinate instructional, assessment and learning tasks (Halverson et al., 2015).

In the fall of 2016, the Personalization in Practice-Networked Improvement Community (PiPNIC) was launched to bring together expert educators to identify, document, and improve core personalized learning practices. PiPNIC sought to engage expert practitioners and researchers in collaborative design around common, meaningful problems of practice that would produce practical and theoretical knowledge about cutting-edge personalized learning practices. The PiPNIC theory of action was that engaged practitioners and researchers in collaborative design would spark help-based interactions, which would in turn generate solutions to the problem of practice and develop the capacity to support further improvement.

A network hub was established, led by the two authors of this paper, and the formation of a Networked Improvement Community was conceptualized as three stages: problem identification, participant recruitment, and a 90-day collaborative design cycle[3].

Stage 1: Problem Identification

This stage involved contacting and interviewing schools across the state to identify shared problems of practice in personalized learning. Identifying a problem of practice from the field established the interdependence and authenticity of the partnership from the start as researchers would have to rely on the practice-based knowledge of educators, while educators would have to rely on the researchers to structure the common inquiry. To do this, our network initiation team drew on Gawande's (2008) idea of listening to those closest and most knowledge about the work in order to identify meaningful insights and challenges. Through phone calls, visits, and discussions at conferences, over 60 educators were consulted from traditional public, charter and private school communities. Schools were nominated through the PiP researchers' existing connections for their expertise in personalized learning. In this way, the research team leveraged its existing social capital to better understand the challenges faced by personalized learning educators and leaders.

We identified *conferring* as central, shared problem of practice on the frontier of personalized learning. When personalized learning educators ranked their practices, conferring emerged as the practice that had the highest utility for their work (Rutledge, 2017). Conferring came to be defined as the regular one-on-one conversations between an educator and student. For example, in a project-based learning school, a student might sign up to meet with their teacher to discuss their ideas for an interest-based project. In a competency-based school, a student and teacher might meet to look at their progress on a computer adaptive platform and discuss next steps. Educators from different contexts described the purpose of conferring as developing learning relationships, individualizing learning, and/or capturing evidence about learning. While the instructional origins of conferring are found in other pedagogies (e.g., Calkins and Harwayne, 1991), it also roots in the individualized educational program meetings of special education. Despite near universal agreement that conferring was a core practice, teachers reported little consensus on process documentation or evidence of impact. This made conferring an excellent problem of practice for NIC design.

[3]In this paper, we focus on stage 3, the collaborative design cycle. For more detail on the first two stages of the process.

Stage 2: Participant Recruitment

The Stage 1 listening effort resulted in a long list of potential NIC educator participants. We narrowed this list by identifying practitioners who had well-established conferring practices, district leadership support, and the capacity to engage in the project. We also sought to recruit educators from a range of schools in terms of student age (kindergarten through twelfth grade) and context (school size, locale, age of program). We ultimately invited 21 educators from five K-12 public schools based on their expressed expertise in conferring and their willingness to spend four Saturdays over the course of 3 months working on a collaborative design project. Each participant received a stipend and the option of continuing education credit. Ten UW researchers agreed to help coordinate the collaborative design process.

Stage 3: 90-Day Design Cycle

In the spring of 2017, 10 UW researchers, including the authors, and 21 educators from five schools (see **Appendix B** for school descriptions) came together to participate in collaborative design activities. The collaborative design activities were organized by the 90-day design cycle (Park and Takahashi, 2013), a way to prototype an innovation through leveraging knowledge of those within and outside of the field associated with the topic; coordinating the development and "testing" of a product by at least one of several means; begin and conclude within a span of 90 days … [and] deliver needed knowledge in a timely fashion (Park and Takahashi, 2013, p. 6–7). The 90-day cycle also provided a strategy to synchronize the work of participants from different organizations, a key challenge of RPP (Coburn and Penuel, 2016). The outcome of the design task was to develop and validate conferring protocols that could be used across the schools. Each school team that participated ultimately produced a protocol to guide their local conferring practice, and all protocols were published in a final 90-day report (Kallio and Halverson, 2017). Meetings were held on four Saturdays, hosted by participant schools.

The research team developed a series of five key activities to engage participants in collaborative design. Each school team of educators:

1. Created videos of their own practices to share current conferring strategies;
2. Pitched a plan for the improvement of conferring to the whole group;
3. Developed protocols that described the context, conversation, and documentation strategies for their desired conferring practices;
4. Engaged in a user-testing cycle where each educator tried out their school's protocol and experimented with protocols from other schools; and
5. Contributed to a final report and community discussion where experts in personalized learning and student-focused instruction commented on the presentation of new practices.

To facilitate these activities, each PiP research team member was assigned as a liaison, or "site captain," as primary points of contact for each school. PiP site captains visited participant schools prior to and throughout to support design activities.

TABLE 2 | Collaborative design activity sequence during the 90-day design cycle.

Collaborative design activity		Modes of interactions		Who	
		Reflecting, planning, and testing	Sharing representations of practice	Within teams	Mixed-groups
1*	Watch videos of current conferring practices		x		x
	Reflect on feedback and plan for improvement	x		x	
2	Create a pitch to share improvement plan	x		x	
	Present pitch		x		x
	Refine pitch into action plan	x		x	
3	Discuss action plan data, Write conferring protocol	x		x	
	Share protocol		x		x
	Finalize protocol	x		x	
4**	User test protocol from another school	x		x	
	Add user testing feedback to protocol		x		x
	Meet with user testing partner		x		x
	Reflect on feedback	x		x	
5	Share protocols		x		x

*Example 1.
**Example 2.

The NIC collaborative design activities were held during the Saturday whole-group meetings. Each activity included (1) *sharing activities* in mixed-school groups and (2) *reflecting, planning, and testing* activities within same-school teams (see **Table 2** for a summary).

In *sharing activities*, participants presented representations of their conferring practice or plans for improvement to participants from other schools. The goal of these structured sharing activities with mixed-school groups was (1) to maximize opportunities for each participant to ask for and receive help from educators from other schools and to minimize the possibility of one person serving as the de facto spokesperson for the school, and (2) to require participants to take a risk in sharing their practice publicly and allowing others to comment on it. These kinds of sharing activities were repeated each week as school teams refined their representations of conferring, created and executed improvement plans that incorporated feedback, and ultimately user-tested each other's conferring protocols. This repetition built a history of interactions between educators from different schools and with researchers.

In *reflecting, planning, and testing* activities, participants from the same school plus their site captain had time to make sense of their feedback. Participants then negotiated how they

would incorporate individually-received feedback into future collective action. The repetition of these activities also provided opportunities for same school colleagues to build a history of interactions with each other and with their site captain.

The conferring protocols that resulted from the NIC process have since been shared through the state Department of Public Instruction, as well as presented by participants and researchers at state-wide educator conferences. There has also been follow up between researchers and schools as part of a continuation of the Personalization in Practice study, specifically focused on the implementation of the conferring protocols and the instructional systems that support it. The remainder of the paper focuses on the interaction structures and emerging network in Stage 3.

RESEARCH DESIGN

This study uses a mixed methods approach that draws on social network and qualitative data to answer our qualitative research question (Plano Clark and Ivankova, 2016): *how do NIC collaborative design activities foster reciprocated, help-based interactions?* We collected social network and qualitative data to determine the patterns and progressions of these interactions, and connect these to the design of the initiating activities of the NIC. We operationalized relational trust with a survey that allowed participants to identify who they valued in the NIC process, then explored key design tasks for evidence of reciprocated, help-based interactions. While all members of the research team engaged in data collection, the two authors of this paper were primarily responsible for both the design of the NIC activities and the collection of data.

Social Network Data Collection and Analysis

The research team developed a social network survey to collect data about participant interaction. The survey was given at the conclusion of the 90-day cycle, to all participants (n = 31, 21 educators and 10 researchers), built and delivered through Qualtrics (**Appendix A**). To ensure 100% response rate, participants were given time during the final meeting to complete the survey, and the network coordinator verified that each person had submitted it before the meeting concluded.

Participants indicated who they had interacted with about conferring prior to participation and who they interacted with during. We used a roster with the names of all the participants as a feature of the survey. They then rated how important that person was to their "learning about conferring." The question was phrased as "learning" to capture the range of interactions across the different design activities but rooted in collaborative and professional interactions. Because relational trust is a condition for learning with someone in the context of a professional learning community (Louis, 2006) and other studies have used tie strength as a proxy for trust (Gulati, 1994), we interpreted higher "important to my learning" as a valued interaction.

In the analysis of social network data, we use whole network and dyadic characteristics (Borgatti et al., 2013). Responses from the social network survey[4] were imported into Excel, anonymized, and uploaded into UCINET (Borgatti et al., 2002). Operationalizing what the tie represents is critical for interpretation. The ties we capture indicated who an individual interacted with and how that interaction was valued. This provides insight into the distribution and quality of ties across the network and situates qualitative observations, providing evidence about the ways in which participants relied on one another for help in the design activities.

Qualitative Data Collection and Analysis

We also collected data to capture the emergence of help-based interactions in the collaborative design activities. A number of written documents served as data sources, including the initial grant application, an advisory committee report, a research group presentation, meeting agendas, and a final report. During the listening sessions, the research team had a Google form that team members filled out with the answers from their calls. We collected planning documents and agendas, with notations for how meetings were modified in the moment, as well as email communications, internal and external presentations. Observation data was recorded by research team members as they participated in and/or facilitated activities related to the project, including notes and participant reflections from all collaborative design meetings.

We also collected direct feedback from participants. We asked participants for feedback about the activities, their thinking about conferring and personalized learning, and what each individual was interested to improve. After the second meeting, participants emailed one thing that they found to be the most meaningful during the morning's activities. On the last Saturday, we had teams do a focus group debrief of the user testing process and reflect on their progress up until then. The audio from these focus groups was transcribed.

Finally, we used the qualitative data to write detailed design narratives for each site and the NIC as a whole. The site narratives were semi-structured, describing each school's context and participating team members, what conferring and personalized learning looked like prior to PiPNIC, then a chronology of actions and design moves during the 90-day cycle. The network narrative focused on the meta-design of the processes that brought this work together. At a research meeting, these narratives were cross-checked with other members of the research team. The narratives were also presented with participating educators at a conference.

The analysis in this paper began with the social network then qualitative data. The social network analysis was used to identify patterns in interactions, then the qualitative data provided the quality of the interactions. For example, when the network analysis showed that participation in PiPNIC created interactions between participants from different schools, we turned to the qualitative data to understand the progression and

[4]For understanding the structure of the network during implementation, we omitted the ties between researchers. The reason for this was 2-fold: we wanted to see the structure of the network around the design work as the educators experienced it and the interactions amongst researchers were primarily focused on the organizational design of the network.

function of those interactions. This led us to identify a pattern of authentic requests for help between educators and researchers and amongst educators. Our attention was drawn to examples of participant interaction that could illustrate the kinds of help-based interactions indicated by the social network analyses. In our discussion (below), we consider the explanatory relation between the activities and the social network data as part of a larger argument about designing for relational trust.

In this way, the social network data provided selection criteria for the qualitative data, though not all of the qualitative data demonstrated the existence of help-based interaction. Many of the fieldnotes, for example, described information presentation activities, or documented participants involved in discussions or non-project related interactions. Our attention was drawn to examples of participant interaction that could illustrate the kinds of help-based interactions indicated by the social network analyses. In our discussion (below), we consider the explanatory relation between the activities and the social network data as part of a larger argument about designing for relational trust.

Because of the focus of this case on a context that includes educators as partners in social innovation, we constrain the analysis in this paper to educator-researcher and educator-educator interactions. While the researchers had some previous connections with each other, their pattern of interactions would have been confounded by other meetings beyond the collaborative design activities. Future analyses could examine how the ties between the researchers changed, but that is beyond the scope of this case.

FINDINGS

Our findings focus on identifying the emergence of help-based interactions through the PiPNIC collaborative design activities, then on describing the conditions that sparked these interactions. We present three kinds of collaborative design activities that produced the observed help-based interactions: (1) activities that created *meaningful cross-school connections* among educators and activities that strengthened ties between *same-school colleagues* and between *researchers and educators*; and (2) *activities to build reciprocal interactions across the network*.

Meaningful Cross-School Connections

The first kind of activity we highlight is the process of bringing together educators from different schools and school contexts interested in shared problems of practice to spark new professional interactions. Bringing together a group of weakly-connected educators and researchers can be a source of new ideas and resources for the NIC (Granovetter, 1973; Johnson, 2011), and it is integral to the process of finding what works, for whom, and under what conditions (Bryk et al., 2011). However, the lack of existing ties between educators from different schools and the differences in their school contexts can also produce barriers to collaborative problem solving if they perceive that other people's practices would not apply[5].

In PiPNIC, recruitment began with researchers who had existing ties with potential partners. Recruitment via existing ties has implications for the initial structure of the relational network, how new ties might be created, and the function of these new ties in terms of building the relational resources for innovation. Once a school indicated they were interested in participating, the school leader and the PiP team worked together to invite other educators from the school. Asking the school leader to identify someone meant that the educator might have a strong connection to their own school colleagues, but probably would not have a direct connection to the research team. This created a situation where one person from each school was connected to the PiP team, but most of the educators did not have prior connections with the PiP researchers or with other school educators.

Our social network data reflected this initial condition. The social network survey asked participants to identify who they knew prior to PiPNIC[6]. Ties prior to participation show a weakly-connected researcher-practitioner network with six subgroups: the five school teams and the research team (**Figure 1**). Researchers were central and densely connected to each other with ties to a few educators, but educators were not connected to each other (with a few exceptions). The ties between researchers and educators are characterized as weak because the average importance rating of the research team prior was 2.83/5 whereas the average importance rating of educators to their own colleagues at each school was 3.64/5 (**Table 3**).

A weakly-connected researcher-practitioner network is an important initiating condition for many NICs. The research team recognized we would need to initiate meaningful interactions across school groups early in the process by creating stable mixed-groups of educators from across schools. We intentionally created stable mixed-groups so that educators would come to know one another and have opportunities to consult each other over time.

The first mixed-group activity was sharing videos of their current conferring practice. Prior to the first Saturday meeting, PiP site captains had met with educators at each school to video the existing local classroom conferring practice of most teachers. Site captains worked with educators to shoot and edit the video to present at the first group meeting. Then on the first Saturday, each educator in the mixed-group shared their video of the school's conferring practice. A PiP Site Captain facilitated the discussion process. This activity allowed each educator to see how their conferring expertise compared with the other school's educators. Each educator could ask about the practices of the other schools and serve as an expert for the practices represented in their school videos.

Researchers noticed that this first look into each other's practices sparked discussion about the similarities and opportunities they saw in how conferring happened in other

[5]When educators encounter new ideas for practice, such as from research, they are likely to use their context as a primary filter for whether that new information will fit (Tseng, 2012).

[6]The accuracy of their recall was corroborated with what members of the research team knew as well. We knew there were very few ties across schools, but we did know about a few preexisting cross school connections and those were accurately reported. Likewise, we compared whether participants indicated interaction with their site captain, and this was consistent with what we knew, providing an external measure of accuracy that participant responses match observed interactions (Kashy and Kenny, 1990).

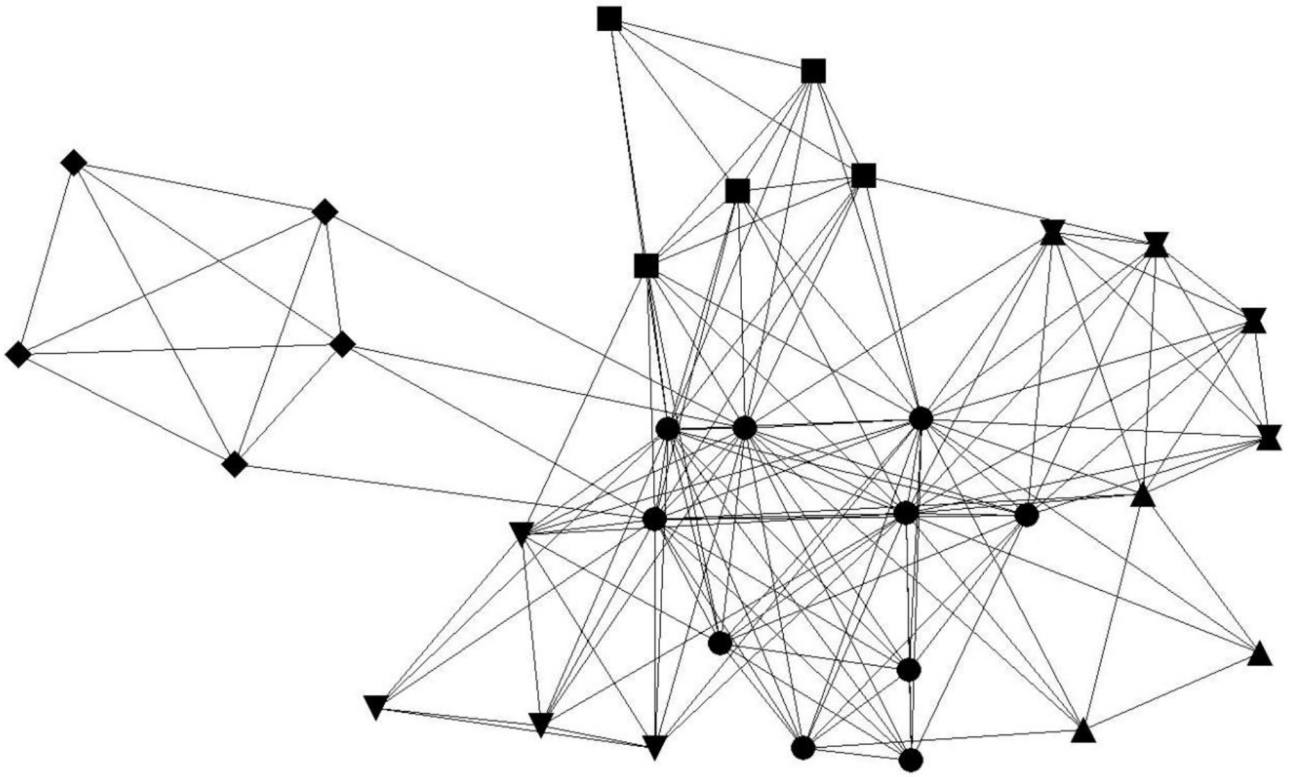

FIGURE 1 | This graph shows the network prior to the 90-day cycle. Participants answered the survey question, "Who did you know prior to PiPNIC?" The graph, constructed in UCINET, includes all participants ($n = 31$). The non-circle nodes are educators, circles are researchers, and the shape indicates organizational affiliation. More highly connected nodes are moved to the center, while people with fewer connections are moved to the periphery.

schools, rather than focusing on the differences in their contexts. One participant observed how remarkably similar the goals of conferring were, despite the variation in the implementation, age levels, pedagogical models, or student populations.

These mixed groups met again on the second Saturday where educators "pitched" their plans to improve their conferring practices, again facilitated by a researcher. Participation in these activities meant they needed to interact with participants from other schools to complete the design task, and next we show how we know these interactions were meaningful.

At the end of the 90-day NIC design activities, we saw changes in number of meaningful connections that each participant reported with others. The density of the network[7] increased from 0.28 to 0.44. This increase in density indicates the creation of new ties amongst the same number of nodes. The structure of the resulting network showed a distributed network of interactions (**Figure 2**). Educators became more centrally located in the network, whereas most of the PiP researchers had moved to the periphery, which confirmed our intention to design activities that would foster help-based interactions amongst participating educators. The network graph illustrates how educators were creating new connections with educators from other schools and with researchers. This creation of interactions across school groups reflects research on how networks can close structural holes and create access pathways to the ideas and resources of the other actors (Burt, 2017).

TABLE 3 | This table shows the average importance rating for different types of ties.

	Average importance rating		
	Prior	**During**	**Change**
In-group (i.e., between colleagues)	3.9	4.5	+0.6
Out-group (i.e., between educators at different schools)	1.3	3.3	+2.0
Educator-researcher	3.1	4.0	+0.9
Educator-site captain	3.0	4.4	+1.4

Participants answered the survey question, "During PiPNIC, how important was this person to your learning about the conferring process?"

We also observed that the new ties that were created were valued by participants. Half (12/21) of the educators indicated that "interactions with innovative educators from other schools" was the most important aspect of their participation. Participating educators shared the following reflections on their most meaningful moments:

[7]Network density is calculated by the number of indicated ties divided by the total number of possible ties.

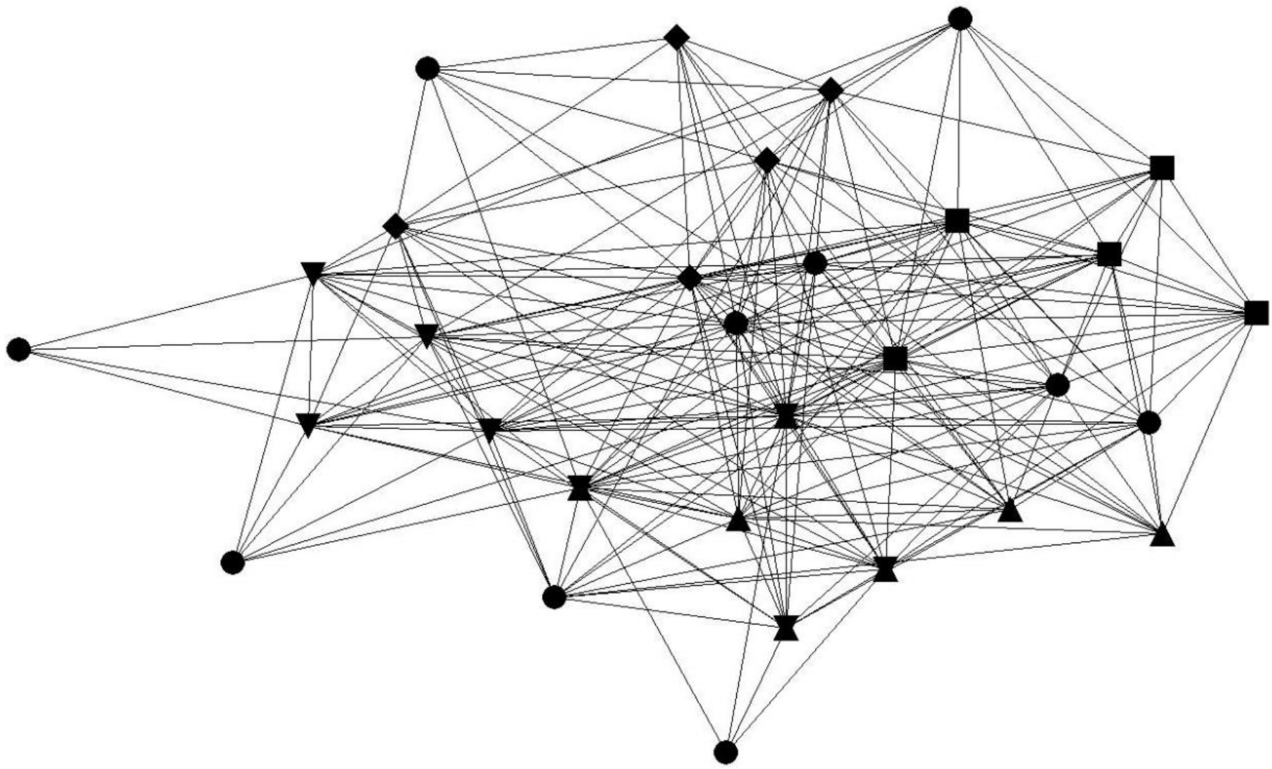

FIGURE 2 | This graph shows the network during to the 90-day cycle. Participants answered the survey question, "During PiPNIC, who was important to your learning about conferring?" The graph, constructed in UCINET, includes all participants ($n = 31$). The circles are researchers, non-circles are educators, and the shape indicates the different schools. More highly connected nodes are moved to the center, while people with fewer connections are moved to the periphery.

- "The process of sharing with others who have similar missions but very different contexts and different practices around a common question has been even more powerful and effective than I imagined it would be. I have greatly enjoyed this experience and feel as if I am gaining a lot."
- "I think the most meaningful part of the PiPNIC was when we were partnered with one person from a different school to share our protocol and talk through it with them so that they could try it in their context."
- "Meeting with different age levels teachers to see the connection with what is happening in my classroom"
- "The most meaningful part of the PiPNIC process was the interaction and conversations amongst the different schools."
- "The connections, stories and experiences shared from other professionals. The honest and open vulnerability everyone had through the process."

Every educator reported meaningful interactions with at least three educators from other schools. The number of meaningful interactions that each person receives is called *in-degree centrality*, and is often used as a measure of status in a network (Siciliano, 2016). This is because a person with more nominations from others has an influential position (Moolenaar, 2012). We considered a rating of 3 or higher (5 being the highest possible) for the question, "During PiPNIC, how important was this person to your learning about conferring?" That each person developed meaningful connections with educators from other schools is significant in establishing the conditions that support help-based interactions, as similar levels of status support the development of relational trust (Tschannen-Moran and Hoy, 2000).

Strengthening Ties Between Same-School Colleagues and Between Researchers and Educators

Sparking new ties among new colleagues is an initial challenge for the NIC process, but strong ties within schools, and with network initiators, are needed for innovation to take root in practice (Coburn and Russell, 2008). In many ways, it is not surprising that time spent together increased tie strength. A quarter of the educators responded that spending time working with their colleagues and other educators was meaningful. In this part of the analysis, however, we consider how the quality of interactions across the network strengthened ties within schools and ties with researchers.

The NIC leaders designed activities to foster help-based interactions amongst same-school colleagues. Saturdays began with an hour for school teams and their site captains to meet and prepare for the mixed-group session and concluded with an hour for them to prepare for their work going forward. Providing teams with this time was at first a way to reduce the demand for their participation on time outside of NIC activities, but it also

gave them designated time to complete collaborative tasks. For example, one school recognized that it had two approaches to conferring. They had to come to a consensus as to which version they would focus on or whether they would try to blend the two. The interactions to complete this task required a willingness to be vulnerable by sharing one's own practice, being open to change based on new information, and acknowledging each other's competence and expertise. The site captains noted that the team ultimately decided to go with one protocol, citing that "they saw themselves as one school." In this way, this design task forged a sense of shared commitment to this direction and engagement in the collaborative design process.

Other educators shared how important it was to have the time to work with their colleagues, including the drive to and from the meetings. One educator shared that the best part Saturday was "The ability to sit with my team, free of distractions, and have a conversation. Coming up with conferencing/project protocols has been on our to-do list for far too long. Often we are just going full speed and have little time to stop and just do ONE thing. I also appreciate seeing and hearing about what others are doing with their students. The experience is encouraging us to keep moving forward."

Looking across the network at the change in tie strength, participation in NIC activities strengthened all types of ties and ties across schools increased the most, but same-school ties were the most important (**Table 3**). The survey asked participants to indicate how important the person was to their learning about conferring. "More important" here indicated that the interaction supported them in the task they were trying to accomplish and suggests that the person was judged as competent in helping the respondent learn. The deepening of ties amongst colleagues is an important indicator that the NIC process sparked meaningful interactions among educators from the same schools.

Because the goal of NICs is to work across research and practice boundaries, the ties between a school group and their site captain provides an examination of a particularly important type of interaction in the context of the NIC. During design activities, site captains were included in the same-school groups, often helping participants clarify of the task or make sense of feedback, as we draw out in more detail later in the paper. All participants indicated that they had meaningful interactions with their site captains. The average importance rating of the tie between the school members and their site captain was 4.4/5, on par with their ratings for their own colleagues. The importance of the educator-researcher relationship and the deepening of ties across all subgroups suggests that the strong ties that were created represent meaningful, distributed interactions where help could be sought and received.

Activities to Build Reciprocal Interactions Across the Network

The social network and qualitative analysis presented provides insight into the patterns of interactions across the network. In the next section, we look at progressions of interactions. We highlight examples from the first NIC activity (sharing the video of current conferring practices in mixed-groups and deciding on a conferring improvement focus) and the fourth NIC activity (user-testing each other's conferring protocols). Though there were other examples of help-based actions, these two examples were the richest in participant perspective and provide examples of what was possible in the context of the activities.

The first example illustrates how researchers and educators began to ask for help from one another in developing representations of conferring practice. As described earlier, prior to the first meeting, PiP site captains had met with their school to help record and edit a representation of how conferring happens in each educator's school. These videos were then discussed at the first meeting's mixed-group sharing session. This session presented a moment of high vulnerability for educators who had just met each other. The interactions in the video, one-on-one conversations between a teacher and student, are perhaps the most intimate part of a teacher's practice. The researchers sought to create a safe space by prompting participants to notice, rather than evaluate, each other's practices. For example, the activity encouraged participants to describe carefully what they saw in each other's practice rather than making suggestions about how practice might be improved.

The educators from Franklin Elementary School recorded a conferring session in which two teachers met with one student to talk about her idea for an interest-based project. After presenting the video in the mixed-school groups, the Franklin educators reconvened with their site captain to make sense of the feedback they had gotten from educators at other schools. They discussed that other educators had noticed a lack of structure in their conferring process and that the teachers did most of the talking. Their site captain wrote down that their main takeaway from this discussion was that "We talk too much. We need to do something that helps students find their voice." This design task facilitated their ability to get feedback on their practice, then make sense of the feedback with their colleagues. At the conclusion of the first Saturday, the teachers decided to develop a conferring protocol that would structure conferring around interest-based projects, hoping that the structure would provide the scaffolding for students to speak more.

Before the second Saturday NIC meeting, the PiP site captain analyzed the Franklin conferring video and created a representation of the turn-taking between teachers and students (**Figure 3**). This visualization affirmed what had been observed the previous meeting and prompted continued conversation among the Franklin teachers about student ownership of the learning process. The team agreed that their conferring sessions were too teacher-led, and they decided to focus their conferring improvement efforts on supporting student-led conversations.

Notably, the interaction between the Franklin teachers and the PiP site captain lacked any signs of defensiveness that could limit reciprocal learning (Argyris, 2000). At the end of this second Saturday, one Franklin teacher shared in an email that she was thankful for "having the chance and opportunity to chat with my colleagues and hash out the details of our project process, having [our site captain] organize our thoughts and make sense of them, and creating meaningful project/conferring opportunities for the students we serve."

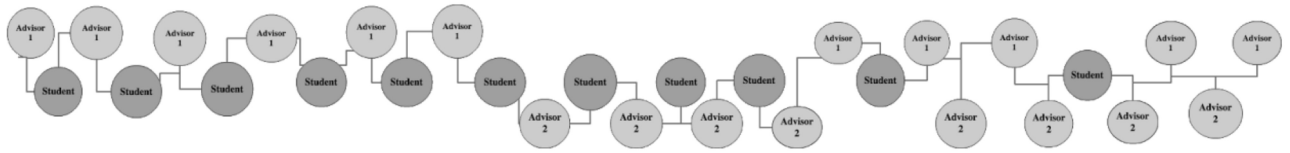

FIGURE 3 | Visualization of the Franklin conferring process created by the site captain. This figure represents the conferring process of one advisory session with two advisors and one student. In this instance, the student mostly responded to questions from the advisors and the student spoke less often toward the end of the meeting.

This example illustrates the PiPNIC collaborative design strategy. First, participants engaged in activities grounded in their current practices. Then they received feedback from other schools and from their site captain, and reflected on how to integrate feedback into their own protocol design process. Help was requested and received by educators and researchers alike in an effort to design a solution to the problem of practice.

The second example spans the third and fourth NIC Saturdays to show how the collaborative design activity of user-testing sparked authentic, help-based interactions between educators from two different schools. At this point, each school had a rough draft of their conferring protocol. The PiP team developed a user-testing activity for school teams to test and give feedback on each other's protocols. Each participant was paired with an educator from their mixed-school group in order to continue to build on their history of interactions. Pairs traded protocols, tested each other's designs with students in their own classrooms, then wrote feedback on the protocol. They then discussed their feedback in person at the final meeting.

One pair included Allison, an educator from Jackson High School, and David, an educator from Grant Elementary. Allison had 10 years of experience working in an alternative high school, and David was in the first year of creating a personalized program within his elementary school for disengaged students. Allison and David were assigned to work together because one of the research team members had noticed that they had often engaged each other in conversation during the mixed-group activities. The focus of their protocols, however, was different: Allison's school team had focused on protocol questions to elicit evidence of student growth, whereas David's school team focused on questions to guide the development of interest-based projects with students.

On the third NIC Saturday, tasked with exchanging protocols and making a plan for user-testing, their conversation started with the context and logistics of using the protocol, but soon turned to probing each other's expertise. David asked Allison for help thinking about two questions when she was testing his protocol: "Are there questions that are better predictors of student success?" and "Are there questions that lead to student self-awareness and potential for success on a project?" Allison noted these on her planning document.

A few weeks later, when Allison made comments on David's protocol (via Google documents), she wrote that two of the questions from his protocol, "Who is your audience?" and "How will you measure the quality of your work?" elicited the response from her students, so she suggested that the two questions could either be combined or one of them eliminated. To David's question about student success with the project, Allison challenged him to define his criteria for success better, noting that his use of the term "reasonable" could be interpreted in different ways. In her feedback, Allison responds to David's request for help and shares her expertise with David through a high level of specificity in her feedback combined with recommendations for improvement.

This help was reciprocated by David. He wrote a page of comments on Allison's protocol about his testing process. The goal of Allison's protocol was to develop the relationship between teacher and student through questions about the student as a learner. David described how his conversation with a fourth grader went and that through the protocol, he "learned a lot of new information about the student as a person and learner and think that this protocol … could really strengthen the relationship between the teacher and the student." This reflection provides evidence of mutual appropriation, where David is adopting some of Allison's perspectives on the goal of conferring.

On the final NIC Saturday, Allison and David met to discuss each other's feedback. They engaged in 45 min of animated conversation, sharing their experience with testing out each other's protocols. David later shared this reflection with his colleagues, "This whole idea of knowing your students better … we were talking about [this as] the key to creating robust personalized learning projects because they are so connected to who the students are as people." This quote shows a converging understanding of ideas that can be traced through the series of interactions that were set up by these collaborative design activities. Additionally, on the social network survey, Allison and David both indicated higher than average importance ratings for each other. This supports that David and Allison asked each other for help, reliably received help, and valued the quality of the help they received.

These two examples illustrate the progression of interactions that was possible within the 90-day cycle. As the cycle progressed, participants increasing relied on the authenticity of their colleagues' expertise as designers in similar situations to guide their actions. The NIC process created the conditions for building a distributed network of expertise where help-seeking interactions happened across participants.

DISCUSSION

Networked Improvement Communities and other social innovation approaches require educators and researchers to

work together to solve complex problems. We explore how collaborative design could serve as the interaction structure at the heart of a NIC process. This case study is a first effort to test using social network and qualitative data analytic techniques to understand the network of relationships that were fostered through the initiating NIC activities. Our research question, *how do NIC collaborative design activities foster reciprocated, help-based interactions?* helps us understand how social network and qualitative data might be applied to explore the development of network ties amongst participants. We use the idea of reciprocated, help-based interactions as an indicator to point toward how NIC activities could lead to the development of relational trust. Tracing the patterns and progressions of reciprocated, help-based interactions opens a window into the capacity that emerges from NIC collaborative design activities.

Answering this question leads us to explore how we could use social network tools and qualitative data to trace the emergence of help-based interactions across the participant network in order to contribute to the growing literature on the effects of NICs on research-practice partnerships, and social innovation more broadly. The NIC initiation framework described by Russell et al. (2017) states that "coordinated action among the partners should align with the core design activities and that the development of social infrastructure, such as the "culture, norms, and identity" (p. 5) is a desired outcome. We find Penuel's (2019) insight that infrastructuring establishes the "configurations of conditions needed" (p. 2), a helpful way to think about the role of NIC design in sparking emergent relational trust networks. The social infrastructure of PiPNIC emerged from the strategic action of the initiation team to create a sequence of help-based interactions across participants.

Leveraging social network and qualitative data illustrates the path from configuration conditions to the emergence of the PiPNIC social infrastructure. The mixed-group assignments provided proximity for interaction. An early task, watching and annotating other participants' conferring videos, created an initial condition for asking for and receiving feedback from other educators. The grouping strategies built a history of professional interactions over time and a network structure that positioned educators to connect with each other within and across schools.

The social network data showed that researchers moved to the periphery during implementation. A peripheral position for a researcher is different from a traditional research-practice model of researcher as source of knowledge. The peripheral position instead aligns with more collaborative design approaches that center the user (the educator, in this case). Positioning the researcher this way may suggest a structural component to the shift in researcher role in the context of research-practice partnerships that are described (e.g., Cohen-Vogel et al., 2015). This insight presents an important follow up investigation of the networked position of the researcher.

The triangulation of social network and qualitative data was crucial in our study. The social network data helped trace how the patterns of interaction emerged. Our argument suggests that social network analysis can serve as a valuable indicator and as a strategy for how NIC designers might measure emergent network capacities. While the social network analysis demonstrated that relational ties were being developed, we needed the qualitative data to understand how and why help-based interactions occurred. We find that the feedback on which activities mattered, and why, called for qualitative information about participants, designers and the work produced. Together, the social network analysis and qualitative data provided feedback to PiPNIC designers on how and why the planned activities worked, and gave voice to the participants on the effects of the activities on the growth of their knowledge and skills.

Attention to the social infrastructure is not meant to replace measuring the targeted outcome of the NIC. The key outcome for a successful NIC, of course, is a change in the targeted behavior highlighted in the core problem of practice. If the NIC is organized around collaboratively designed solutions to improve student outcomes, then evaluation should be focused on how the solutions change the outcomes. Our work here is meant to investigate the social dynamics during initiation and propose how interactions might be seen in terms of fostering long-term relational trust networks.

Limitations of This Analysis

We would like to note several limitations of this paper. First, there are limitations in terms of how we operationalized relational trust, and more work is needed to establish a causal link between reciprocated, help-based interactions and the development of relational trust over time. Initially, we aimed at a NIC strategy that would create relational trust among participants. Careful reflection led us to understand that relational trust emerges as a result of long-term engagement in help-based interactions, and that the 90-day NIC cycle may not create enough opportunities to create relational trust. Although our paper emphasizes the role that the design of help-based interactions can plan in shaping professional interaction, we would need to continue the study by returning to the daily practices of educators in order to document whether the PiPNIC spark sustained into professional interaction in their schools.

Second, because the study was limited to documenting the PiPNIC 90-day cycle, we are also unable to answer the ultimate question of the PiPNIC process of whether everyday conferring practices changes in the participant school communities. The goal of a NIC is to change everyday practices, and the design of this study, which focused on the NIC process itself, did not allow us to subsequently track the effects of PiPNIC into participant classrooms. Anecdotally, we have checked in with each participant group since the PiPNIC experience. We found that each team experimented with new conferring practices in some way, ranging from formalizing all conferring practices across the school to trying new kinds of conferring (project-based, or interest-driven) protocols in everyday practice. Still, without a systematic study of post-NIC outcomes, we are unable to make claims about the impact of the NIC on practitioner work.

Third, there was a significant limitation to the social network data we collected. We were only able to give the survey near the end of the PiPNIC process (rather than at the beginning and at the end). Thus, the data that we report about the network at the outset was based largely on the recollection of participants near the end of the PiPNIC process (as well as on interview data

collected near the beginning of PiPNIC). It would have been better for us to have surveyed people several times throughout to indicate where and how interactions were happening and to have asked specifically about who they were getting help from.

A final limitation of our study is the positionality of the designers. The authors of this paper also acted as the designers of the PiPNIC process. While this situation provided a unique perspective on the design process, it also limited our ability to see beyond the design choices that appeared obvious to us. Our use of interview, observation and social network data helped to triangulate our positionality, but did not remove our role in the design process as a factor in the analysis. In future studies, we would use the social network and qualitative inquiry models to study other NIC implementations to create a distance between the actors interested in the success of the NIC and those interested in measuring its results.

CONCLUSION

Our paper uses social network analysis and qualitative data analysis to trace how the collaborative design activities of a Networked Improvement Community create the capacity for participants to work together to solve their common problem of practice. The PiPNIC project used a NIC model to create an RPP around the emerging challenges in personalized learning, bringing together 31 participants from five schools and a university for a 90-day collaborative design cycle. In our findings, we document the emergence of network interactions across participants, as well as examples of the kinds of help asked for and received within and across participant groups. We showed that when help-based interactions are reciprocated, the emerging relationships allow the necessary risk-taking required for the kind of experimentation with practices characteristic of successful research-practice partnerships.

With increasing interest in using social network analysis as a form of network-level data to assess the health or effectiveness of a research-practice partnership, we conclude that the social network data alone described *that* interaction changed, but qualitative data supported a stronger connection with the design activities. The aim of this study is to contribute to emerging ideas of how to use social network analysis to understand how Networked Improvement Communities, and social innovations more generally, are initiated and developed. In doing so, we demonstrate, on a practical level, how social network and qualitative data might be used to generate network-level data for improvement, and we contribute theoretical insight into the way collaborative design creates the conditions for the kinds of interactions associated with long-term development of relational trust.

Social innovation requires attention to interactions. Collaborative design provided a helpful guide to developing activities that lead participants to ask for and to receive help from one another. Network designers can use collaborative design to create opportunities for participants to make their own practice public, engage in collaborative revision of their practices, try out each other's solutions, and create dissemination networks for resulting insights. Our efforts to trace the emergence of help-based networks across participants, and to use qualitative data to illustrate important occasions for interaction, provided insight on how the conditions for relational trust started to emerge in PiPNIC. We hope that our study of how participants helped each other design and test solutions to a shared problem of practice can provide an example for NIC leaders on network design, and for NIC researchers on network evaluation and guidance. More broadly, understanding how collaborative design activities can create these characteristics suggests that, by attending to how people come together, social capacity for innovation can be built in and through orchestrating meaningful help-based interactions among professionals.

DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available. The data only available to members of the research team per the institutional ethics board policy.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Education and Social/Behavioral Sciences Institutional Review Board University of Wisconsin-Madison, Wisconsin, USA. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

RH and JK contributed to the conception and design of the partnership. JK organized the data collection. JK did the social network analysis and wrote the first draft of the manuscript. RH contributed the substantive revisions and framing. Both authors contributed to the manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2019.00154/full#supplementary-material

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Entrepreneurial Education for Persons With Disabilities—A Social Innovation Approach for Inclusive Ecosystems

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Fostering entrepreneurship and inclusive societies are on top of EU policy agenda. This article is bringing together both aims by discussing a social innovation framework for inclusive entrepreneurial education for persons with disabilities. Similar to other disadvantaged groups, persons with disabilities can benefit from entrepreneurial skills for self-management or, on a next level, for starting own, opportunity-driven businesses. The framework suggests several building blocks considered necessary for successful entrepreneurial education for the beneficiaries. First, it is approaching the framework through a social innovation perspective. In doing so, it suggests a social innovation ecosystem perspective to operationalize all relevant stakeholders and contextual aspects relevant for the framework. Second, it suggests to build on socially innovative, hence novel, practices by starting from co-creation and co-production in order to meet individual demands and needs of learners. Furthermore, it takes the concept of universal design into account as it holds major implications for inclusive entrepreneurial education for persons with disabilities and underlines the need of different, more suitable practices in entrepreneurship education and beyond, toward an inclusive learning ecosystem.

Keywords: entrepreneurial education, persons with disabilities, social innovation, inclusive learning ecosystem, co-creation, co-production, entrepreneurial skills, entrepreneurial ecosystem

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INTRODUCTION

Supporting a shift toward inclusive societies is a major aim on the agenda of the European Union (EU) (David and Hamburg, 2013; Hamburg and David, 2017). Hereunder, the European Commission primary understands the reduction of social exclusion and addresses especially the decrease of discrimination and various forms of inequality through innovation[1] in general and social innovation in particular [Bureau of European Policy Advisers (BEPA), 2010] as one important stream. Yet, to tackle challenges such as economic recovery, inclusive and sustainable long-term growth with a focus on citizen involvement, the engagement of citizens, academia, social partners, public authorities, the creative sector, businesses, and (e.g., social) *entrepreneurs* is key. In shaping inclusive societies in the medium term, these actors can only succeed when

[1]Europe in a Changing World. Inclusive, Innovative and Reflective Societies. Available online at: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/europe-changing-world-inclusive-innovative-and-reflective-societies (accessed May 11, 2019).

acting in a social and economic framework that promotes fairness and sustainability in Europe[2]. Entrepreneurial ecosystems, for instance, which are more open and supportive to new, inclusive forms of entrepreneurship (Hamburg and David, 2017), are part of such frameworks. They address social and economic behavior answering the needs and demands of specific target groups, which aim to become entrepreneurs (David and Hamburg, 2013). In this vein, equal access to (entrepreneurial) education and labor markets for all societal groups is an important building block toward more inclusion.

Among other groups, persons with disabilities are still marginalized, including career opportunities by means of labor market entry (Grammenos, 2011) as well as lower-skilled and lower-paid occupations (Kitching, 2014). Partially, this is caused by limited access to appropriate education. For instance, David and Hamburg (2013) found that often these target groups face a serious lack of hard and soft skills[3] and therefore more often than other groups enter a vicious circle of unemployment, social exclusion, and later fall into age-related poverty. In today's world of digital shifts, employers' changing requirements make it increasingly difficult for persons with disabilities to gain a foothold in working life when necessary skills are missing (David and Hamburg, 2013). For "nascent entrepreneurs with disabilities" in the United States, Renko et al. (2016, p. 571) highlight a "particular financial disadvantage" as a major barrier for successful start-ups realized by this group of people, together with weaker social networks and lower knowledge levels. Increasing the levels of knowledge and skills via entrepreneurial education should create new opportunities (OECD/EU, 2017). Enhancing professional knowledge and (business) skills through self-empowerment, supports persons with disabilities to implement their own businesses and to be part of the labor market under equal conditions[4]. Entrepreneurial education with a focus on self-empowerment provides the tools to build new forms of entrepreneurship and unlocks untapped potential of "disadvantaged" groups (David and Hamburg, 2013; Hamburg and David, 2017). Consequently, the question arises how inclusive entrepreneurial education with persons with disabilities (IEEPD) could look like.

Popular success stories of labor market participation of persons with disabilities are often related to both self-employment and entrepreneurship[5] (Kitching, 2014). Using European Community Household Panel data from 1995 to 2001, Pagán (2009), for example, showed for 13 European countries that self-employment rates among this group is higher compared to persons without disabilities. This may seem positive at first sight as self-employment can be a pathway for self-determined labor. However, entrepreneurial activities might also be the only possibility to entering the labor market at all. In that case, it would rather be necessity-driven (i.e., necessity entrepreneurs) than opportunity-driven (David et al., 2019a). Although evidence on decision-making of entrepreneurs with disabilities is still scarce or even missing (Renko et al., 2016), based on earlier experiences with other disadvantaged groups, it is assumed that entrepreneurial education could help to supersede necessity entrepreneurship in favor of opportunity entrepreneurship of persons with disabilities. In order to better meet individual demands and varying talents, capabilities and possibilities, self-determined co-creation and co-production (Brandsen and Honingh, 2018) of a learning framework and respective educational services are suggested.

This paper is organized as follows: The next section (2) introduces the implications of and for an inclusive society. Here, also their relation to global trends are discussed. In section 3, key elements and concepts of entrepreneurship and entrepreneurial education and their linkages to opportunities for self-empowerment for persons with disabilities are presented, followed by the discussion of their importance for inclusive societies. The fourth section focusses on concepts of the socially innovative approach and implications from social innovation studies, whereas section 5 summarizes with a discussion of the presented elements forming the IEEPD framework. The article closes with a conclusion in section 6.

EU's CALL FOR INCLUSION

For decades a broad range of literature and discussion explicitly points at an increasing skills-shortage and the role of skilled human capital in and for the EU (e.g., Mohr, 1997; Faggian and McCann, 2009; Growe, 2009; Haisch and Klöpper, 2014; David, 2015). In this context two sides of the coin are addressed: on the one hand the need for skilled or even highly-skilled and highly-specialized employees and on the other hand the groups of people whose potential still is unlocked or untapped and who therefore are often confronted with disadvantages, leaving less room for self-determination. When talking about unlocked or untapped potential, groups of persons are characterized who are described as vulnerable and marginalized. Hereunder the OECD/EU (2017) describe disadvantaged or under-represented groups of people such as immigrants, long-term unemployed, low-skilled persons, but especially women and persons with disabilities, which are in focus of this article.

Foremost, when it comes to education, it is often especially the group of persons with disabilities who is excluded from full participation, leading to a need for "mainstreaming disability in education" as, for instance, Sefotho (2015) puts it. Lower levels of education and labor market participation have strong effects on their employment rates and income (Berthoud, 2008; Jones, 2008; OECD/EU, 2014). Based on experiences from projects with this target group Hamburg and Buksch (2015, p. 1) summarize that "[l]earners with disabilities at all levels of education are vulnerable to exclusion from educational opportunities and often

[2]Europe in a Changing World. Inclusive, Innovative and Reflective Societies. Available online at: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/europe-changing-world-inclusive-innovative-and-reflective-societies (accessed May 11, 2019).

[3]Both hard and soft skills are referred to as "skills" throughout this paper as the authors believe that both groups of skills are equally important for successful entrepreneurship and tasks that benefit from entrepreneurial skills.

[4]This is also particularly important as it directly refers to the UN Convention on the Rights of Persons with Disabilities (CRPD), 2008) and the call for better supporting self-determined work.

[5]While self-employment does not necessarily equal entrepreneurship, both activities can benefit from skills necessary for successful, self-determined labor.

from social life." In result of social disadvantages and lower education levels they lack job possibilities and have higher drop-out rates in comparison to the average rate of a country. Consequently, as stated above, the gaps starting in education and continuing in job-inconsistency often lead to poverty. Hauben et al. (2012, p. 23) report that 21.1% of the target group faces that risk in comparison to 14.9% of people without disabilities.

According to OECD/EU (2014) it is estimated that 16% of the working age population is in some way permanently or temporarily influenced by disability and the numbers are likely to increase during the years to come. In broader terms, "disability" subsumes a broad variety of physical and mental characteristics in accordance to their type, duration and time of onset (OECD/EU, 2014). Therefore, when talking about persons with disabilities, we talk about a group of people that strongly varies in itself and has individual needs and demands (Lutz et al., 2011). As Kitching puts it for the OECD/EU (2008, p. 3): "Disabilities are extremely diverse and are not a fixed characteristic of individuals. Many disabilities are invisible to the eye yet popular stereotypes of disabled people as permanent wheelchair users or as blind from birth persist." When taking a closer look at concepts of disability a social model as, for instance, that of Oliver (1990) comes into play. This model distinguishes *impairment*, for instance physical or mental characteristics limiting abilities, from *disability* which is linked to social aspects. The whole complexity is also addressed by the well-established *biopsychosocial* model (Wade and Halligan, 2017). It comprises not only physical and mental impairments but also several social as well as individual conditions of a person and their interplay. In this respect, discussing disability and measures for persons with disabilities does always have to take each individual and its specific situation into account, especially when it aims at being created together with this group. For the framework discussed in this article, it is therefore essential to highlight the need for tailored and individualized measures as already suggested by Renko et al. (2016, p. 574) for "entrepreneurs with disabilities." In practice, IEEPD will therefore need to go beyond a fixed set of curricula and needs to take a dynamic path responsive to individual demands and needs. Nonetheless, the presented concept may be directed to manifold target groups, as it is generally open to adaptions.

EMPOWERMENT THROUGH ENTREPRENEURSHIP AND ENTREPRENEURIAL EDUCATION

In search for inclusive approaches, the concept of *empowerment* comes into play—one of the central principles and goals of social work (Stainton, 2005). Understood as self-empowerment, the concept aims at increasing autonomy and self-confidence. It also aims at the identification and further development of one's own strengths and competencies on her or his own (Hamburg and David, 2017). The core concept of empowerment is based on the term *power* in the sense of having the power to realize oneself and to help others do the same (Pettit, 2012). Fundamental to the approach are understanding of participation, integration, individualization, power, influence, and self-realization (Jönsson, 2010). Ideas, ideologies and understanding vary according to the context and are limitless as studies of Fernandes (2015) present, based on research on the group of immigrants. Here, responsibility does not mean that there is not a support system in which the individual can develop and become self-determined and therefore, self-responsible. In contrast, the development of own carrier pathways is to be supported by an educational ecosystem which provides the basis for social and economic skills for people who want to improve self-management of their private and working lives. Spinning this idea, entrepreneurship occurs as a form of empowerment. Hence, entrepreneurship also provides a path for more self-determination. In this section, the potential of entrepreneurship and entrepreneurial education for empowerment, self-determination, and inclusion will be discussed after briefly introducing the main concepts.

Entrepreneurship in a broader sense is the art of putting ideas into action (Hamburg and David, 2017). It relies on creativity, innovation, risk-taking, and the ability to plan and implement projects (Shephard, 2004). Entrepreneurial competences are not only important for those who want to start or run a business, but also for those who want to achieve change in the individual and collective economic and social environment by expanding their own competences and their ideas in all areas of life.

In order to unfold the potential of entrepreneurship for empowerment, entrepreneurial education is needed and should be an integral part of anybody's learning biography who wants to benefit from this pathway. Entrepreneurial solutions for problems in personal and professional contexts can be offered at all stages of life. Entrepreneurship encompasses a variety of professional skills and characteristics. An improvement of entrepreneurial skills is therefore not only aimed at increasing the number of self-employed, start-ups or companies in general, but—in the sense of self-empowerment—at communicating the awareness of being able to act self-determined in all life situations similar to an entrepreneur (David et al., 2019b). Hence, individuals need to be provided with skills that enable them to manage their careers, succeed in reorientation, and master transitional phases. This also includes the establishment of a perception of changes as opportunities, broadening networking skills, identifying one's own potential, adapting it to the local needs of the respective target regions, and developing alternatives if Plan A does not work right away.

Ultimately, there is another benefit of entrepreneurial education in addition to abilities, which it offers for everyday life: triggering the entrepreneurial spirit of individuals can show people concrete possibilities for self-employment or even entrepreneurship. This includes not only the ability to create a business plan, to self-manage and self-organize, to identify customers and their needs, but above all the development of innovative ideas in the context of each region, their (future) sectors, their networks and existing services and products. Above all, for persons with disabilities this may be a chance for more participation.

Entrepreneurship Education: How?, What?, by Whom?, Where?, Which Channels?

In the past decades, remarkably pushed by the European Commission, it seems like entrepreneurship has found its

way to the forefront. Its existence and increasing importance are seen to be linked to sustainable growth and economic development in the EU. In addition, entrepreneurs are known for innovative impacts as well as job creation in regional contexts[6] and social entrepreneurs add social value to the agenda of entrepreneurial activities. Generally speaking, entrepreneurship is a given phenomenon and was always part of the economy (Hamburg and David, 2017), even if there are gaps in literature when it comes to the prominence of the entrepreneur and his/her role in economic theory during the decades (Hébert and Link, 2006). It was Schumpeter in 1912 "[…] who constructed *The Theory of Economic Development* around the dynamic, innovative actions of the equilibrium-disturbing entrepreneur" (Hébert and Link, 2006, p. 2). Today, entrepreneurship is a crucial point for many disciplines, among them economics, sociology, and management, and it could become topic to further ones.

A central change in entrepreneurship for the discussion of IEEPD is the shift from entrepreneurs as persons running businesses only, to persons who want to self-empower through entrepreneurial activities and entrepreneurial principles (David et al., 2019a). Through promoting entrepreneurial mind-sets, encouraging innovative ideas and solutions to challenges and fostering a culture friendly to entrepreneurship and diversity within an ecosystem, full individual potential can be exploited (OECD/EU, 2017). In the *Proposal for a Recommendation of the European Parliament and of the Council on Key Competences for Lifelong Learning* of the European Commission, under the eight key competences which the Parliament urged the Member States to implement to national strategies for young and adult learners, entrepreneurship was on the forefront[7].

Against this background, Hamburg and David (2017) consider entrepreneurial competences as not only being relevant for those who would like to start or run a business, but for all, who want to enhance their own competences and stepping up with their ideas to transform their own lives and their communities.

According to Hébert and Link (2006) by the dawn of the twenty-first century, nearly 200,000 American students alone, had been enrolled in entrepreneurship or small business courses at universities and the numbers since then are increasing. Whereas, such numbers are not available for the EU level, many European countries have included entrepreneurship in their national curricula for vocational education and training and higher education (Hamburg and David, 2017). However, the standards differ and are not officially recognized within the EU. There are universities and further education institutes in Europe, which are specialized on knowledge transfer with a focus on spin-offs[8]. Furthermore, there is an increasing number of entrepreneurial courses for students all over Europe created by European Projects, for instance (see for instance Erasmus + projects)[9]. In addition, entrepreneurial education is no longer a topic for economists only, but also students from further faculties attend entrepreneurial education (Hébert and Link, 2006). Furthermore, the need to address entrepreneurial abilities at a younger age was identified by economy and research (e.g., Stifterverband für die deutsche Wissenschaft, 2014) for Germany. In this particular context, the trend to train pupils in entrepreneurship is also a topic of some foundations (e.g., entrepreneurial education programs of the Joachim Herz Stiftung). Others have established professorships, which foster entrepreneurial thinking or even entrepreneurship hubs (e.g., Freie Universität Berlin)[10]. Nonetheless, the gaps in entrepreneurial education among Europe still wait to be filled and a focus on entrepreneurship education tailored to individual needs of marginalized groups and for persons with disabilities in particular is still scarce.

The challenges relating to entrepreneurial education, especially in the EU, raise the following questions: *"how to teach," "what to teach" "by whom," "where to teach," and through "which channels."*

Currently, there are limited answers to these questions. Hamburg and Buksch (2015) as well as O'Brien and Delaney (2017) empirically identified the best ways of *how to teach*. For instance, they argue, that learners in entrepreneurship education should train on practical projects, in order to make real experiences, which are similar to daily businesses. In addition, today teaching possibilities based on existing digital tools open doors also for learners who demand more flexibility, individual approaches, and user-friendly learning environments which, at its best, are part of an entrepreneurial ecosystem (Hamburg and David, 2017).

Learning materials and contents (*what to teach*) are already discussed (Ripsas, 1998; O'Brien and Delaney, 2017; compare Hamburg and David, 2017), proposing specific curricula and contents for entrepreneurial education. Some of these suggestions are target group specific, addressing women entrepreneurship or immigrant entrepreneurship (David and Coenen, 2017; O'Brien and Delaney, 2017). Amongst others, the first steps in entrepreneurial education basically enclose these topics:

- time management,
- (self-)motivation,
- idea development,
- taking responsibilities,
- ways to funding possibilities,
- business plan development.

[6]European Commission. *The Entrepreneurship 2020 Action Plan*. Available online at: https://ec.europa.eu/growth/smes/promoting-entrepreneurship/action-plan_en (accessed May 13, 2019).

[7]EUCEN Observatory for Lifelong Learning (LLL). Available online at: http://lifelonglearning-observatory.eucen.eu/recommendationcompetences (accessed May 13, 2019).

[8]The term "spin-off" refers to start-ups that start from existing business rather than from scratch.

[9]The co-author of this article Alexandra David was involved in several projects on the creation of entrepreneurial courses in Europe. Among them ENTER to Entrepreneurship or EFEB Network under the Erasmus+ of the EU (compare: https://www.iat.eu/forschung-und-beratung/projekte/2014/enter-einstieg-in-das-unternehmertum.html and https://www.iat.eu/forschung-und-beratung/projekte/2015/efebnetwork-european-region-entrepreneurship-connection.html) (accessed May 13, 2019).

[10]Digital Entrepreneurship Hub. Available online at: https://www.wiwiss.fu-berlin.de/fachbereich/bwl/pwo/rothe/research/Digital-Entrepreneurship/index.html (accessed May 13, 2019).

Sujan Patel—an entrepreneur and marketer—describes several skills needed as an entrepreneur[11]. Besides basic skills needed for entrepreneurship in general, in summary he stresses the abilities how to become a successful entrepreneur and among them:

- the ability to manage and raise money,
- the ability to be productive by relieving stress,
- the ability to interconnect and make entrepreneurial friends and to identify own strengths and weaknesses,
- the capability to hire effective people who can fill gaps, and to train the staff in such a way to make them even more effective in daily work processes,
- to focus on customers and identify new trends as well as to improve the world.

In that line, the Aarhus Technical College (2013) names the following skills for enhanced learners:

- working with (geographically) distributed production or companies,
- working in foreign languages,
- professional and vocational competence key skills, knowledge and understanding like problem solving, working with others, skills for Information and Communications Technology(ICT), and health and safety—also skills, knowledge, and understanding that are related to different occupations and professions (e.g., finance, retail) and environmental issues,
- communication and social competence key skills, knowledge, and understanding in effective communication and interpersonal activities, as well as in ethical, moral, and cultural concerns,
- personal competence development of autonomy, responsibility, personal role, own performance, and learning.

While not all of these skills might be important or necessary for each learner with her or his individual demands, this list still provides implications for IEEPD. It also highlights the importance of both hard and soft skills for successful entrepreneurship. On the one hand, skills not exclusively specific to entrepreneurial activities, such as working in foreign languages or problem-solving skills, can be particularly important for a wider target group. On the other hand, more specific vocational skills or skills of particular relevance for entrepreneurs like basic skills in accounting, can, of course, also become relevant and could especially be demanded by learners with the explicit aim of starting a business. However, as self-determined entrepreneurial skills education would lead to more individual curricula as an output of co-creation (Brandsen and Honingh, 2018) for entrepreneurial education (see the next sections), it is not possible to unalterably set the compilation of skills to be taught.

With the transformation in entrepreneurial education and education systems in general, there is also the question: who is the teacher/trainer and who is the learner? Besides traditional teachers and trainers, also unconventional teaching staff with, for instance, practical knowledge relevant for entrepreneurship and entrepreneurial skills in more general terms should also be considered, answering the question *by whom to teach*. In line with the idea that such education should be less theoretical, but rather practical, the question arises: who are better teachers than entrepreneurs themselves? In a framework of co-creation (Brandsen and Honingh, 2018; section 4.4) for marginalized groups (compare Steinberg et al., 2019), where both sides the teachers and the learners jointly create a learning framework oriented toward the demands of learners, often practical experiences seem to be more valuable. In such co-creative processes, the definition of teacher/trainer and learner can become blurred and they often also shift, so that role changes can occasionally happen. In addition, building entrepreneurship networks seems to be important foremost in the context of *inclusive entrepreneurship*—understood as entrepreneurship that is inclusive to as many disadvantaged groups as possible. Referring to the OECD/EU (2015) and Renko et al. (2016) especially persons with disabilities and further under-represented groups in entrepreneurship often rely on such networks of established entrepreneurs, who can simplify their access to finances, markets, and other resources.

When it comes to the question *where to teach*, the suitability of physical space comes into play. For IEEPD, this question addresses the decision between services provided at a physical space or provided through digital *channels*, hence at whatever physical space with sufficient technical equipment. While physical space meeting the criteria of Universal Design (e.g., regarding the avoidance of physical barriers; see below) can be adequate for groups with a higher amount of mobility, it might not be the right choice for other groups. For persons with limited mobility options, especially the role of digital tools needs to be considered, answering the question *which channels* to be used for IEEPD. When taking into consideration that entrepreneurial education first was realized at universities and colleges in the UK in the 1920's (Ripsas, 1998), one can imagine that the transformation from physical learning environments such as class rooms to digital learning spaces took several years. However, today e.g., ICT-based learning methods like Massive Open Online Courses (MOOCs) (Alumu and Thiagarajan, 2016; Carrera and Ramírez-Hernández, 2018), with open access to large populations, are generally a step forward toward an inclusive education framework (Hamburg and Buksch, 2015). Thus, the internet and digital developments in all varieties often support not only new forms of entrepreneurship, but also improve vocational education and training and other educational practices. Thus, digitalization plays a dual role in the context of entrepreneurial education, it can be the instrument to be used for achieving more inclusive learning and it is part of the "digital" business model that creates e.g., digital solutions to customer demands (Hamburg and David, 2017). Hereby, digitalization also allows inclusive education being the *channel* that brings flexibility and diversity to learning opportunities and overcomes physical, cultural, and social barriers, to name some. In context of the potential for inclusion provided by digital tools and digital services (section EU's Call for Inclusion), their adaption in the context of IEEPD should be considered. Especially the target group of persons with disabilities can profit from such a way of

[11] The 17 Skills Required to Succeed as an Entrepreneur. Available online at: https://www.entrepreneur.com/article/242327 (accessed May 14, 2019).

inclusive education when it is oriented toward the principles of universal design [The Center for Universal Design (CUD), 1997], as will be shown in the next section.

Inclusive Entrepreneurship and Inclusive Entrepreneurial Education With Persons With Disabilities

What is inclusive entrepreneurship? Asking this question, one may reflect the possibility that inclusive entrepreneurship is a specific form of entrepreneurial activities like "cross-border entrepreneurship," "sustainable entrepreneurship," or "social entrepreneurship." In addition, the connotation of specific characteristics of an entrepreneur may come up such as "women entrepreneurs" or "immigrant entrepreneurs." And yes, to answer the question directly it is all of that and nothing at the same time. In a society aiming at equal chances for all, every context should be inclusive, especially such integral parts of society as economy. In this respect, the term "inclusive" indicates the ideal that entrepreneurship is not exclusive to certain groups of people, but is for all. Thus, inclusive entrepreneurship is not about *who* and *how*. It aims at supporting entrepreneurs from all backgrounds (OECD/EU, 2015) by co-creating an environment in which they are not confronted with any kind of barriers.

But why is there a need for stressing inclusive entrepreneurship and entrepreneurial education in respect to persons with disabilities? Based on the practice-led approach of "Social Impact"[12] we refer to *inclusive entrepreneurship* as to entrepreneurs who belong to socially disadvantaged groups and therefore require specific support. Such disadvantages can be linked to a lack of access to resources (education, contacts, capital, etc.) and/or structural obstacles. Inclusive entrepreneurship puts into focus an inclusive entrepreneurial environment for not only persons with disabilities but also other groups facing disadvantages just as women, immigrants, long-term unemployed, etc. A call for inclusive entrepreneurship pleads for the involvement and the access to entrepreneurship for anyone who wants to start own business activities or wants to be self-employed. Thus, inclusive entrepreneurship holds potential for labor market participation for disadvantaged groups. Greve (2009) states that data on labor market activities of persons with disabilities are limited and even inconstant. As already mentioned, there are various barriers to entering the labor market and to hold a job for longer. Many occupation possibilities for persons with disabilities are low-skilled and low-paid (Meager and Higgins, 2011). Especially when it comes to self-employment rates of persons with disabilities their rates vary also and are lowest in north-eastern EU countries and higher in southern EU countries (OECD/EU, 2014). However: "Caution is needed in interpreting these data because the differences in self-employment rates across countries are influenced by a number of factors, including variation in the definition of disability used in collecting the statistics" (OECD/EU, 2014, p. 5).

[12]Social Impact. Available online at: https://socialimpact.eu/inclusive-entrepreneurship/ (accessed December 1, 2019).

When discussing inclusive entrepreneurship, the question for supportive structures comes into play. In this context, the key role of entrepreneurial education for successful entrepreneurial activities points at a need for respective educational services for disadvantaged groups. Persons with disabilities—as members of the group focused on in this article—can therefore benefit from inclusive entrepreneurial education when aiming to become entrepreneurs or in support of self-employment. Inclusive entrepreneurial education is based on entrepreneurial education for everyone but needs to consider different education methods, channels, and contents. It also requires a stronger consideration of individual needs and therefore asks for more participation of the target group in the planning phase of each course and also in its provision, as section Discussion: Building a Framework for Entrepreneurial Education Embedded in an Inclusive Ecosystem shows. In IEEPD, persons with disabilities facing disadvantages during school career, might sometimes for the first time become the opportunity for work-based experiences, as well as the opportunity to exercise leadership and interpersonal skills. In doing so, it can even open the door to mainstreaming disability in entrepreneurship (Sefotho, 2015), which, for instance, could be seen in the sense of hephapreneurship, "a process of fostering positive and meaningful existence anchored on subsistence entrepreneurship of differently abled persons and underprivileged persons, which is founded on the ethos of career choice/construction" (Sefotho, 2014, p. 306). However, IEEPD can most probably be more effective when it is oriented toward universal design (Mace, 1988) as demanded in the UN Convention on the Rights of Persons with Disabilities [Convention on the Rights of Persons with Disabilities Convention on the Rights of Persons with Disabilities (CRPD), 2008]. Roughly summarized, universal design encloses design fundamentally made accessible for all groups regardless their individual characteristics (e.g., impairments, age). Whereas, universal design has already been discussed in education for more than a decade (e.g., Rose and Meyer, 2002), our approach to creating an inclusive learning framework for entrepreneurial skills is guided by the general aim of self-determined co-creation (and co-production, cf. section Co-creation and Co-production as Facilitators of Inclusiveness; Brandsen and Honingh, 2018) of particular courses and their contents. The Center for Universal Design names seven principles [The Center for Universal Design (CUD), 1997]:

I. "Equitable Use [:] The design is useful and marketable to people with diverse abilities."
II. "Flexibility in Use [:] The design accommodates a wide range of individual preferences and abilities."
III. "Simple and Intuitive Use [:] Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level."
IV. "Perceptible Information [:] The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities."
V. "Tolerance for Error [:] The design minimizes hazards and the adverse consequences of accidental or unintended actions."

VI. "Low Physical Effort [:] The design can be used efficiently and comfortably and with a minimum of fatigue."
VII. "Size and Space for Approach and Use [:] Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility."

While not all of these seven principles may be achievable in each manifestation of IEEPD, by tailoring methods, contents, and therefore curricula self-determined toward the demands of learners, this approach is generally open to meet all of them. This aspect in entrepreneurial (or hephapreneuerial) education with persons with disabilities is also highlighted by Sefotho: "training in hephapreneurial skills implies a repertoire of variable skills according to individual needs" (Sefotho, 2015, p. 6). However, for truly inclusive IEEPD, the principles of universal design have to be considered by educational practitioners to the largest extend possible. This is particularly important for those principles aiming at practical realization (esp. principles III–VII, whereas principles I–II are more relevant for the general framework design and already covered by a co-creative approach as explained in section Co-creation and Co-production as Facilitators of Inclusiveness and for the framework). Questions about *how to teach, what to teach, by whom to teach, where to teach,* and *through which channels* (cf. section Inclusive Entrepreneurship and Inclusive Entrepreneurial Education with Persons with Disabilities) need to be answered in light of the principles of universal design.

INCLUSIVE ENTREPRENEURIAL EDUCATION FOR PERSONS WITH DISABILITIES AS SOCIAL INNOVATION

While the term of social innovation dates back to a long history with several turns in reception and understanding (Godin, 2015), especially in the last decades it received raising awareness and influence in scientific discourse and practice of policy-makers and practitioners [European Commission (EC), 2014; Mulgan, 2018; Nicholls and Edmiston, 2018; Schubert, 2018]. Since then, especially policy-makers of the European Union began to recognize social innovation (Nicholls and Edmiston, 2018). It was increasingly considered a promising and empowering approach for new solutions to realize the fulfillment of policy objectives across societal levels, for instance concerning the aim of more social inclusion of disadvantaged groups (Nicholls and Edmiston, 2018). In this context, successful social innovations on the micro-level are seen as solutions to specific demands and needs of specific (local) target groups like the need for an inclusive approach to entrepreneurial education as suggested in this article. For the macro-level, social innovations are also understood as means to realize solutions for large-scale aims like supporting a shift toward inclusive societies [Bureau of European Policy Advisers (BEPA), 2010; European Commission (EC), 2014]. In this section, the underlying concept of social innovation as a basis for the discussion of the framework for IEEPD in section Discussion: Building a Framework for Entrepreneurial Education Embedded in an Inclusive Ecosystem will be introduced. For better understanding IEEPD, also concepts related to Social Innovation and their basic characteristics, specifically those of the ecosystem-perspective (Kaletka et al., 2016) and the co-creation approach (Brandsen and Honingh, 2018) will also be presented and linked to IEEPD before the discussion in section Discussion: Building a Framework for Entrepreneurial Education Embedded in an Inclusive Ecosystem.

Social Innovation and Inclusive Entrepreneurial Education for Persons With Disabilities

When discussing from a social innovation perspective, it needs to be clarified which theoretical concept of social innovation is used. Such a specification is particularly necessary because of different streams of understanding in scientific discourse (Rüede and Lurtz, 2012), also reflected by the broad variety of scientific and practical approaches in anthologies on social innovation like the Atlas of Social Innovation series (Howaldt et al., 2018, 2019). As Havas points out: social innovations "draw on different types (scientific and practical) and forms (codified and tacit) of knowledge, stemming from various sources" (Havas, 2016). For delimiting the concept, it first needs to be differentiated from other approaches to innovation in general: different to the term "innovation," the term of social innovation is obviously distinguishable by putting the *social* aspect into focus. In fact, this marks a shift in discourse on innovation in general, which has been dominated by technology—or economy—centered perspectives in the last decades (Godin, 2015). However, simply emphasizing the social aspect does not necessarily delimit the concept. Much more, it opens up a bandwidth of possible understanding, ranging from normative approaches with a focus on something good or ethical to sociological approaches (Rüede and Lurtz, 2012). At first sight, a normative concept might fit the goal of creating a framework for IEEPD as it is aimed at "meeting a social need" (Mulgan et al., 2007, p. 8). At the same time, this framework encloses an approach that is "social both in their ends and in their means" (Murray et al., 2010, p. 3), when its focus is the aim of creating more opportunities for inclusion oriented toward the capabilities of its target group. However, discussing IEEPD as something new and "social" in the meaning of something that is good for society or a more specific target group does not sufficiently provide explanatory capacity for the necessity and selection of its pillars. Taking a sociological perspective, on the other side, shifts attention toward "changes in how people interact among each other" (Rüede and Lurtz, 2012, p. 9). A sociological perspective, therefore, provides the basis for the focus on actor-relations, their cooperation and collaboration. Furthermore, this perspective does also open the door for a discussion of actors' roles and the context (Kaletka et al., 2016) framing the interactions. Hence, IEEPD is not just a social innovation itself, it is also linked to a set of contextual factors put in the limelight when understanding IEEPD as social innovation.

Additional implications have to be considered when understanding innovation as a process comprising not only the invention of something new and its realization, but also its diffusion as, for instance, a three-phase model of innovation suggests (i.e., invention, innovation, diffusion; e.g., Borbély,

2008). Taking the final phase into account raises the question of how social innovations (successfully) spread and in result, institutionalize. In fact, one possible explanation can be found by shifting focus to practices and how they are changing. For better understanding social innovation, Howaldt and Schwarz (2010a,b) suggested such a perspective on social practice while building on a broad definition without a normative understanding of social innovation, enclosing the variety of manifestations in practice. Choosing this path, they are referring to the work of Tarde (originally published in 1890) and his understanding of social change characterized by a change of practices triggered by (intentional) improvements or novelties of social phenomena and diffused via imitation of new social practices on the micro-level (Tarde, 2009, p. 26). Considering the importance of changing established practices links back to the question of how change can be achieved via their imitation and in result, their diffusion. Put into the context of IEEPD, this highlights the importance of not only suggesting new services but also new practices for their effective execution in line with the aim of suggesting a contribution to tackling social inequality toward more inclusiveness. Hence, the discussed framework comprises the suggestion for co-creative practices (see below). If these intentionally suggested practices come to life and get imitated in the sense of Tarde (2009) and Howaldt and Schwarz (2010a), they might diffuse and institutionalize. However, while these late steps of social innovation will not be discussed for IEEPD as this article presents a first outline and framework, it is still important to consider their framework conditions for a solid basis. Hence, the question for possible drivers of realizing, diffusing and establishing IEEPD comes into play.

In addition to a strong focus on practices, the definition of social innovation by Howaldt and Schwarz (2010a) also emphasizes the role of different sectors (i.e., not only non-profit actors) and their specific rationalities: "social innovations are revealing their unique power particularly where different social (sub) rationales intersect" (p. 65). Therefore, for the presented framework of IEEPD, the role of actors from different sectors for a *supportive* ecosystem is taken into account. Furthermore, the emphasis of cooperation between different sectors also points at different pathways for social innovation and IEEPD in this particular context. While some perspectives on social innovation focus on bottom-up pathways, the approach of Howaldt and Schwarz (2010a,b) is also open to approaches initiated top-down—for instance, by public institutions. Although the discussed framework for IEEPD does not put a top-down approach to its center, it still considers the importance of top-down (i.e., public institutional) support as an important element of an ecosystem (see below) that is supportive to the socially innovative approach (i.e., IEEPD) discussed in this article.

Taking on a Social Innovation Ecosystem Perspective

For studies of the Programme for International Student Assessment (PISA), the concept of *alignment* is discussed as one crucial factor for the most successful education systems in the sample (e.g., Sliwka et al., 2017). In this concept, the success of education is linked to the commitment and support of all relevant societal actors for the common aim of achieving best education. This perspective shifts focus to several levels important for IEEPD: *First*, it highlights the importance of including all relevant actors—within and, especially, outside of the formal, traditional education systems. For a social innovation focus on IEEPD, this aspect underlines the need for identifying relevant stakeholder-groups and especially those significantly influencing education discourses like, for instance, foundations (Kolleck, 2017). *Second*, it highlights their willingness for collaboration. Translated to the discussed framework, it emphasizes the need for joint activities (cf. section on co-creation and co-production). *Third*, it emphasizes their willingness to find common aims. Different actors have different aims and different perspectives, often determined by the specific rationality of their respective fields or sectors. (Co-) Creating (Brandsen and Honingh, 2018) a supportive ecosystem for IEEPD could open up a new pathway for alignment in this particular educational field and even beyond. All of the aspects discussed in respect to the alignment concept in this section can be operationalized as a supportive ecosystem (Schröder and Krüger, 2019) where all relevant stakeholders jointly form and develop the environment for IEEPD.

Although such an ecosystem-perspective on contextual factors is not an exclusive specific of social innovation research, it is a major stream. When social innovation ecosystems are discussed, there often is a strong focus on contextual factors for social innovation in a certain physical area, be it specific (urban) territories (e.g., Sgaragli, 2014) or nation states (e.g., Hansson et al., 2014). However, in a globalized world, ecosystems for social innovation are also discussed taking a supranational perspective (e.g., Pulford, 2011). Considering and extending the perspective on the importance of strong networks for successful social innovation up to the stage of institutionalization (e.g., in education; see Kolleck, 2016), an ecosystem perspective on actors also highlights the supportive function of actors from all societal sectors based on their particular rationalities. When taking this analytical path, Carayannis and Campbell's (2009) concept of a "quadruple helix of knowledge production" is often referred to. In this approach, the aforementioned actors from different societal sectors (i.e., "academia/universities," "industry/business," "state/government," and "media-based and culture-based public"; Carayannis and Campbell, 2009) do not only contribute based on their particular "knowledge and innovation paradigms" (Carayannis and Campbell, 2009) but, moreover, as part of a helix enabled by the combination of these different paradigms and related rationalities. As Schröder and Krüger (2019) highlight, this approach is intertwined with the concept of alignment discussed above. However, it puts a stronger focus on the role of actors (and other factors, see below) for successful innovation (here: in education).

While the focus on actors and sectors is an important building block within an ecosystem perspective on social innovation, research on contexts and processes of social innovation brought up several additional factors. Kaletka et al. shift perspective to a differentiation between four dimensions of social innovation

ecosystems for accessing "driving and hindering factors" (Kaletka et al., 2016, p. 83):

"Context of roles" (1), "context of functions" (2), "context of structures" (3), "context of norms" (4) (Kaletka et al., 2016, p. 85).

While the first context (1) focusses on the target groups of certain social innovations and their stakeholders in general, the second context (2) basically encloses the abovementioned perspective of actors from different sectors and their functions as well as their modes of interaction within a network and its governance. The third context (3) puts attention on the structures, which frame social innovations and their different dimensions. Kaletka et al. (2016, p. 85) highlight "path dependencies" and linked "institutions" as well as "economic, political and technological imperatives," driving or hindering the process of social innovation. Their fourth level of analysis (4) addresses the norms defining possible trajectories for social innovation on not only the legal level but also on the level of, for instance, "social standards" (Kaletka et al., 2016, p. 85).

This framework for analysis provides better understanding about successful social innovation in general and certain socially innovative approaches in particular need. For the IEEPD framework, the chosen social innovation ecosystem perspective is particularly relevant for understanding the contextual factors supporting (or hindering) the realization of inclusive entrepreneurial education. Hence, the approach of Kaletka et al. (2016) will guide the discussion of context factors.

Co-creation and Co-production as Facilitators of Inclusiveness

In order for entrepreneurial education to be inclusive to persons with disabilities, it needs to be sensitive to individual abilities, talents, and demands. While entrepreneurship education in general should be tailored to individual demands (Vanevenhoven, 2013), entrepreneurship education with persons with disabilities needs to realize the deepest possible form of individual tailoring. Therefore, it might even become a particularly suitable blueprint for entrepreneurial education in an inclusive society in general. Disability as a generalizing social construct encloses people with various capabilities. People with wheelchairs, for instance, will have different demands for IEEPD than people using prostheses. While the first group might favor virtual learning environments when physical space for entrepreneurial skills courses is not easily accessible, the second group of people might favor physical space as learning environments when the use of computers is not fully appropriate due to individual capabilities. Hence, a perspective considering key elements of the capability approach (Deneulin and Shahani, 2009) contributes a major implication to be considered for IEEPD: if means are provided it still needs to be considered whether these means are the right choice for a certain person. For the discussion of IEEPD, the notion of "means" in this regard is, of course, not limited to physical and virtual space or even learning tools. It also applies for teaching and learning methods as well as for the choice of skills to be taught. For both, a co-creative approach is suggested. The concept of co-creation, originally coming from the field of business, is meanwhile characterized by ambiguity due to its diffusion across disciplines (Brandsen and Honingh, 2018). It is already being discussed in education, for instance, regarding value creation (cf. Tsourela et al., 2015; Dziewanowska, 2018) or education for sustainable development (cf. Perello-Marín et al., 2018). However, evidence on transferring the approach to entrepreneurial skills development with persons with disabilities is scarce.

For better understanding different levels of co-creation, the differentiation between "co-creation" and "co-production" suggested by Brandsen and Honingh (2018) provides a helpful approach. Basically, they suggest to understand co-creation as a process in which people (for Brandsen and Honingh it is "citizens" as they are looking at the concepts from a public services perspective) "are involved in the general planning of a service-perhaps even initiating it." "Co-production" could be understood as the process where people "shape the service during later phases of the cycle" (Brandsen and Honingh, 2018, p. 13). This differentiation shall be used in this article as it is facilitating distinction of different forms of collaborative action for IEEPD in a manner that allows a large extent of self-determined individualization. Furthermore, referring to one type of co-creation and co-production might be helpful to achieve even more clarity on the suggested pillar for IEEPD. Amongst others, Brandsen and Honingh (2018, p. 15) suggest the type of "co-production in the design and implementation of core services." This type directly refers to "training modules where entrants, together with instructors, define their own learning objectives and learning activities" (Brandsen and Honingh, 2018, p. 15). This description is also adequately summarizing the suggested approach for IEEPD, where learners are also deciding on objectives (i.e., which specific entrepreneurial skills should be taught) and learning activities (i.e., which methods and tools are used in the courses). This aspect also directly refers to the level of co-production in addition to the initial phase of co-creation. Moreover, when IEEPD is realized within an environment of peer-learning, where learners benefit from experiences made by peers (e.g., people with similar capabilities), self-empowerment of these peers also takes place via co-production on this level.

Beyond the basic concept of joint creation and production, co-creation is, of course, linked to tools and methods. On a conceptual level, the *design thinking* approach (e.g., Brown, 2009) is probably one of the most important approaches for co-creation. While it originally comes from product design, it is meanwhile applied for co-creating solutions for a variety of social challenges leading to not only tangible artifacts but also services—especially in the public domain (Rizzo et al., 2017). Briefly summarized, design thinking builds on an iterative approach with a basic "loop of understanding-designing-and-redesigning" (Rizzo et al., 2017, p. 134), often divided into more steps, for instance, "Need finding and Synthesis," "Ideate," "Prototype," "Test," "(Re)define the Problem" (Brenner and Uebernickel, 2016). However, as Brown (2008, p. 88) puts it: "The design process is best described metaphorically as a system of spaces rather than a predefined series of orderly steps." Put into the context of co-creation and co-production of IEEPD, design thinking could be understood as a mindset comprising

a broad and, in practice, varying set of principles. Brenner and Uebernickel (2016, p. 8) put special emphasis on the principle that "Innovation is made by humans for humans." By this, building on a design thinking approach means building on a people—or user-centered approach, which is in the heart of tailoring an educational service to individual capabilities and demands. Therefore, one relatively new application of design thinking is aimed at co-creation for solutions together with and for persons with disabilities. In this context, the application of design thinking for inclusive co-creation (and also co-production) proofed itself as an adequate pathway for people with different communication abilities (cf. Bosse et al., 2018; Linke et al., 2018) when oriented toward their individual communicational capabilities and with the aim of user-centered innovation. This learning highlights the importance of individualized tailoring for the best possible inclusiveness in co-creating solutions toward the principles of universal design. Applied for the co-creation and co-production of IEEPD, a user-centered design thinking approach could provide one eligible tool for co-creating learner-centered courses. Of course, such courses would most likely be different in each cycle, reflecting the heterogeneity of its co-creators.

When discussing co-creation, co-development and their manifestation in methods like design thinking, another implication for IEEPD comes into play: in the described societal environment where co-creative practices diffuse across sectors, teaching methods for co-creation and co-production for respective skills development should also be considered. First, participants would be equipped with the respective skills. Second, when not only learning about co-creation and co-production, but also learning via respective methods like design thinking, learners can benefit from the advantages of problem-centered or problem-based learning (PBL; Stokholm, 2014).

Overall, co-creation and co-production are considered as promising approaches for IEEPD, especially when combined with methods that already proved their potential for joint activities with persons with disabilities. Co-creating and co-producing IEEPD together with persons with disabilities can be an auspicious pathway for individualized and self-determined IEEPD.

DISCUSSION: BUILDING A FRAMEWORK FOR ENTREPRENEURIAL EDUCATION EMBEDDED IN AN INCLUSIVE ECOSYSTEM

Entrepreneurial skills and IEEPD can add value for persons with disabilities. Entrepreneurial skills can enable both, the management of one's daily activities and the unfolding of one's specific skills that can lead to self-employment or entrepreneurship. Entrepreneurial skills, as discussed in this article and developed through IEEPD, are also valuable when considering social entrepreneurship. Hereby, more sustainable business opportunities resulting from social entrepreneurship may open up for persons with disabilities, for instance, in the field of social innovation initiatives set by persons with disabilities for persons with disabilities. Often, such initiatives are fruitful, as the target group for socially innovative solutions in this field better knows particular needs and resulting demands due to own experiences. Hence, such initiatives often come up with better solutions. Entrepreneurial skills can then support the sustainability of such social innovation initiatives. This aspect is particularly important as research on social innovation initiatives worldwide frequently highlights an often seen lack of business knowledge and sound business models for sustaining such initiatives (e.g., Debref et al., 2015; Howaldt et al., 2016).

As a basis for the discussion of a possible IEEPD framework (see **Figure 1**), this article presented some major implications to be considered. These are related to the key questions raised in section Inclusive Entrepreneurship and Inclusive Entrepreneurial Education With Persons with Disabilities: *how to teach, what, by whom, where* and *through which channels*? The concepts guiding these implications are (1) found with the *principles of universal design* as a guideline to be taken into account for allowing the highest possible level of inclusiveness. In line with these principles (2), a co-creative/co-productive approach is suggested and furthermore (3), perspective is shifted to the framework conditions. This is done by taking an ecosystem-perspective as suggested by Kaletka et al. (2016).

Universal Design for Inclusive Entrepreneurial Education With Persons With Disabilities

As mentioned in section Inclusive Entrepreneurship and Inclusive Entrepreneurial Education With Persons with Disabilities, universal design is considered key for the inclusiveness of IEEPD in practice. For meeting the criteria of universal design, co-creation (and co-production) are major building blocks for the framework discussed in this article. In order to meet the aim of having an environment that can be individualized to all demands, it is important to enable self-determination in all aspects of such a framework and on all of its levels starting from the planning phase and finishing with the rollout of IEEPD in practice by educational practitioners. The concept of universal design [The Center for Universal Design (CUD), 1997] leads to the following suggestions for co-creation and co-production of IEEPD:

- "Equitable Use": Each particular design of each educational service for IEEPD needs to be oriented toward the needs of the respective learners in order to be useful for them. Its marketability should, therefore, be assured by a strong orientation on the demands of each individual target-group and the particular capabilities of its members. This principle addresses the questions of how to teach but also the question of where to teach, as barriers to participation might be linked to spatial aspects. However, the question for barriers is more specifically addressed with the last principle.
- "Flexibility in Use": This principle is to be met by allowing full participation and self-determination of learners in the whole creation process and, ideally, even in the process of co-production.

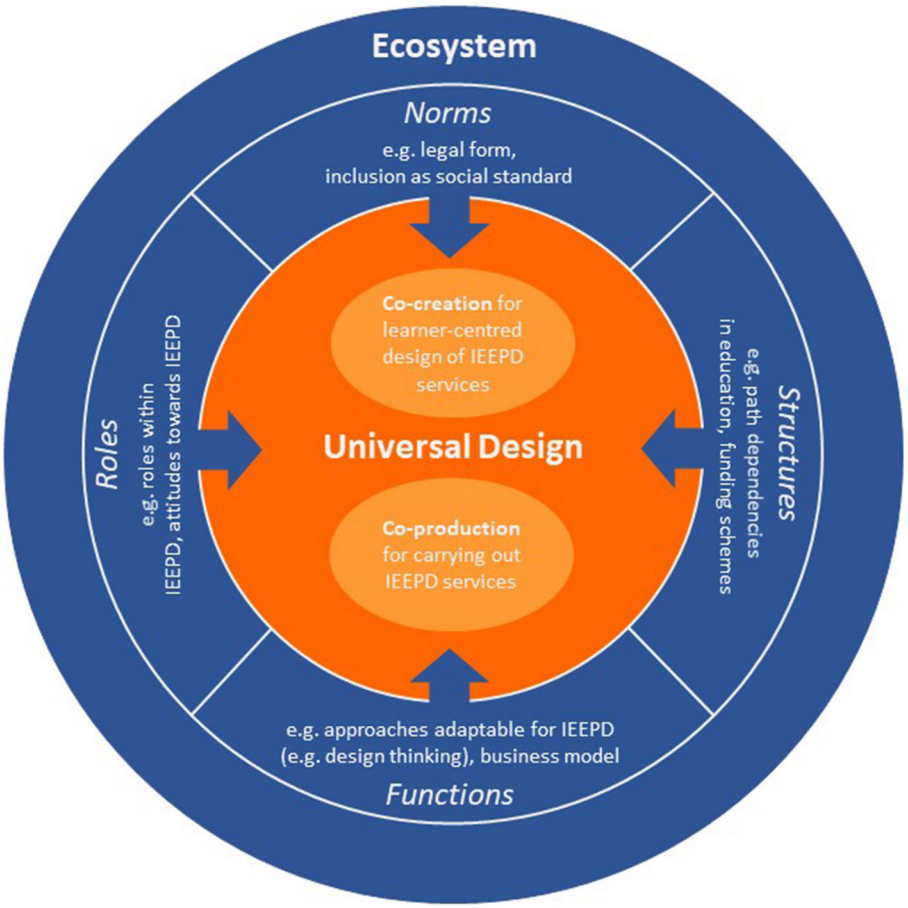

FIGURE 1 | Framework for IEEPD.

- "Simple and Intuitive Design": This should be considered for two levels. First, where learners and teachers jointly shape an IEEPD service (i.e., how to teach). Tools and methods for this phase should be easy to understand (which is possible for the application of Design Thinking, as research shows; see e.g., Bosse et al., 2018). Second, where the service is carried out. Educational tools and methods have to follow this principle in order to be adequate (again: how to teach).
- "Perceptible Information": This fourth principle addresses the contents (i.e., what to teach), which should be accessible to the learners, which, of course, does also address the question for methods (i.e., how?).
- "Tolerance for Error": This principle is particularly important in order to meet the capabilities of people with different learning abilities. But also, in general, the learning speed needs to be met in order to achieve successful learning outcomes as well as for avoiding frustration.
- "Low Physical Effort": This principle especially addresses the question for channels. Digital tools can help better meeting the aim of low physical effort when accessible to everyone and therefore universally designed themselves. Such tools could be, for instance, MOOCs. They (and online courses in general) potentially help diminishing obstacles related to the reachability of courses in physical spaces—no matter if these obstacles are physical barriers excluding e.g., people with physical disabilities or the sheer distance[13].
- "Size and Space for Approach and Use": The seventh principle clearly addresses the question of where to teach and hence, especially physical spaces. However, when virtual space is used for realizing educational services for IEEPD, this principle also links to the question for channels.

Of course, as universal design is also being discussed for education in general in the last decades (especially for schools; Turnbull, 1995), these principles are not only relevant for IEEPD. They are much more relevant to inclusive education in general, which is also true for the majority of other framework conditions discussed in this section.

[13]Even if there are sometimes imperfections and room for improvements when it comes to realized participation of disadvantages groups in MOOCs (Emanuel, 2013), they open a path for more inclusive learning environments when accessible to all.

Co-creation for Self-Determined Education With Persons With Disabilities

In the following part, suggestions for different levels of co-creation and co-production for IEEPD are discussed.

Co-creation in the Planning Phase

Learners together with teachers jointly create each course. This may be done following the iterative steps of design thinking. Roughly, this co-creation process could be started by collecting and understanding particular educational needs of participants concerning entrepreneurial skills. Here, especially their individual aims (e.g., Do they want to start businesses? Do they want to achieve entrepreneurial skills important for self-management?), their individual demands and capabilities would be examined by all teachers and learners. This is also where it has to be decided which particular skills should be in focus. Focus could be on both hard and soft skills or only on one set of skills—strictly oriented toward the demands. In the next steps, a prototype could be co-created and carried out as a test (e.g., one single session). In the following, the suitability of the created prototype could be assessed and a refinement could take place. However, as such planning and testing phases would demand a larger time frame than usually found in educational services, it might be important to consider some pragmatism. Nevertheless, if "short-cuts" within the creation-process are taken, it would still be utterly important to consider individual demands and capabilities of learners as these should be the pivotal decision criteria.

Co-production in Carrying Out the Educational Service

For the phase of realizing an inclusive educational service for entrepreneurial skills development for persons with disabilities, co-production does hold important benefits. The participation of persons with disabilities as not only learners but also teachers (or maybe assistant teachers) would make education *for* persons with disabilities turn into education *with* them. Therefore, it holds potential for (self-)empowerment of these teachers. At the same time, it also helps shaping a better tailored educational service based on the perspectives of teachers who have a better practical understanding of disability and its implications and, therefore, possibly a higher sensibility for the situation of their learners. However, the participation of teachers with disabilities would also have the benefit of mutual learning between them and others teachers.

Co-creation and Co-production as Learning Contents and Methods

The discussion on problem based learning (Stokholm, 2014) points at the possibility and adequacy of learning via co-creation and co-production (e.g., for social entrepreneurship education; Kickul et al., 2018). When learners are working on solutions to design-challenges identified, for instance, in the course of a design thinking process, they are not only achieving skills for problem-solving. Moreover, when co-creation and methods like design thinking are part of curricula, learners are given the possibly to achieve problem solving skills for challenges in entrepreneurship and beyond. Co-creation and co-production also point at cross-sectoral collaboration for creating and carrying out services and products. Therefore, learners could also acquire basic knowledge on how to create and carry out innovation in the sense of a quadruple helix (Carayannis and Campbell, 2009), where actors with different backgrounds jointly create.

Co-creation and Co-production for Shaping the Ecosystem

While the ecosystem for IEEPD is at the core of the next section, the relevance of co-creation (and co-production) for shaping such an ecosystem (i.e., the roles of actors but possibly even the other suggested layers; Kaletka et al., 2016) needs to be mentioned. Similar to co-creation and—production of the service itself, the same principles apply for shaping the context. Not to mention their expertise and sensibility, empowerment of persons with disabilities could take place when they or their associations or single initiatives are part of stakeholder discussions and their activities. At the same time, all stakeholders could mutually learn from each other and much likely become better sensitized to disability in learning contexts—not only for IEEPD but also for education in general.

An Inclusive Ecosystem for Entrepreneurial Education With Persons With Disabilities

When discussing framework conditions for IEEPD based on the previous sections, the social innovation ecosystem approach as presented by Kaletka et al. (2016; see section Co-creation and Co-production as Facilitators of Inclusiveness) helps identify contextual elements beyond the role of relevant stakeholders while taking them into account at the same time.

When looking at the context of IEEPD, the question for actors and their contributions to create a supportive ecosystem can be asked. This addresses not only actors of the quadruple helix of knowledge production (Carayannis and Campbell, 2009), which can more broadly be subsumed as science, economy, state and civil society actors. For an ecosystem for IEEPD, also schools might be relevant as they could provide space and personnel. However, when looking at the helix actors, it becomes clear that all of these groups could take relevant roles, more or less. For successful IEEPD, science can contribute knowledge on teaching methods and tools suitable for groups with particular capabilities. Furthermore, within an understanding of a third mission of universities (Jäger and Kopper, 2014), scientific units or organizations might also become active parts for carrying out IEEPD. This also points at the aspect of physical space or infrastructure in more general terms, enclosing, for instance, digital infrastructure at universities. Civil society plays a two-fold role as well. On the one hand, engaging actors from this sector with expertise on services for (and by) persons with disabilities would be beneficial for IEEPD. On the other hand, actors like welfare organizations, sheltered workshops and related networks and charities can help diffusing and even sustaining IEEPD via their networks or their own resources. The involvement of these groups of actors is relevant, but not the unique selling point. In addition, their **roles** and their political and

social attitudes, motivation, socialization, skills, and capabilities are important (Kaletka et al., 2016) for the success of social innovation in general and IEEPD in particular. Therefore, not only their support needs to be achieved. IEEPD would also have to recognize and address the aims and attitudes of relevant actors. Most importantly, the role of the target groups in the abovementioned understanding needs to be considered. In the suggested framework, this could be best met by building on a co-creative environment, as described before. Hereby, also the discussed questions *by whom to teach* and *who to teach* play out. The answers to these questions are embedded in the roles of the actors.

Under the context of **functions**, Kaletka et al. (2016) highlight the interlinkage and the ways of collaboration of stakeholders such as in our case the function of entrepreneurship experts, training and education centers, rehab educators etc. The discussion how training can be shaped, implemented, and realized (keyword: co-creative approach by e.g., design thinking) and by which topics and substance it may be filled should take place in this context. For the context of functions, also tools to be used like digital applications are put into focus again. With a view on digitalization, it can be discussed in two-fold manners, as tools for learning and training in the form of e.g., online courses, and in regard to digital skills for even achieving digital entrepreneurship or technology-based entrepreneurship. Hereunder one can subordinate the questions: *Where to teach? What to teach? Through which channels? How to teach?*

Furthermore, a focus on **structures** is suggested by Kaletka et al. (2016). Here, framework conditions beyond actors and their roles need to be considered. Maybe the most important implication for IEEPD is linked to path-dependencies of education systems. As research on Social Innovation in Education as part of the SI-DRIVE project highlights (e.g., Schröder et al., 2018; Schröder and Krüger, 2019), actors of formal education are often reluctant to initiatives coming from the outside (e.g., civil society, business). For successful IEEPD in practice, the path-dependency (for the actor-perspective sometimes translated as "silo thinking"; e.g., Schröder and Krüger, 2019: p. 19) of education in respect to a preference for (formal) top-down approaches needs to be addressed by all actors, including IEEPD actors themselves (i.e., the latter might have to find strategies to cope with these structures if they persist). Furthermore, possible funding opportunities for IEEPD courses and policies supportive or hindering such measures should be reflected. Within the EU, policies toward inclusive societies could be helpful in combination with the aim of supporting entrepreneurship. This also points at marketing opportunities for IEEPD when it comes to accessing supporters as well as the target group itself. Furthermore, a perspective on structures puts the socio-economic situation of the target groups into focus. In respect to findings presented in earlier sections of this article, it quickly becomes clear how important entrepreneurial skills for the target group can be in order to enhance own living conditions or to find pathways into opportunity-driven businesses.

Finally, the context of **norms** (Kaletka et al., 2016) addresses "social standards" (Kaletka et al., 2016, p. 85), ethic and political framework conditions. For successful IEEPD, cultural preconditions need to exist, which create circumstances, situations, spaces and places as well as human relationships that allow inclusion, that allow thinking out of the box, different unconventional learning modules, virtual meeting spaces, more time for consultation, co-creative approaches and so forth. Culture, as Clifton et al. (2014) or David and Rehfeld (2017) were able to show, is one of the main essences of each action and breeding ground for novelty, but at the same time a change maker. Change or transformation in the long run needs a reciprocal approach. The traditional institutions for business start-up and scale-up are actors that also need the transformations themselves next to the target group aspiring (stand-up) for business. The presented approaches of peer-to-peer, co-creation or co-production where actors of the ecosystem as part of a quadruple helix (Carayannis and Campbell, 2009) do not act in parallel, but mix up in roles, structures, and functions can foster future business activities among the target group. The future responsibility is to empower such a process and to create an ecosystem, which due to the mix up is not diffuse by nature, but which allows a structured blending. Hence, new regulations, new meeting places, new wording, but foremost a new inclusive mind-set etc. is needed. However, as especially legal structures do not change from 1 day to the next, IEEPD actors will probably have to build on sustainable "business" models already found in practice of social innovation initiatives worldwide (e.g., Debref et al., 2015; Howaldt et al., 2016; Komatsu et al., 2016). Social entrepreneurship, for instance, might be an adequate alternative for carrying out the services. However, as IEEPD as a social entrepreneurship activity would have to generate revenue it would have to be taken into account that this might limit access for the target group. Therefore, funding opportunities, which could possibly be found in (future) EU funding schemes or on national, regional or even local level, might help facilitating access to IEEPD in practice for broader groups. Hence, IEEPD could, for instance, build on an approach where: "Social value is generated through goods or services that are sold to beneficiaries at below market rates subsidized by financing supporters." (Terstriep and Kleverbeck, 2018, p. 35) Of course, that would not be the only possible approach but maybe one that is sustainable while accessible.

CONCLUSION

The presented framework for IEEPD for persons with disabilities is intended as a first approach toward important implications for shaping entrepreneurial education services for this specific marginalized group. It presents a plea for sensitively considering individual needs and demands by allowing a high level of participation and self-determination. It points at the importance of taking all actors on board and considering all functions, roles, norms and structures forming the environment of IEEPD, hence its ecosystem when it comes to the question of a supportive environment and its elements.

Answering the question for conditions of a framework that currently does not exist to the presented extent may seem out of context at first sight. However, as entrepreneurial education for persons with disabilities holds a lot of potential for meeting aims that are—for instance—collected in the Convention on the Rights of Persons with Disabilities [Convention on the

Rights of Persons with Disabilities (CRPD), 2008], this question needs to be answered in order to provide an elaborated basis for such activities. This is especially true as an appropriately early implementation of co-creation is key to the whole approach presented in this article. It needs to be there right from the beginning, hence considered as early as possible by the actors involved in realizing such services or a whole infrastructure. Of course, the paper at hand does not provide a full deductive blueprint rather than important implications and it does not aim to do so. Individualized, hence more inclusive, education shaped according to the needs of learners cannot be deducted from theorizing. It needs to be built right up from the respective communities of learners and teachers/trainers or tutors. However, in practice educational services are often initiated top-down. Therefore, the plea for a participative approach for an educational service aiming at a highly individual group is particularly important. Top-down decisions and services in this field might fail meeting the real needs and demands of the learners and hence even acceptance. A reciprocal approach meeting the needs of each target group through their active participation in the design process and adaption of these needs in the curricula by trainers or teachers assures a promising approach.

Therefore, with the presented outline some open questions remain of which one would be that for which skills to be taught (*"what to teach?"*). The paper presents some ideas for relevant skills and does not aim to have a comprehensive or even complete list. Moreover, it leaves this question intentionally open as different—again: very individual—groups would have very individual demands for skills. Assessing the right skills (both hard *and* soft skills for both daily activities *and* entrepreneurial activities) would and should therefore be part of a co-creation process between learners and teachers, especially when considering a co-productive approach (*"who teaches?"*) where learners contribute with their own skills that might not be very common in recent mainstream entrepreneurial education. Other questions are also left open intentionally. The question: *"where to teach?"* cannot be answered without considering each individual case of IEEPD as there is no unifying recipe and there cannot be such a recipe. Hence, the article suggested to choose the learning spaces according to the needs of the respective learners. There might often be good reasons for virtual spaces that tie back to the question for "*which channels*" to use for the provision of IEEPD services—especially as spatial barriers could be avoided more often. However, virtual spaces will also not be the right spaces in other cases. Hence, from this perspective the selection of *spaces, channels, teachers,* and *skills* needs to be part of the answer to the question of *how to teach:* via a co-creative approach. In result, physical space is not in focus of the presented approach. It is rather the learning atmosphere created by learners and teachers shaping the space. It builds a pop-up environment that opens up for the needs of persons with disabilities and other disadvantaged groups (in more general terms) in a given moment. By pop-up, we mean a space that is not bound to a specific spot. Much more, it unfolds as soon as a reciprocal exchange process, at eye level between learners and teachers, begins.

Furthermore, the presented outline also holds implications for entrepreneurial education more generally when it comes to education for marginalized groups in general. Top-down approaches to educational services in this context sometimes recognize the need for networks supporting the learners. However, these learners sometimes ask for more contacts to role-models that might take a tutoring role and who also have a similar cultural and biographical background—peer-to-peer approach. This aspect exemplifies the potential of co-productive approaches where the learners can also be tutors or teachers/trainers. Moreover, it again points at the potential for allowing leeway for bottom-up approaches as it is the learners who often know best what they need—at least in adult education beyond basic education necessary for everyone without question.

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"And Then We'll Just Check If It Suits Us" – Cognitive-Affective Maps of Social Innovation in Early Childhood Education

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The idea that a simple execution of an innovation invented by actors other than those who are expected to apply it is not likely to take place is a truism. We assume, however, in this paper the idea of a discursive production of knowledge on the application of an innovation across different levels of the education system. We aim to shed light on an innovation's 'journey' from educational policy over training providers to teams of professionals in early childhood education and care (ECEC). By investigating knowledge and emotions associated with the introduction of an intended innovation using the example of "stimulation interactions" in day care-centers, the paper contributes to research on the transfer of innovations in education. To better understand challenges occurring during the transfer of innovations, we triangulate methods from discourse theory (coding techniques based on GTM) and cognitive science, namely cognitive-affective mapping (according to the scholarly conventions). The data corpus includes educational plans (N = 2), in-service training programs (N = 123) and group discussions of pedagogical teams (N = 6) who participated in an in-service training on the subject, stimulating interaction. Findings underline that similar messages from the inventors on the educational policy level are received and processed heterogeneously by the teams of pedagogues as a result of their preexisting views, routine practices and experiences with intended innovations through in-service trainings. Besides, a diffuse mixture of competing and contradictory information is communicated to the professionals and, hence, collides with the in-service training providers' and educational policy actors' expectations on the processing of the intended innovation. Specific knowledge elements and their valences are diametrically opposed to each other. Dissonances like these are considered as obstacles to social innovation. The obstacles are caused by the lack of a 'common language' beyond all levels. Hence, policy-makers and in-service-training providers should anticipate the supportive as well as competing knowledge-emotional complexes of professionals and take these into account when communicating an intended innovation.

Keywords: social innovation, cognitive-affective mapping, sociology of knowledge approach to discourse (SKAD), early childhood education, education policy, stimulating interaction, in-service training, triangulation

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INTRODUCTION

Although educational programs have been introduced as binding guidelines for educational work in Germany for almost 15 years (Diskowski, 2008) and although the educational staff of day-care centers participate in many educational initiatives and in-service training courses (von Hippel and Grimm, 2010; Baumeister and Grieser, 2011; Schneewind et al., 2012; Müller et al., 2016), the quality of the educational processes and in particular the interaction between pre-school teachers[1] and children still needs to be improved (Wertfein et al., 2017). 'Stimulating interactions' are linguistically stimulating interactions or dialog formats, e.g., sustained shared thinking (SST). SST is a didactic action pattern aiming to support the cognitive development of children and is regarded as a key variable of process quality in early childhood education (Siraj-Blatchford et al., 2002; König, 2009).

Recent studies show that process quality in German day-care centers is at best average (Wetzel et al., 1997; Tietze, 1998; Smidt, 2012; Tietze et al., 2013).

According to findings of recent studies, pre-school teachers are addressed to further develop their skills in order to enhance the quality of children's learning processes through stimulating interactions. Siraj-Blatchford et al. (2002) found that although 'sustained shared thinking' was most effective to encourage children's thinking, this promising interactional format is only scarcely put into practice. Based on their videographic study on the ability of pre-school teachers to promote learning processes of children through stimulating interactions during free play settings, Wadepohl and Mackowiak (2016) report that participating pre-school teachers only achieved very low scores on a valid rating scale for stimulating interactions. Correspondingly, they have to improve their respective competences (for an overview of studies with similar results see Wadepohl and Mackowiak, 2016). Years earlier König (2009) came to the same conclusions. She was able to show that pre-school teachers rather practice direct instructions which leave only limited opportunities for children to think independent, than introducing stimulating interactions which proved to contribute to children's enhanced learning. Accordingly, the introduction of 'stimulating interaction' is the aim of the intended education policy innovation. But even though the promotion of interaction between teachers and children is seen as the key to successful learning and development in early childhood (e.g., Sylva et al., 2004; Anders, 2013), it is still unclear to what extent such practices are realized as a result of intended educational policy innovations.

In addition to a lack of in-depth research concerning the effectiveness of in-service training for the educational staff of day-care centers (Müller et al., 2016), empirical insights on the implementation of educational plans in practice (Große and Roßbach, 2015; Anders, 2018) and on pedagogical beliefs and attitudes (Wertfein et al., 2015) are required. Due to the lack of empirical evidence in the areas mentioned there is no definitive answer to the seemingly simple question of why initiated innovative interaction formats do not reach the practitioners and do not significantly change existing practice.

Against this background the paper examines the 'journey' of an intended social innovation in the multi-level system of education using the example of a selected innovation desired by education policy, i.e., 'stimulating interactions' in the field of early childhood education. So far, little is known about how an innovation intended by education policy is put into practice, in particular the influence of education policy on improving the quality of education in German day-care centers through educational plans (Meyer, 2018). It seems necessary to question the extent to which innovative pedagogical interactions are taken up, negotiated and put into practice on the level of the day-care centers and their teachers, i.e., those to whom the call for innovation is directly addressed.

The purpose of this paper is to develop a sound understanding of innovation processes in education. The subsequent sections will therefore explain the theoretical and methodical foundation of our empirical research approach, particularly discourse analysis and cognitive-affective mapping (see Bormann et al., 2018). Finally, the findings will be presented and discussed with regard to the implementation of social innovation in early education.

An Entangled Journey of Innovation in Early Education

Innovation promises change. This claim becomes particularly clear in the field of early education with regard to the large number of initiatives that have been launched, for example in order to improve the quality of educational organizations and pedagogical interaction in the last few decades (Edelmann and Roßbach, 2017; Jergus and Thompson, 2017). However, an innovation can neither be forced nor adopted *ad hoc*, because it is a complex, selective process of understanding and adding situated meaning to an intended innovation in education (Euler and Sloane, 1998; Fend, 2009; Bormann, 2013).

Nevertheless, some scholars argue that innovations should be understood as intentional processes. For example, Howaldt and Schwarz (2010) claim that social innovations are intentional, targeted re-combinations of social practices with the aim of better solving or satisfying problems or needs (ibid., p. 54). Even more striking than the assumption that innovations always aim at improvement is the fact that the authors assume that these changes were deliberately launched by assertive actors. This view neglects the specific reception and assessment of an intended innovation by the actors to whom it is addressed. In the eyes of its "inventors" an innovation can indeed aim at improvement. But whether the addressees of an innovation also assess the same need for improvement, is a different matter. Such an evaluation, however, determines how the addressees of an intended innovation perceive and assess the innovation itself. Thus a linear idea of the direct implementation of an innovation that is assumed to be successful as long as powerful actors take care of its implementation misses the complexity of processes of

[1]In the following, the term 'teacher' is used for pre-school teacher, and refers as a synonym to all terms used in German for the educational professionals in day care-centers.

innovation transfer by neglecting the perspectives of the actors to whom the innovation is addressed.

With that said and in contrast to approaches that consider social innovations as intended social changes, we refer to innovations as emergent phenomena labeled 'discursive innovations' (Bormann, 2011). According to Foucault, Keller points out that discourses are "considered as historically situated 'real' social practices" that constitute the objects which the discourses 'talk' about (Keller, 2011, p. 46). Discourses can be understood as powerful in that they transport knowledge through space and time (ibid., p. 60) although they do not require the co-presence of the actors who participate in a discourse in the sense that they refer to the contents, positions etc. of that particular discourse. According to this understanding, an innovation is not implemented just because powerful actors think it is the right thing to do. Instead, innovations need a discourse that contributes to their being seen as relevant and effective. That is to say that a particular innovation and its underlying intention merge with other information and events relevant to an educational field. Together, innovation intentions and for example politics, policies, narrations on necessary changes, programs established to promote the transfer of an innovation etc., form a discursive event, which is in turn transported via discourses and changed in them (Bormann, 2011, p. 324).

In line with this approach, the innovation process is subdivided into two partial processes: the de-contextualization of an innovation and its subsequent re-contextualization (ibid.). Basically, this model assumes that a discursive event is followed by the process of de-contextualization as an interpretational act of the perceived event as influenced by the individual evaluation. Subsequently, re-contextualization takes place, in which the discursive event is actively appropriated in a given organizational context: from the perceived discursive event, requests are constructed (level of interpretation patterns), which guide action (level of practice) and lead to a result (level of position), so that at the end a new discursive event is formed (ibid., p. 316). However, it is not natural for the event to be perceived at all, since innovation is negotiable and subject to social practices of generating and acquiring knowledge (ibid., p. 317). In short, the innovation process within an organization is more than just replicating a simple idea intended by others (Bormann and Nikel, 2017, p. 796).

Thus, the focus of our investigation lies on the process of reception on the part of actors who come together situationally through a common theme, in our case: innovative pedagogical interaction formats (Bormann, 2011, p. 317). How do teachers perceive and evaluate the innovation? To what extent do they consider the whole intention of the innovation or do they only take into consideration some selected aspects which they think match their previous practices and routines?

Following the approach of discursive innovations, the analysis is not about evaluating implementation processes as right or wrong, but rather about recording the conditions and forms of the process of its joint appropriation on the part of the addressees in discourses (ibid., p. 325).

As a supplement we consider Rogers (1995, 2002) diffusion model. This supports the idea that innovation is processual, communicated through certain channels and negotiated between affected members of a social system. The condition to be negotiated is that the individuals or units involved perceive this innovation (idea, practice) as new. Rogers (2002, p. 990) proposes a characteristic of innovation that determines its rate of adoption as follows:

- Relative advantage: Is the new practice perceived as better by the addressees?
- Compatibility: Does the new format match existing values or personal needs?
- Complexity: Is the new format easy to understand?
- Trialability: Are there limits within an organization that prevent experimenting with and testing the format?
- Observability: Is the use of the new format visible to others, e.g., outside the organization?

Rogers claims that a great relative advantage, compatibility, trialability, and observability plus less complexity lead to a more rapid adoption of the perceived new practice. The decision within the organization on whether to adopt or reject a new idea also depends on how others think about the innovative format (ibid.). Diffusion is a social process –(people have to talk to each other to spread the new idea) and decision-making process based on the mental efforts the individuals or units have to make (ibid.). From this the hypothesis can be derived that the team processes and interchange routines which are applied within day-care centers are decisive in the implementation of the innovative interaction format.

Coburn (2001) provides insights into the collective sensemaking processes in a community of teachers, who mediate reading policy by constructing and reconstructing multiple calls to implement new pedagogical formats. The sensemaking process is selective in that different communities find different meaning within the same messages (Coburn, 2001). However, a high quality of conversation among the teachers leads to their deeper engagement with content, and thus abstract messages can be translated more easily into concrete action (ibid.). In order to determine the quality of an innovation more closely, Coburn proposes three success criteria: 'depth' (pertaining to norms, beliefs, pedagogical approaches), sustainability (as an expression of consistency of change and retention) and shift in reform ownership (i.e., a permanent adoption with impact on children) (Coburn, 2003, pp. 4–8).

In conjunction with all previous ideas concerning perception, negotiation and implementation of innovations embedded into discourses, our approach goes one step further. We assume that not only knowledge circulates within innovational discourses and has to be de- and re-contextualized, but also that the emotions and affects associated with each knowledge element are part of the innovation process (Bormann et al., 2018). The term 'emotional cognition' derives from cognitive psychology and means that human thinking and the resulting actions are influenced by emotions, moods, or motivations (e.g., Thagard, 2000, 2006). During decision-making processes such as those involved in rejecting or adopting a new idea, mechanisms occur in our thinking that can be described with the concept of emotional

coherence that "serves to explain how people's inferences about what to believe are integrated with the production of feelings about people, things, and situations. On this theory, mental representations such as propositions and concepts have, in addition to the cognitive status of being accepted or rejected an emotional status called *valence,* which can be positive or negative depending on one's emotional attitude toward the representation" (Thagard, 2006, p. 147).

The point of this perspective is that information processing in human cognitive systems runs in parallel. In most cases, different information is simultaneously active in different modalities. While thinking that a person permanently constructs holistic, coherent interpretations, which in turn affect the representation, weighting, and evaluation of the individual information (ibid., p. 170). This means in particular that the information which is compatible with a person's individual motives is more easily perceived, considered as relevant and processed (ibid., p. 171). Knowledge and attributed emotions can be represented as networks in which the nodes stand for domain-specific terms that are related to each other. The connections form the semantic relations between the terms. Innovation from a coherence-theoretical perspective is a "conceptual revolution" (Thagard, 1992): the network is fundamentally reconfigured, i.e., new information is not just integrated or rejected (ibid., p. 162).

Following Intended 'Stimulating Interactions' on Their Way From Policy Into Practice

The use of the new interactional formats called 'stimulating interaction,' with which educational policy makers and training providers intend to innovate pedagogical interactions, is supported by bindingly introduced educational plans. Furthermore 'stimulating interactions' are an obligatory part of the contents of in-service training. Accordingly, this innovation is an example of an intended cross-level transfer from educational policy makers via training providers into early-education practices.

In response to societal changes and the resulting demands on the early childhood education system, a scientifically inspired educational policy publishes binding educational plans for the teachers within the organizations. New demands are made on teachers, which they should be able to meet because of their participation in in-service trainings. The training courses offered to them are considered to be of great importance for the effectiveness of pedagogical actions (Thompson, 2017, p. 60f), whereby most of the offers concentrate on accompanying and supporting children's educational processes (Baumeister and Grieser, 2011, p. 33). On their journey from educational plans to in-service training to practice, innovative pedagogical interactions are challenged by many fractures. It may turn out that the ideas of educational policy makers and in-service training providers of 'good' or 'better' pedagogical practice may collide with the ideas of the practitioners concerning the relevance or value of the envisaged new pedagogical approaches. However, because the principle of emotional coherence – initially at the level of the individual but also at the level of the group – ensures that only the information that fits with an existing idea is likely to be taken up, it may not be possible to perceive or integrate innovations at all (e.g., Thagard, 2006; Homer-Dixon et al., 2014).

It is therefore necessary to examine and compare the perspectives of *all* the actors involved in social innovation in education in order to identify possible obstacles to innovation on its entangled journey. So far, no approaches that shed light equally on both circulating knowledge and associated emotions of different actors involved in an innovation seem to be in place. If we know which knowledge-emotional complexes are produced by them, to understand to what extent they differ from one another, and to realize how the addressees of an innovation react toward the expectation to support intended changes, we can deduce how the re-structuring of a social practice can be better promoted. Besides, this knowledge can then contribute to the field of ECEC, so that 'stimulating interactions' can be introduced, understood and implemented more reasonably. This is especially important for modern societies. If children are better supported to think independently, they will hopefully be better able to react to global demands and challenges in their future lives.

Against the backdrop of these theoretical explanations, the following research questions arise for an investigation of the intended transfer of the 'stimulating interaction' innovation in the field of early education:

(1) What prescriptive-normative specifications about the respective interaction can be reconstructed in the educational plans of two selected German federal states and the programs of regional in-service training providers on an emotional and cognitive level?
(2) In what respect do these specifications differ from the ideas of the teachers within different the day-care centers?

MATERIALS AND METHODS

According to the abovementioned notion of discursive innovations, the analysis of the transfer of social innovations constructed by different actors who are not necessarily co-present (Bormann, 2012) requires specific methodical approaches. After all, it is about the generation and circulation of knowledge and its effects on different levels: firstly, on the level of educational policy makers and in-service training providers, a discourse analysis of policy documents and training programs focuses on how and with what linguistic means the necessity of the innovation is made plausible. Incongruities could already appear here and provide important clues relating to the further journey of this innovation, because in-service training providers pass their interpretations of intended innovations by educational policy makers on to the individual organizations in early childhood education. Secondly, on the level of the respective educational organizations, the analysis of group discussions focuses on the meanings that are associated with the planned innovation of 'stimulating interaction,' how the innovation intentions transported from above or outside are replicated in teams, and what factors lead to indifference, approval or rejection on the part of the teams.

With the aim of the subsequent journey of the innovative interaction format, it seems indispensable to capture norms on 'stimulating interaction' on different levels, to visualize the actors' perspectives and to compare the actors' views. The central method of this investigation is an innovative form of the sociology of knowledge approach to discourse ('SKAD'; Keller, 2011), which triangulates the cognitive science-based approach of cognitive-affective mapping (Thagard, 2010) with discourse analytical methods (for triangulation see, Bormann et al., 2018). The triangulation, as a combination of methods, aims here to "examine a problem from as many different methodological perspectives as possible" (Denzin, 1978, p. 291). Denzin (1978) argues that "each method implies a different line of action toward reality – and hence each will reveal different aspects of it" (ibid., p. 292) and this in turn has the power to diminish the researchers' personal biases that can arise from the application of a single methodology (ibid., p. 294). Our approach of inter-methodological triangulation follows the idea "that the flaws of one method are often the strengths of another; and by combining methods, observers can achieve the best of each while overcoming their unique deficiencies" (ibid., p. 302). Leech and Onwuegbuzie (2007) even emphasize "the need for researchers to use more than one data analysis method" (Leech and Onwuegbuzie, 2007, p. 579) to contribute to trustworthiness.

SKAD is more a research program than a method "embedded in the sociology of knowledge tradition in order to examine the discursive construction of symbolic orders which occurs in the form of conflicting social knowledge relationships and competing politics of knowledge" (Keller, 2011, p. 48). SKAD aims at reconstructing the processes of the social construction of meaning and sense, assuming that the structures of interpretation and action at institutional and organizational levels and at the level of social (collective) actors are not singular events, but occur within structured contexts, i.e., discourses (Keller, 2008, p. 233). Discourses materialize in spoken and written language (ibid.). Language is linked to emotions. Thus, discourse analyses should also consider emotions. The innovative combination of SKAD with CAMs introduced here aims at reconstructing typical patterns of knowledge, practices and forms of subjectivation, supplemented by the affective dimension of a discourse and visualizes it in cognitive-affective maps. CAMs are already used in various fields of research to present the opposing perspectives of political actors, for example, and thus contribute to conflict resolution by visualizing dissonances (cf. Homer-Dixon et al., 2014). The research process is fundamentally oriented toward grounded theory methodology (GTM) and adapts its methods and strategies (Glaser and Strauss, 2010; Bormann and Truschkat, 2018). The process is circular, i.e., sampling, analysis, and interpretation are interwoven and interrelated (Lueger, 2010; Flick, 2016; Bormann and Truschkat, 2018).

The theoretical sensitivity of the researcher determines the initial focus for sampling and analysis and is to be reflected transparently and comprehensibly as a guiding component of the entire research process (e.g., Kelle, 1994; Strauss and Corbin, 1998). Because the analysis of innovation processes is not about evaluating and judging practices, but about identifying typical patterns of the processes, the researcher's position in relation to the research subject as well as the research process needs to be reflected continuously. Parts of the data were therefore analyzed jointly in various collegial analysis groups and the results were also discussed (on the quality criteria of reconstructive research, in particular collegial validation see, for example, Przyborski and Wohlrab-Sahr, 2014).

Sampling: Localization and Sample Formation

The research is part of a cooperative practical research program EQUIP funded by Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (Germany).

Ethical Considerations

The research program, the data collection and the data management follow the guidelines of ensuring good scientific practice and for the management of research data of Deutsche Forschungs gemeinschaft (Deutsche Forschungs Gemeinschaft [DFG], 2013, 2015) and the EU DGSVO (General Data Protection Regulation GDPR). Data in this paper derive from a qualitative group discussion study with pedagogical teams of 6 day-care centers in two German federal states on a voluntary basis during the entire research process. The participants were informed about data protection, that stipulates, f.e., that personal data must be kept separate from the interview material and in encrypted form (VeraCrypt: is a free open source disk encryption software). The participants signed an information sheet stating their informed consent to take part in the study. Informed consent addressed the purpose of the study, collection, storage, and assessment of data [in conjunction with the data protection and privacy manager in project EQUIP]. The participants have the right to withdraw their declaration at any time.

The audio-recorded group discussions were transcribed completely anonymously (names of persons, organizations, institutions, localities, etc.). The transcripts are stored in encrypted form as well. After the transcription, the audio recordings were deleted.

An ethical approval was not required as per applicable institutional and national guidelines and regulations. Such a request is expected on the institutional level, in particular, for studies in which the individuals under investigation are exposed to risks, or for studies in which the individuals under investigation are not fully informed about the objectives and procedures of the studies, or cannot understand the information due to their age, health status, etc. (Guidelines, 2017). As the participants did not belong to a particularly vulnerable group as stated above, the study did not affect personal rights, and there was no particular focus on the analysis of individual, subjective level an ethics committee was not involved.

Level I – Educational Policy Makers and In-Service Training Providers

Firstly, the corpus contains the educational plans of both the abovementioned (see section "Sampling: Localization and Sample Formation") federal states. These provide an orientation framework for pedagogical work in day-care centers. Secondly,

the training programs of 12 regional in-service training providers were specifically selected (Patton, 1990). Because the in-service training sector in the field of early education is very heterogeneous and there is an almost unmanageable number of providers (Müller et al., 2016), the sample selection was based on a study by Baumeister and Grieser (2011) compiling the most important in-service training providers for all federal states and their program priorities. The corpus then contained 123 short programs of in-service training with a focus on pedagogical interactions. The programs explicitly address pedagogical staff in day-care centers as recipients and potential participants. The sampling strategy used corresponds as far as possible to the homogenous strategy (cf. Patton, 2002, pp. 235, 243). In order to identify programmatic models of innovation at Level I, the educational plans and the in-service training programs were examined in discourse-analytical terms, with the focus on linguistic means that underline the need for innovative interaction formats. However, the procedure and its results will not be the subject here, but rather the presentation of the merged results and their visualization with CAMs. The findings of the SKAD have to be considered as a base for the development of ideal-typical 'cognitive-affective maps' (CAMs).

Level II – Day-Care Centers in Two Federal States

Six day-care centers were selected from the project's internal database so that it would be subsequently possible to contrast the various cases. Both rural and urban day-care centers were selected, financed by independent or state bodies, with different team sizes and varying numbers of children aged from 0 to 6 years. All teams participated in a 1-day in-service training course on 'stimulating interaction' before the group discussions took place on a voluntary basis. The semi-structured group discussions were held in the organizations during the course of the day (children's sleep breaks) or during service counseling hours after closing time. The discussions focused on the perception and evaluation of the intended social innovation of 'stimulating interaction' in education and its meaning for educational practices. The discussions were recorded, then transcribed and finally added to the analytical corpus. They were analyzed with the help of GTM analytical strategies. The findings were transferred into CAMs on Level II.

Research Procedure – Coding and CAM-Visualization

The procedure of analytical steps from coding to visualization is shown in **Figure 1** and briefly described below:

*Box*I and II (**Figure 1**, left) illustrate the ongoing sampling process from a first material body including the educational plans in total, all the programs of the selected in-service training providers available in 2017/18 and the reduction of the transcribed group discussions into a smaller analytical body as a result of rough analysis. The selection of key sections was guided by predefined criteria. For the detailed analysis, those text passages within the documents were selected that had an interpreted connection with pedagogical interaction. The selection was supported by lexical word searches, which contained keywords like *interact*, *learn*, *apply*, *exchange* etc.

The detailed analysis (Box III and IV, **Figure 1**) is carried out in the sense of GTM (Strauss and Corbin, 1996), initially by open coding which alternates with axial coding in the ongoing analysis process and closes with a selective coding procedure. During coding memos were written on the codes obtained. The term 'code' corresponds to the term 'concept' in **Figure 1**. The coding process is closely related to the visualization of the concepts using the cognitive-affective mapping approach (e.g., Thagard, 2010; Findlay and Thagard, 2014) with its own conventions as follows: (1) finding main concepts on the topic, (2) determining the emotional value of the individual concept, (3) defining relations, (4) arranging concepts in such a way that the lines intersect at the least, and (5) validating and discussing; for the visualization of the concepts, their values and relations see Box IV, **Figure 1** (according to Thagard, 2010; Milkoreit, 2013). The detailed analysis can be described as a circular process of coding concepts and transforming the interpreted interrelations to the format of CAMs: within key section A two concepts can be reconstructed. They are interpreted as connected to each other, but have a different affective connotation. Concept 1 has a negative connotation (red hexagon), Concept 2 has positive connotations (green oval). The connection of differently connoted concepts is incoherent (dotted line). Within key section B another two concepts can be reconstructed: Concept 2, as found in key passage A and an additional Concept 3 – again with a positive value – are related to each other. Their connection is visualized in the CAM as coherent (solid line), because the affective connotation of both concepts is of equal valence. Since Concept 1 and Concept 3 are not linked to each other in any key section, there is no relation displayed. The core categories result from the selective coding processes. The arrangement of the concepts is the result of this coding step. First the material of Level I was coded and mapped. The results then influenced and contrasted the analysis of the group discussions (Level II) as sensitizing concepts. To support the analysis process, software for qualitative data analysis was used in addition to manual sketches and notes.

Guiding questions for the coding sessions were:

- What do we learn about 'stimulating interaction' at the educational policy maker, in-service training provider and organizational levels:
  - How is 'stimulating interaction' defined?
  - What norms of 'stimulating interaction' are produced by the actors?
  - What emotional connotations of central concepts can be reconstructed?
- How is the formal 'input' concerning 'stimulating interaction' by education policy and in-service training providers negotiated on the organizational level?

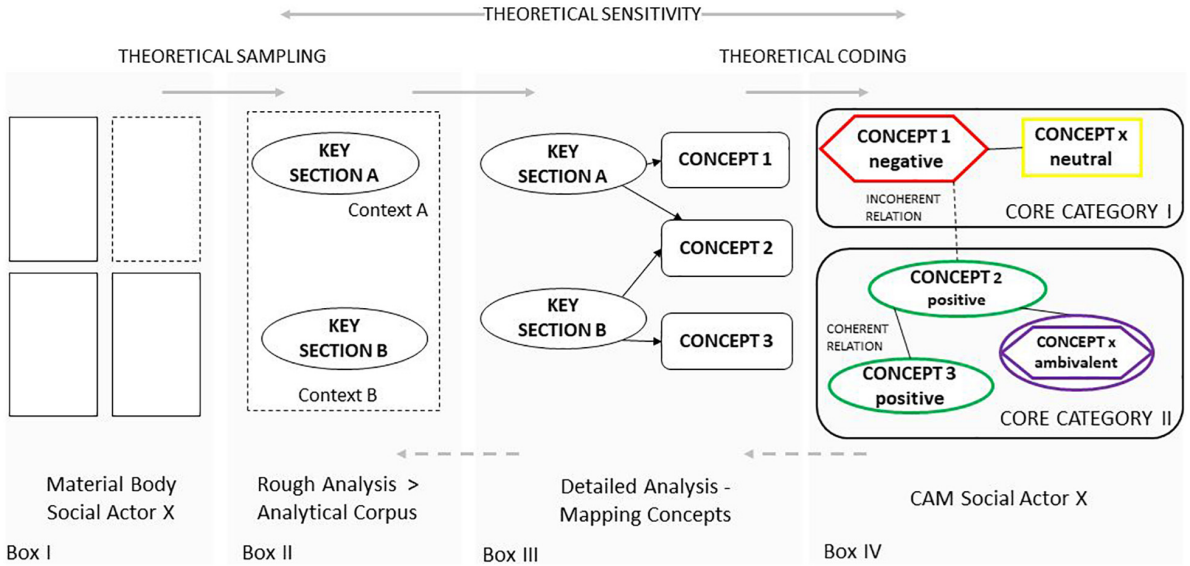

FIGURE 1 | Research process – grounded cognitive-affective mapping approach (gCAMA).

RESULTS

In general, the deliberated social innovation 'stimulating interaction' is perceived at the level of the organizations, with conditions that promote or prevent this interactional format being negotiated in specific ways as a result of shared values and perspectives on pedagogical practices within each team. The presentation of the results follows the premise of introducing the perspectives of the investigated actors, while focusing on their commonalities and dissonances, in order to deduce statements about the diffusion of the required innovation.

Different Perspectives on 'Stimulating Interaction' – Overview of Core Categories

Based on the analytical corpus (educational plans, in-service training programs on Level I, transcribed, guided group discussions with the teams of teachers on Level II), eight different CAMs were reconstructed. The CAMs consist of several interconnected concepts. These concepts, their emotional values and their associations are not only level-specific, but also actor-specific characteristics of the core categories found. Within the document on Level I 'stimulating interaction' is determined by three core categories embedded in the actors' call for innovation:

(1) 'assumed reality of practice': combines concepts that express the presumed reality of the teachers in practice; these concepts tend to be located on the left-hand side of the CAMs,
(2) 'demands on the teacher': combines concepts that express the call for further development; concepts are shown at the top, and
(3) 'principles of child learning and development': unites concepts that express general assumptions about the learning child within a day-care center; concepts are mainly on the right-hand side of the CAMs.

Within the group discussions on Level II 'stimulating interaction' is determined by five core categories:

(1) 'demands on in-service training': summarizes concepts which describe the general expectations the teachers impose on in-service training courses, even independent of content; concepts are located at the top of the CAMs,
(2) 'perceived reality of practice': unites concepts that express the detected practical reality that constitutes pedagogical work on a daily basis; concepts are mainly located on the left-hand side of the CAMs,
(3) 'pedagogical approaches': unites concepts of pedagogical work to which the members of the organization collectively refer; concepts are mainly located on the right-hand of the CAMs,
(4) 'demands on children': summarizes concepts that children contribute to the success or failure of interactions; concepts are again mainly located on the right-hand side, and
(5) the transversal category of 'processing implementation': contains concepts that describe experiences and principles in the implementation of new pedagogical content in further detail; concepts are scattered within CAMs.

Display, Description, and Comparison of CAMs – Level I: Educational Policy Makers and In-Service Training Providers

In this section, the perspectives of both actors, educational policy makers (see **Figure 2**) and in-service training providers (see **Figure 3**), are firstly visualized and described and secondly compared to each other.

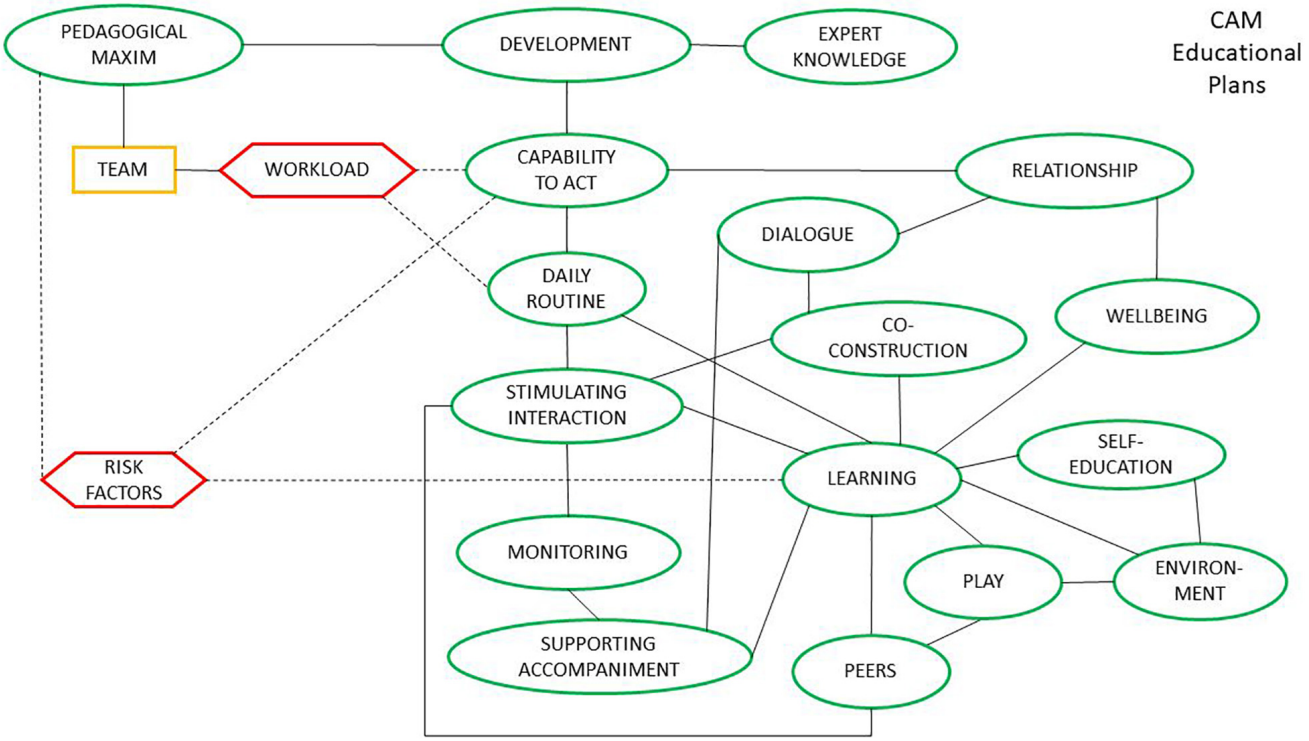

FIGURE 2 | CAM on the educational plans of two federal states.

Perspective of Educational Policy Makers – CAM on Educational Plans

Based on the educational plans of two federal states (Berlin and Brandenburg), 'stimulating interaction' can be reconstructed as a simple, easy-to-implement format of interaction between teachers and children. By assuming daily routines as resources, the pedagogical 'capability to act' as naturally given or a self-evident, intrinsic and promoted need to improve pedagogical skills, 'stimulating interaction' experiences a positive embedding. In addition, child learning and development are framed by only positively connoted concepts like 'dialog,' 'co-construction,' 'self-education,' or 'play.' 'Learning' emerges mainly from the child's inborn need to learn, so that the main pedagogical tasks are 'supporting accompaniment,' 'monitoring,' and guaranteeing access to an enriching 'environment.' Although the concept of 'workload' comes with a negative emotional value, the inherent acknowledgment that pedagogical practice can be very challenging and stressful tends to support the generally positive mood of practical reality in day-care centers. Further negatively connoted concepts can be reconstructed which either impair the child's development and learning or restrict the teachers' ability to respond to the social-economical or educational familial background or the heterogeneity of children. As a universal, idealized solution, pedagogical maxims of action are such as principles of democratic participation in practice or a holistic, individual educational approach are applied.

Perspective of In-Service Training Providers – CAM on In-Service Training Programs

Based on the evaluation of 123 short in-service training programs, 'stimulating interaction' can be reconstructed as an ambivalent concept that on the one hand enables and supports child learning processes, but on the other hand is depicted as difficult to accomplish. The difficulties in applying formats of stimulating interaction are based on the assumed stressful and exhausting daily work of the teaching staff in day-care centers. 'Daily routines,' a heterogeneous child community and children that have behavioral problems or are disadvantaged in a variety of ways, prevent the teachers' 'capability to act.' As the key to the solution, the teachers are taught special techniques that can be easily and uncomplicatedly translated into everyday practice once they have been learned.

Comparing Educational Policy Makers and In-Service Training Providers

Although the core categories and most cognitive concepts are shared within the discourse on 'stimulating interactions' analyzed in the documents of educational policy makers and in-service training providers, a closer look also reveals some discrepancies on the level of individual concepts.

Similarities

In principle, the teachers and children are regarded as active subjects. A successful 'stimulating interaction,' meant

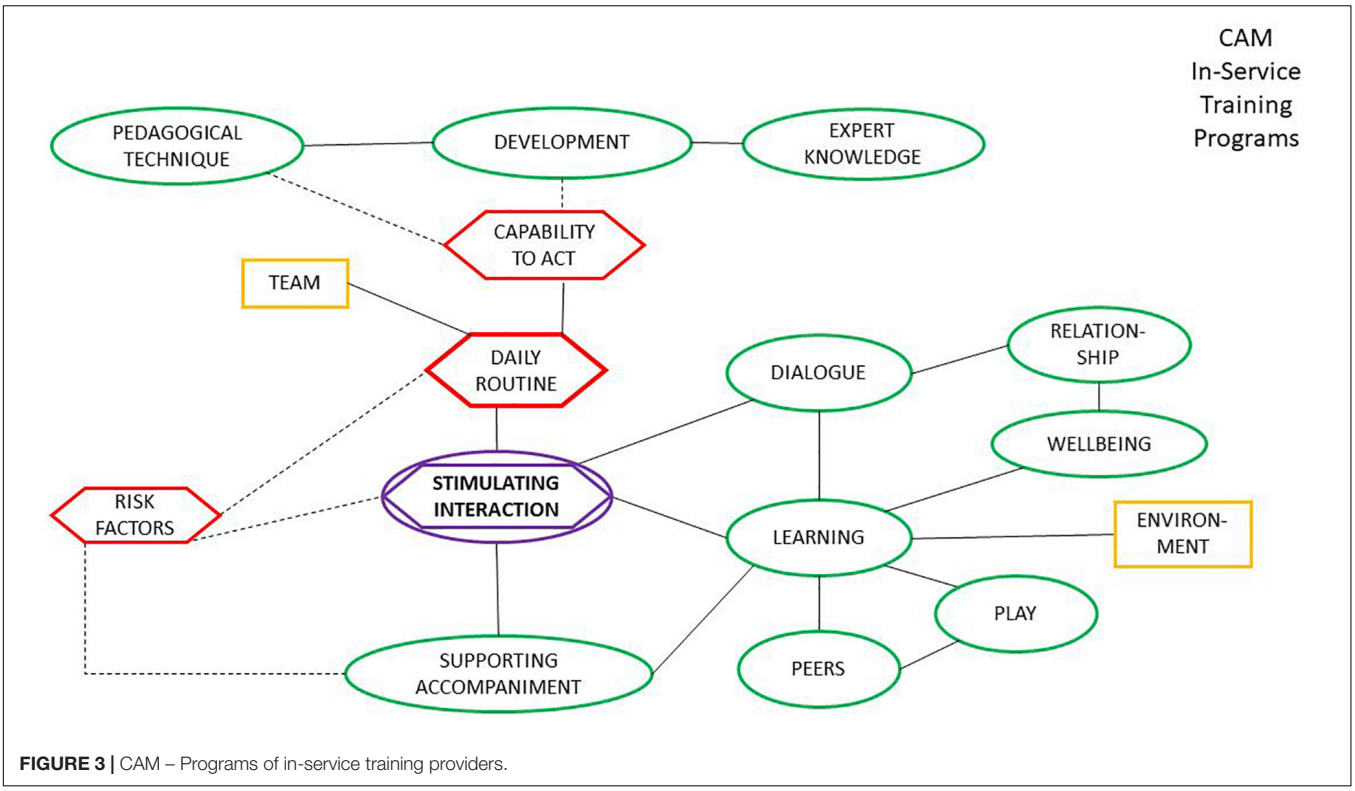

FIGURE 3 | CAM – Programs of in-service training providers.

as execution in the intended sense, is influenced by various personal as well as external factors. They either support or prevent the performance of the activity attributed to the teacher and the children. Teachers have the task of supporting the children actively and empowering them to learn passively by designing the immediate or further social environment within and outside of the organization or by promoting peer-related play. In general, children's activities are fixed on learning and coming to terms with their environment, and are supported in this by the teachers. All concepts in the core category 'principles of child learning and development' have positive emotional connotations. The associative chains of concepts 'play,' 'peers,' 'well-being,' 'relationship,' 'dialog,' or 'supporting accompaniment' are almost identical and form the preconditions for children's developmental processes within those organizations which are labeled as a places of education. The concepts that are linked to the professional or even personal development of the teachers – including the requirement to develop constantly by participating in various in-service training courses and acquiring expertise in several fields – are rated positively. Development is necessary and can seemingly be implemented without effort.

Disparities

In regarding the views of both actors on how 'stimulating interaction' can and should be realized in practice strong contrasts become clear. For example, the concept of 'capability to act' is emotionally connotated in opposite ways. Within educational plans teachers are considered as competent subjects capable of acting against all odds, within in-service training programs they are characterized as deficient in competence and restricted in action. Another emotional contrast exists with regard to the concept of 'daily routine.' Within the educational plans it is understood as a resource that enables child learning even without interaction with the teachers. Within the in-service training programs 'daily routine' is connoted negatively. It limits the interactions seen as necessary for the child's development, the solution for which is to learn techniques at in-service training courses. Moreover, some concepts like the concept of 'risk factors' are linked in different ways. It belongs to the core category of 'reality of practice' and is negatively loaded. This concept includes potentially problematic features of children that challenge the teachers to interact: family and cultural background, poverty, disability etc. Within the educational plans it is regarded as a problem that these children are especially in danger of being disadvantaged. In order to reduce discrimination, pedagogical maxims for action are proposed, e.g., acting on the basis of democratic and participatory principles. Within the in-service training programs, however, it is declared that these risk factors prevent the pedagogical interaction itself that should in fact yield support. Countermeasures can be taken with various pedagogical techniques.

Display, Description, and Comparison of CAMs – Level II: Organization – Group Discussions

The CAMs of the organizations clearly differ from each other in detail. Each of the 6 day-care centers shows an individual picture of the reconstructed core categories.

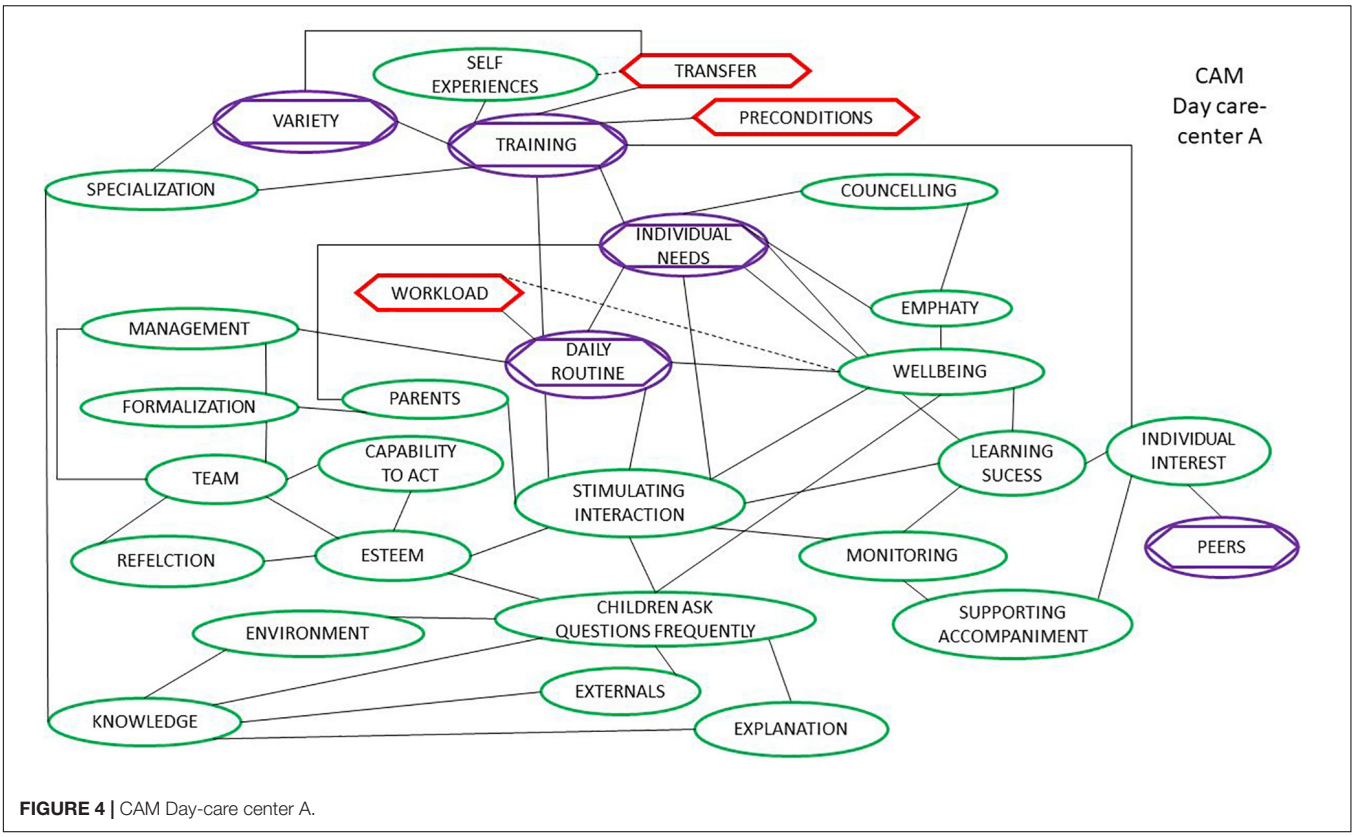

FIGURE 4 | CAM Day-care center A.

Day-Care Center A

In day-care center A 'stimulating interaction' is positively valued (see **Figure 4**). It is associated with a group of positively valued concepts like 'children ask questions frequently': children show their curiosity and thus initiate interactions with the teachers, which is somehow expected and seen as mark of 'well-being.' In addition, the teachers are enabled to satisfy the children by giving 'explanations.' Because 'knowledge' is rated as highly positive and as the basis for 'explanation,' it serves the positive self-perception on the part of the organizations interactional formats. Their positive attitude toward 'specialization' (e.g., qualifying language or natural science experts) within the team by in-service training selected by interest is coherently integrated into the chain of associations. The team has a positive attitude toward its 'environment' or 'parents,' not least because they sense the opening of the organization as an enrichment for the children's acquisition of knowledge ('learning success'). Working as a 'team' is perceived as pleasant through mutual 'esteem,' good informal and formal moments of 'reflection' and the importance the management attaches to the mental and physical health of the employees. All these concepts contribute to stress reduction ('workload') in their observed 'reality of practice.' However, in-service training itself is sometimes viewed with skepticism. This is because the 'variety' of the offered in-service training courses and their perceived demands to develop come with emotional negative values. Beyond that the willingness to implement something new is determined by the equipment and tangible comfort of the in-service training environment.

Day-Care Center B

At day-care center B (see **Figure 5**) 'stimulating interaction' is defined by the 'pedagogical approaches' to philosophizing with children and being able to wait in order to give them space to find their own problem-solving strategies or to follow their interests. These positively evaluated concepts are, among others, linked to the desire of the educators to personally benefit from the perceptible 'learning successes' of the children and to regard this as a motivator for the interaction methods they use. They are supported in the application of their 'stimulating interactions' by a perceived inspiring 'docent' who has a positive influence on the 'team' culture and 'daily routines' through 'videography.' They value their own way of interaction very highly and also defend it against 'externals' like colleges or other familiar day-care centers and 'parents,' because they feel misunderstood and condemned. Their way of interaction is not seen as accepted at all. Their 'own standards' may lead to a negative perspective toward 'material' provided in in-service training, because such material is regarded as imposed on them.

Day-Care Center C

The teachers of day-care center C (see **Figure 6**) have ambivalent feelings about 'stimulating interaction.' On the one hand they blame the children themselves for the failure of this new form of interaction in everyday life. They regard them as not old or capable enough, so that for the teachers but also seen from outside any 'visible success' fails to appear as motivator for the constant application of the method. 'Stimulating interaction'

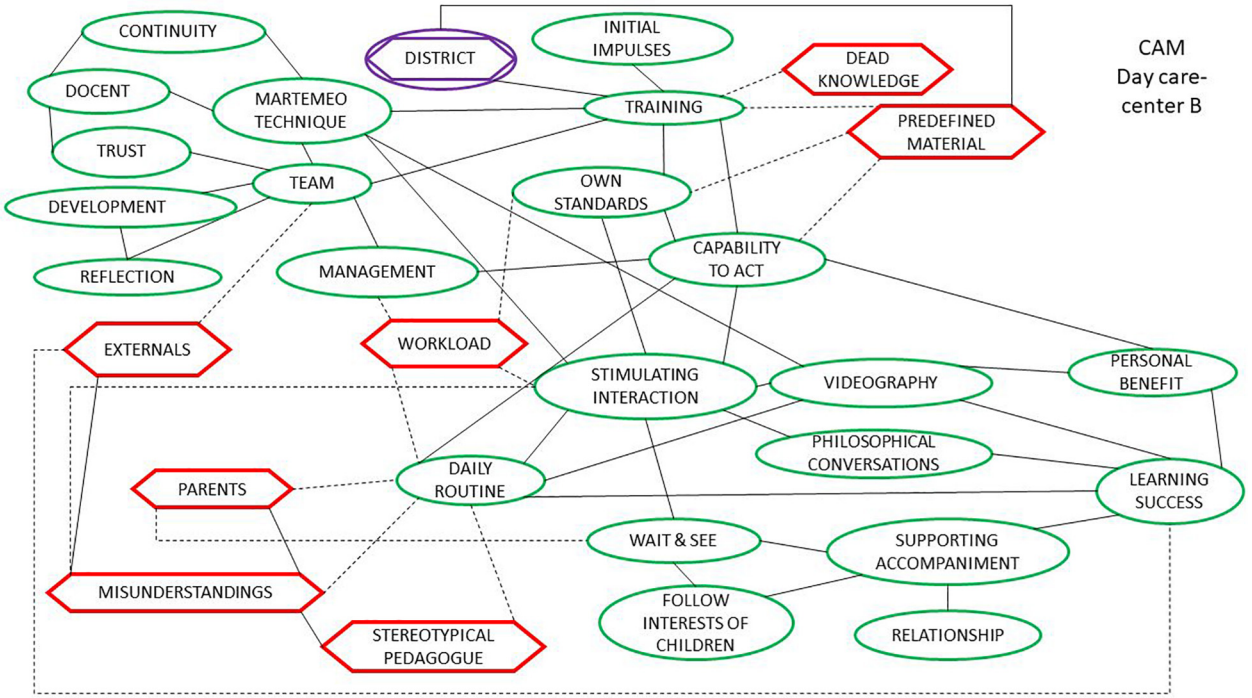

FIGURE 5 | CAM Day-care center B.

is nevertheless connected to positively valued concepts like 'relationship,' 'conversation,' or to 'arouse and show interest.' All of these contribute to the 'learning' processes of children. Parents are held primarily responsible for the educational success of their children. The assumed claim of parents that the day-care center is solely responsible is rejected at the same time. Changes that have taken place in the organization so far are experienced as sluggish and compulsory processes. This leads to a devaluation of continuous 'in-service training' unless the in-service training itself offers entertainment, good 'material' or an authentic 'docent.' Moreover, the informational content offered by in-service training courses is rated in a negative way. The emotionally positive concepts of 'restart' and 'ideal' conditions are mentioned as a self-proclaimed solution to the unenforceability of new interaction formats.

Day-Care Center D

The CAM of day-care center D (see **Figure 7**) is characterized by a particularly high number of negatively evaluated concepts compared to the other organizations. These concepts represent the core category of 'reality of practice.' 'Stimulating interaction' is a poorly rated interaction format. Its emergence is linked to various conditions. The format is for one thing prevented by perceived 'structural conditions' within the organization, and it is limited by 'standard procedures' during daily life and a recognized high 'workload' that lead to a feeling of heteronomy. The political decisions that lead to this unfortunate situation are called into question. As another factor, child conditions like age, cognitive skills, origin are used to predict the failure of the format. However, the assumed impact of the format on child development is assessed as positive in itself, because it can be a stimulus to child imagination ('fancy') and lead to more intensive 'relationships.' A good emotional basis ultimately supports the self-attributed main pedagogical tasks: doing 'conversation' and satisfying the basic needs of the children for sheltered care. The pedagogical approach of 'open work' serves the inherent idea that children are able to 'develop naturally' if they can follow their personal interests. The basic attitude toward in-service training is positive and linked to the concepts of 'knowledge,' 'personal interest,' 'input,' and 'material,' which are also positively regarded.

Day-Care Center E

In day-care center E (see **Figure 8**) 'stimulating interaction' is associated with highly positively valued concepts that represent the pedagogical approach practiced there: 'in-depth conversations,' 'active listening,' interacting with 'all children' are the daily business. All these concepts are linked to a number of other positively rated concepts that enable the teachers to 'get involved in children's topics' to 'share thinking' and trigger children's 'cognitive processes.' This factors lead to an 'intense relationship.' The 'team' work is characterized by a high level of mutual trust and standardized reflection processes, which have led the team to self-developed 'pedagogical standards and interests.' The perceived self-efficacy and the mutual appreciation of the work done in the organization contribute to skepticism about 'formal obligations' imposed by others, e.g., associated facilities. In-service training courses are

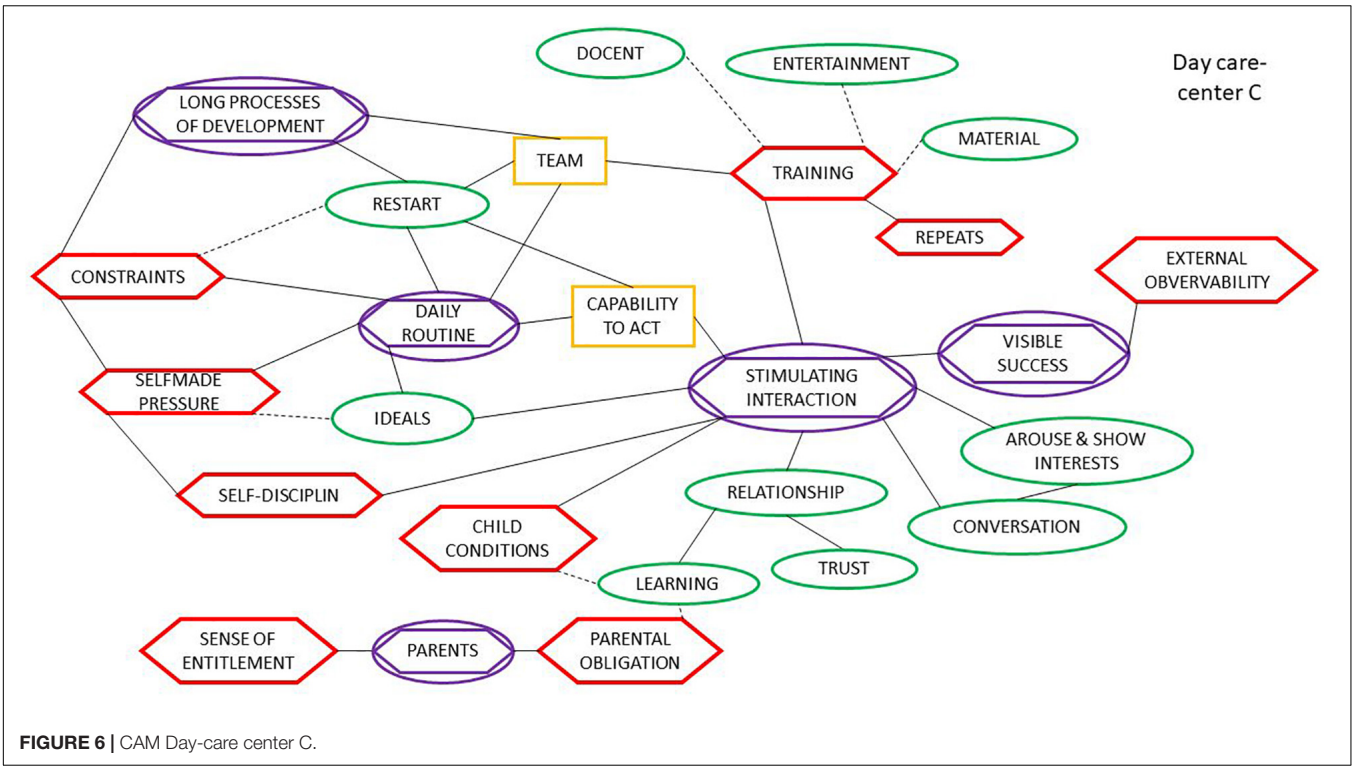

FIGURE 6 | CAM Day-care center C.

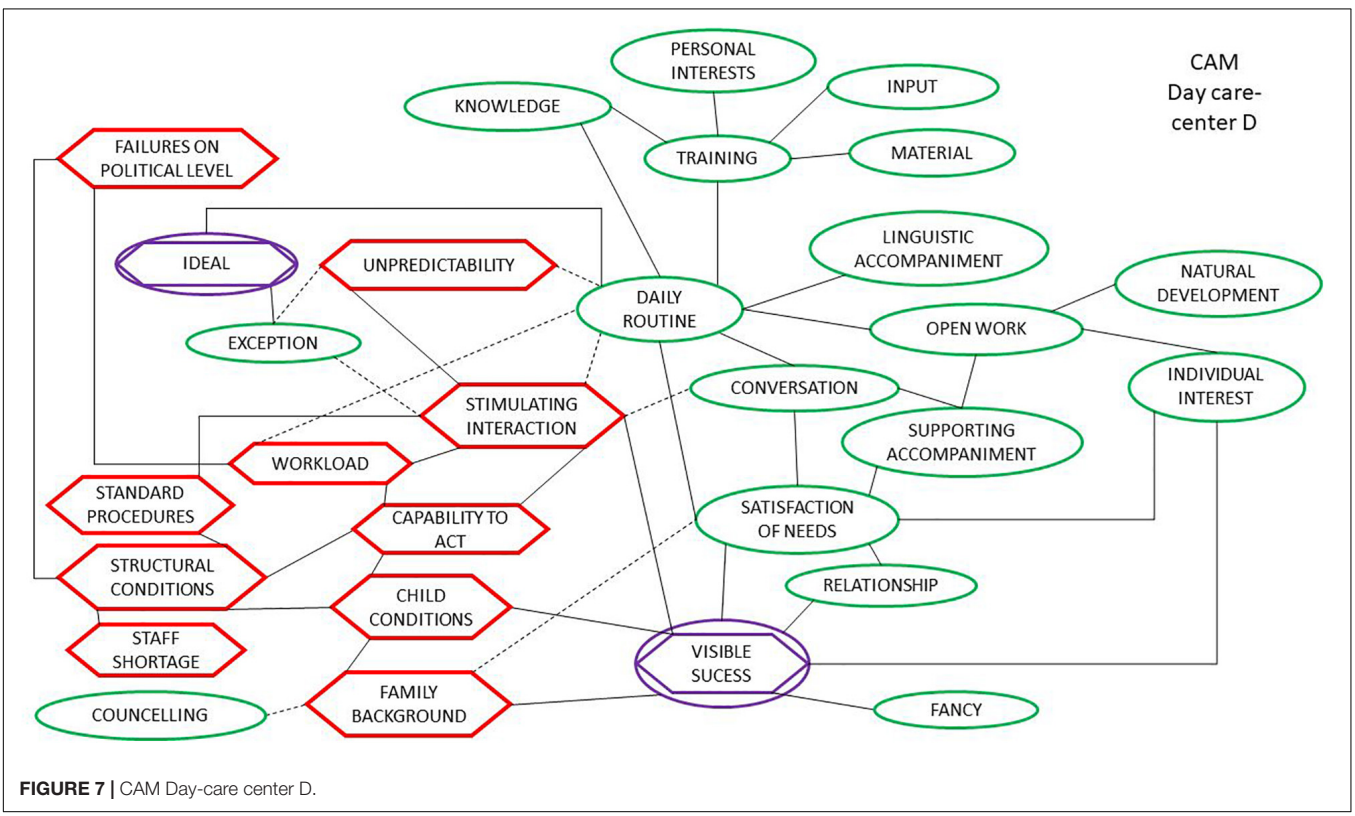

FIGURE 7 | CAM Day-care center D.

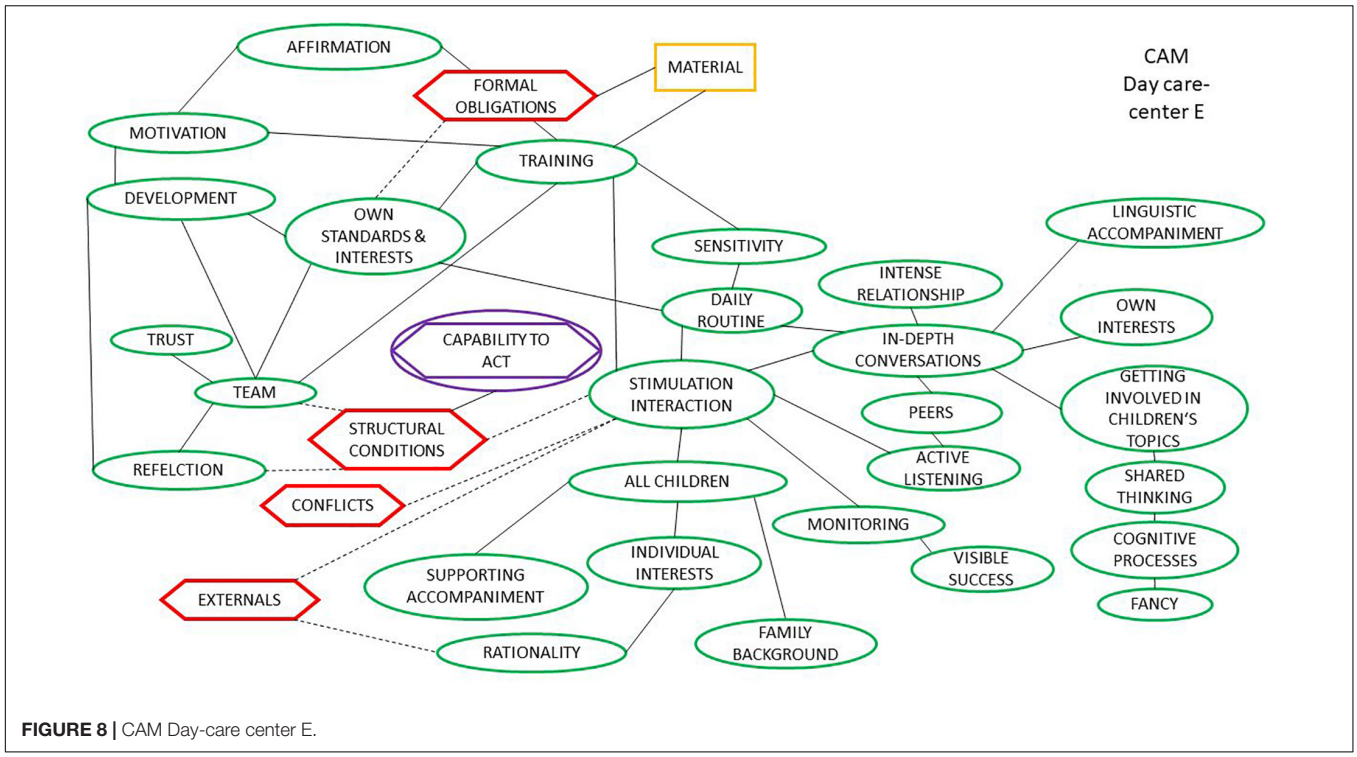

FIGURE 8 | CAM Day-care center E.

perceived as positive and enriching, because they help create awareness of certain topics or as intrinsic 'motivation' for an ongoing team development process.

Day-Care Center F

At day-care center F (see **Figure 9**) 'stimulation interaction' is interpreted as 'linguistic and supporting accompaniment.' Because language is daily life, 'conversation' is also a highly positively valued element of their pedagogical approach. 'Conversation' moreover serves the aim of being able to 'raise awareness on specific issues' for protecting children against environmental hazards, it contains the opportunity to ask children questions and to encourage them to share their thoughts and needs. The 'child is seen as expert' in relation to its own development and the pedagogical idea to 'serve children's interests' logically follows. The concept of 'capability to act,' in other words to empower stimulating interactional formats, is tied to ambivalent feelings. This is because the 'team' is dissatisfied with the current work situation, which was caused by a change in personnel that currently prevents backing each other up and pulling together, which are seen as essential elements of good practice. The basic attitude toward in-service training could be reconstructed as rather ambivalent. 'In-service training courses' have to promote their 'own standards' or 'own interests,' and need to be comprehensible and easy-to-implement.

Practices of Adopting and Rejecting 'Stimulating Interaction' on the Organizational Level

To answer the question of to what extent the innovative messages concerning 'stimulating interaction' are taken up, negotiated and put into practice, this section presents a summarizing classification of the reconstructed organizational mechanisms and practices. Firstly, we describe the different interpretations of what 'stimulating interaction' appears to be in practice across various organizations. Secondly we describe how the teams accept, process or delegate their assigned responsibilities to implement innovational interaction formats, and thirdly we focus on how the teams evaluate their implementation attempts.

Variations of Interpretation as Performed Re-contextualization

As the results reported above show, the intended social innovation of 'stimulating interaction' is interpreted in different ways, i.e., within each organization the teachers make sense of this concept in heterogeneous ways. Apart from the fact that the emotional connotation of the concept 'stimulating interaction' can be positive (day-care center A, B, E, and F) and negative (day-care center D) as well as ambivalent (day-care center C), the concept is linked differently within the CAMs (e.g., day-care center B vs. D). The previously discovered incongruities at Level I continue at Level II. 'Stimulating interaction' is defined as:

- daily conversation that occurs naturally in everyday life, because language is the medium of human interaction. Teachers are able to show interest, to build a relationship and thus contribute to the well-being of the child,
- explanations given to share knowledge,
- a linguistic approach to concretely support language development, and/or
- in-depth or philosophical conversation to think together and make children think.

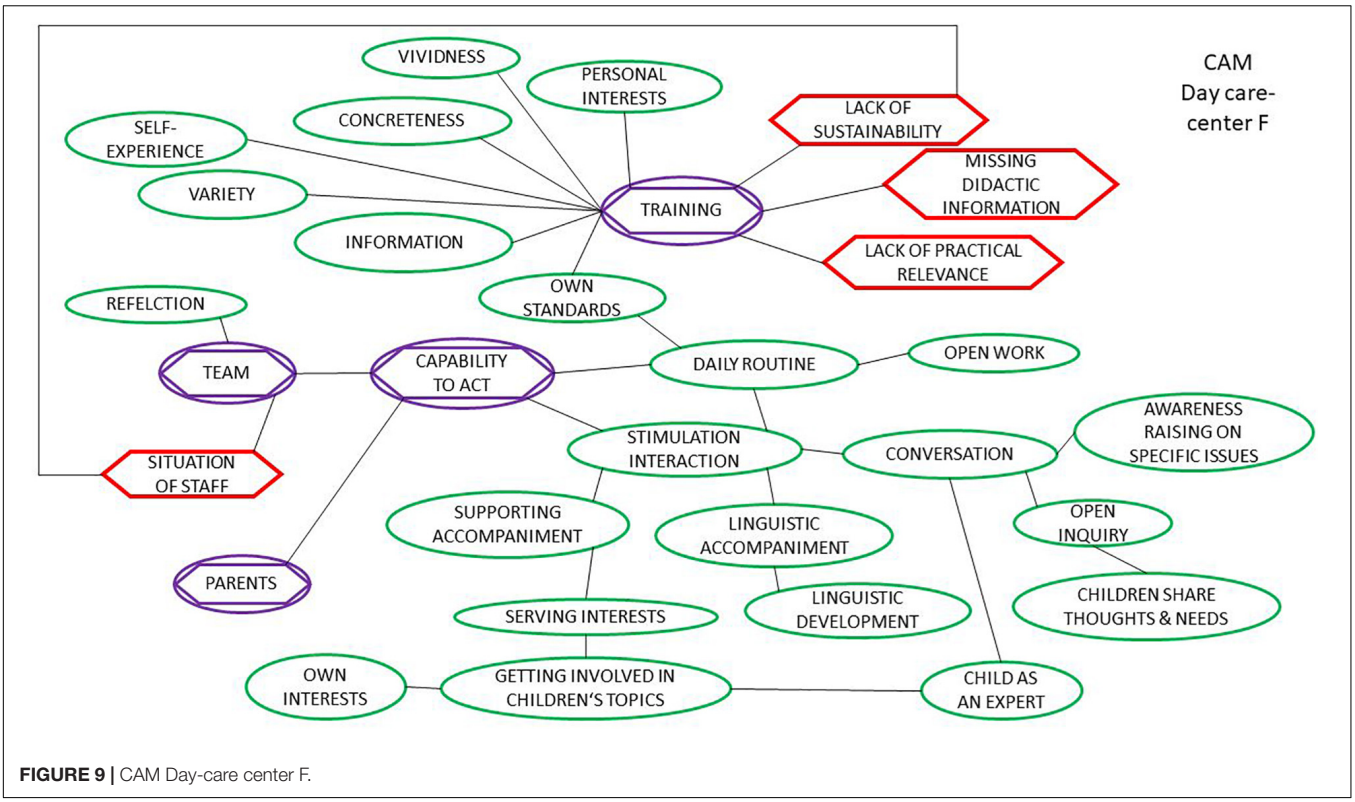

FIGURE 9 | CAM Day-care center F.

The characteristics and abilities as well as external qualities of children and their familial backgrounds are invoked as indicators of successful or failed 'stimulation interactions,' however interpreted. This leads to the implicit, ambivalent normalization of children. If 'stimulating interactions' do not succeed in the daily routines, the age of the children, their cognitive performance and their parental homes with references to origin and social class are listed as barriers and come with a negative emotional value. If 'stimulation interactions' can be realized in the daily routines, the child's image is the exact opposite and independent of social background. All children have rationality, are naturally interested, are active, communicative, open-minded, with positive attitudes, able to be equal partners in the dialog. However, the expectations of the children are ultimately the same and on a high level; they are only embedded in contrasting cognitive-affective ways.

Variations of Accepting and Delegating Responsibilities

In addition to the role of children in 'stimulating interaction,' other mechanisms within the organizations can be reconstructed which are in some way held responsible for the successful implementation of the innovative interaction format. Firstly, structural conditions such as the child-care ratio determined by educational policy makers are listed as negatively connoted obstacles (see day-care center D, E, or F). Here links are set to the negatively framed concept of 'workload' and the heterogeneously connoted concepts of 'capability to act' or 'daily routines.' Secondly, in addition to the perceived educational mission expected by society and educational policy, in a broader sense by referring to the perceived task of family accompaniment teachers also return responsibility for the children's education to the parents (see day-care centers B, C, or D). Thirdly, a successful implementation of new interaction formats is linked to the in-service training courses participated in by the teachers and the defined roles of in-service training with regard to the development process of the organization (concepts at the top of each CAM). The reconstructed different functions of in-service training courses can coexist within an organization and are defined as:

- a short-term, superficial entertainment program, as a place of self-experience and source of concretely applicable, didactically prepared materials and ideas for everyday life, interest-related.
- a place of dialog with docents or teachers from other organizations for the purpose of confirming current practices.
- part of a long-term, self-initiated team development processes to evolve or enlarge their own standards alongside subjectively perceived 'state of the art' pedagogical approaches.

Self-Evaluation Mechanisms During Re-contextualization

It has been possible to reconstruct some concepts that provide an insight into the evaluation of the new interaction format if it was applied within the organization in individually interpreted

ways. For example, the concept of 'learning success' varies emotionally between the day-care centers as a result of the way the children reacted to the applied interactional format. If the teachers monitored a child reaction – interpreted and to some extent expected as positive such as imaginative narration, asking more questions, continuing with their subject further, deepening their interest etc. – they deduced a great benefit, or in Rogers (2002) terminology "a high relative advantage," and used the positive experience as an external motivator for continuing with the format (see day-care center A, B, or E). In contrast, other teachers reported a disappointing reaction by the children to the applied interactional format: the children kept quiet or turned around so that the teachers were negatively affected, deduced no benefit and stopped this way of interaction (see day-care center C or D). Another concept that needs to be taken into account is 'external parties,' who are either valued positively (see day-care center A) or negatively (see day-care center B or E) by different teams. Either way the concept is linked directly or indirectly to the applied pedagogical approaches and the way teachers evaluate the reaction of these external parties. The attributed emotional value is negative if they are regarded as critics of the pedagogical performance. In such cases the external parties are simultaneously downgraded as misinformed or old fashioned, with the teachers thus continuing to entrench their established practices.

Counteractions Between Level I and Level II

In a sense, the core categories which have been found and are presented in Section "Different Perspectives on 'Stimulating Interaction' – Overview of Core Categories" can be understood as mutual counteractions between the actors on the two levels. Whereas, for example, education policy and in-service training providers determine the way of pedagogical development, the organizations make decisive demands on the in-service training providers. The 'principles of child learning and development' which have been found on Level I are reflected at the level of the organizations as subjectively possible pedagogical routines and approaches which, beyond that, manifest demands on the interacting child.

The core concept of 'reality of practice' is shared by all actors – in concrete terms as 'daily routines,' 'workload,' or 'capability to act,' for example – but its character is shaped by different emotional values and several different associated concepts. Even if the actors at Level I do not actively shape pedagogical practice within the organizations like the teachers do, educational policy makers and in-service training providers claim sovereignty of meaning and feeling, though in opposite ways. However, every organization has its own view of its feasible practice, its own experience of what it feels like and generates different concepts and associations to deal with it. Particularly in those organizations where the core category of 'reality of practice' combines rather ambivalent or negative concepts (e.g., day-care center D, E, or F), fractures between the organization and education policy become apparent. Either the view of the practice is reflected on the level of the in-service training providers, or the organizations utilize the rhetoric of the in-service training providers. In either case, however, the positive view of the daily work assumed by educational policy makers is contradicted here.

Furthermore, there is also a differentiation from educational policy makers and training providers, especially if the organizations work according to the pedagogical standards they have themselves developed (see day-care center B and E), which *per se* prevent or complicate unwanted interference from the outside and equally allow only self-targeted interventions as a further developmental step.

The transversal core category of 'processing implementation' can be used to show how the innovation request is negotiated very differently within the pedagogical teams, or in other words, which stage of the diffusion process has already been passed, which ultimately leads to whether the innovative interaction format is individually adapted and implemented or rejected. It should be noted that the call for innovation itself finds its way into practice but is interpreted in very different ways.

Summary

This section shortly summarizes the findings by selecting the particularities on the two levels and between the levels.

Incoherences on Level I – Educational Policy Makers and In-Service Training Providers

The three core categories – 'assumed reality of practice,' 'demands on the teachers,' and 'principles of child learning and development' can be found within both educational plans and in-service training programs. However, the concepts assigned to the core category 'assumed reality of practice' differ greatly in their emotional values. On the side of the educational policy makers the assumed practical reality of a teacher is valued positively. By holding on to pedagogical ideals, the teachers within the organizations can endure any adversity and implement their educational mission for each child. The key to this lies in the hands of every teacher and is linked to further in-service training. On the side of the in-service training providers, the assumed practical reality of a teacher is valued negatively. Facing a lot of obstacles in practice, the teachers need an incredibly large repertoire of pedagogical action techniques in order to be able to implement their educational mission for each child. Because the circumstances within the organizations cannot be changed, the teachers themselves are the key to successful pedagogical work, at least if they keep learning.

Similarities and Differences Between the Day-Care Centers on Level II – Organization

The perspectives of the organizations on 'stimulating interaction' are very heterogeneous, no organization is like the other. While some teams find their perceived everyday life and structural conditions within the organization restrictive in providing the children with the support they actually need, others emphasize the feasibility of the partly new pedagogical approaches, some of them developed in-house, despite perceived difficulties in terms of the welfare and

education of the children. These differences become apparent in the contrary emotional connotations of some concepts, e.g., 'capability to act,' 'daily routine,' 'team,' or by accentuating the perceived reality with different concepts like 'workload,' 'child conditions,' 'structural conditions,' or 'self-made pressure' in an emotionally negative way (see day-care center C, D, E), or in an emotionally positive way with concepts such as 'own standards,' 'reflection,' 'esteem,' or 'trust' (see day-care center A, B, F).

Similarities and Non-conformities in Relation to Selected Concepts Between Level I and II

The perspectives on practice on the part of the actors at Level I to some extent represent extremes with regard to the assumed practical reality, while the organizations move individually between these poles and react to the partial statements of the in-service training providers if there is a need to underline difficulties by implementing innovative interactional formats – illustrated for instance with the emotionally negative concepts of 'risk factors' and 'child conditions.' Furthermore, if effective implementation is not perceived as successful, some organizations comment on the positively connoted concept of 'demands on the teacher' on Level I and their assigned task to develop continuously by targeting educational policy makers as responsible for 'structural conditions' that prevent the embedding of new pedagogical formats into practice, or by criticizing in-service training providers and their programs indirectly via concepts like 'repeats,' 'predefined material,' or 'lack of practical relevance.'

DISCUSSION AND CONCLUSION

The aim of this study was to trace the path of a social innovation using the example of 'stimulation interaction' in the field of early childhood education and to show both the cognitive and affective dimensions of meaning within the innovation discourse. The positions of the actors involved in the discursive innovation – educational policy makers and in-service training providers as senders of the educational innovation (Level I) and 6 day-care centers and their pedagogical teams (Level II) as receivers of the innovational messages – have been examined and visualized by CAMs.

Although educational policy and in-service training providers wish to establish innovative interactional practice, their prescriptive-normative specifications differ greatly from one another: the affective association of some concepts is even of opposite value. Thus a diffuse mixture of competing and contradictory information is communicated to the professionals and collides with their established practices. On the one hand, contradictory information concerning educational innovation makes it difficult to identify clear instructions for the implementation of the according actions. On the other hand, contradictory information cause implausibilities that affect the perception and evaluation of the intended educational innovation on the level of organizations: incoherent messages from decision-makers in education policy seem to miss their effect at the level of educational organizations and, furthermore, at the level of educational practice. Possibly, these inconsistencies complicate collective sense-making which is an essential part of the implementation of an innovative idea, because an in-depth examination of the topic by the practitioners is hampered from the very beginning (Coburn, 2001). In terms of Rogers' characteristics of the diffusion of innovation (2002), content of the intended innovation may also be too difficult to understand or too difficult to achieve in the given context of application for the adaptation of the new ideas without further ado.

These inconsistencies not only inhibit innovation because they make it possible to evade demands, they also generate stagnation: controversial messages unsettle and strengthen the tendency to adhere to familiar rituals, methods and didactics in everyday practice and thus hamper innovation. In practice the professionals dissolve these tensions in different ways, e.g., by rejecting innovation requests as unrealistic and incompatible with their current situation, or by claiming they have already been fulfilled. At this point, we can tie in again with Rogers (2002), because apparently neither the preconditions for adaptation 'relative advantage' nor 'compatibility' seem to be fulfilled and, thus, do not lead to the requested change in the interaction.

If a social innovation cannot be seen as intended or feasible, the apparent insistence on established practice is ultimately a logical consequence.

In order to make a positive contribution to the change of interactions in practice, it might be useful:

- to establish a discursive agreement on central concepts of the topic at the policy level and to connect them with the actual working realities of practice in order to implement social innovations in education and
- to define 'stimulating interaction' more clearly as distinct from conversation and to link it more closely to existing ideas in practice. This will not be universally possible, but requires organization-specific support measures and time.

What also becomes clear is that in addition to the development pressure on teachers, there is also enormous pressure on in-service training providers, who have to translate the ideals of educational policy into the language of practice, while at the same time satisfying the needs and interests of practitioners. The problematization of everyday life as an obstacle to new interaction formats for instance seems logical, because it may be easy to tie in with the perspectives of practitioners, but it also points to an odd dependency relationship which spans a certified need for further in-service training, the options which are available and the interest-led participation.

Thompson (2017) shows how difficult and challenging it is to establish common sense and joint language between the in-service trainer and the participants. She points out that there are translational difficulties because of which the participants and their daily routines remain in a, lost position' (Thompson, 2017,

p. 248) and reflections are only partially possible. For in-service training providers, it is therefore necessary to respond more individually to the participants' experiences, emotions, knowledge concerning an intended innovation in the training courses. It is questionable whether this is easily possible, because they actually have to deal with subjective narratives and can hardly refer to a common ground of experience within the specific organizations. Education policy actors could also react here by investing more financial capital in individual in-service training courses that are provided for local organizations rather than across different organizations that have to deal with various challenges (f.e., to enable permanent, process-accompanying coaching with the teams according to their needs and to support the development of a 'common language' beyond all levels). What probably seems most helpful in preventing reservations about innovation is providing educational professionals with consistent information. Policy-makers and in-service-training providers should anticipate the supportive as well as competing knowledge-emotional complexes of professionals and take these into account when communicating an intended innovation. Further research is needed to clarify whether it is more useful to use a rather positive-normative discourse on stimulation interaction rather than to clearly reveal deficits.

In this paper an innovative inter-methodological triangulation approach was presented which made it possible to reconstruct the perspectives of various actors representing different levels of the multi-level education system who are involved in a social innovation. The study uses the example of an intended new interaction format of 'stimulating interaction' in the field of early education based on various sources such as public documents and group discussions. This cross-layer approach made it possible to understand more comprehensively how innovations travel through space and time, and why it is often so difficult to implement innovations as planned. The visualization with the help of CAMs depicts the perceptions and values of different actors as crucial for a coherent process of innovation transfer.

It has to be mentioned, of course, that the CAMs are a result of an interpretational process of narratives within different documents. Moreover, the process of purposeful sampling which was applied led to a limited choice of materials. These focused primarily on large regional providers, leaving out smaller suppliers or training courses conducted by the bodies of the different organizations. Another limitation is certainly the design of the study itself, because only two federal states and one single survey were focused on, instead of longitudinal studies that might enlighten the follow-up process subsequent to the first interaction with an intended innovation. Such a method could make it possible not only to examine collective knowledge and values, but also to focus on the individual teacher involved in implementing an innovation in practice and to trace perceived obstacles to implementation at a subjective level. It can be assumed that pedagogical action and work are influenced not only by colleagues or the organizational culture, but that biographical experiences and the personal environment can also contribute to a change.

DATA AVAILABILITY STATEMENT

The datasets for this manuscript are not publicly available because of strict data protection regulations (EU DGSVO; data protection regulations). Requests to access the datasets should be directed to: Jasmin Luthardt, j.luthardt@fu-berlin.de.

AUTHOR CONTRIBUTIONS

JL: theory, methods, results, and discussion. TS: methods. FH: discussion. IB: idea, methods, and discussion.

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POLICY BRIEF
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Embedding Social Innovation and Service Learning in Higher Education's Third Sector Policy Developments in Austria

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Social innovation in Austrian HEIs is discussed under the headline of their "Third Mission." The HE sector is pressured to have more and more impact on society. Internationally speaking, many countries benefit from national policies and networks in the Third Sector, but policies in Austria were initiated only recently, in 2017, on a national level. Interestingly, the service learning approach as an innovative and socially responsible teaching methodology stands out in Austrian HE. This article classifies the developments of the Third Sector in Austria in the form of a policy brief. Austria has a growing community of practice in social innovation and service learning. The article gives insight into the strategic developments in Austria and is underpinned with recommendable action to be transferred to others.

Keywords: social innovation, third mission, higher education policies, service learning, civic engagement

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INTRODUCTION

Throughout their long history, HEIs have regularly been confronted with intensive discussions about their position in society. HEIs have been facing a fundamental paradigm shift about what they are expected to accomplish on an economic, social, and environmental level. The old paradigm of scientific discovery ("Mode 1"), which was characterized by an internally-driven taxonomy of disciplines and the autonomy of researchers and their institutions, was superseded by a new paradigm of knowledge production ("Mode 2"), which is socially embedded, applied, transdisciplinary, and "subject to multiple accountabilities" (Nowotny et al., 2003, p. 179). As a consequence, the place of universities in society (Maassen et al., 2019) had to change as well. This placed an emphasis on activities in the Third Sector, which are neither governmental nor for-profit, but value-driven, and which operate between the state, the market, and the community (Evers and Laville, 2004).

While in the United States, Third Sector activities have been a central component of HE, European HEIs still lag behind. Scholars have discussed the adequacy of terminology for Third Sector activities, which are contextual and regional (Aramburuzabala et al., 2019). While in the Anglo-American context, civic engagement, community-based research, or action methodologies in the Third Sector are guiding terms (Nigro, 2017), the umbrella term "Third Mission" has

prevailed in German-speaking countries. Additionally, there is a broad discourse about Social Innovation (BEPA, 2010), Social Responsibility (GUNI, 2009), Service Learning (Reinders, 2016)—concepts, which also shape the Third Sector discourse, however, we identified service learning as *the* central discursive element in the European Third Sector discussion.

Service learning has since the 1990ies emerged as a central component of HE in the United States connected to both civic responsibility and academic learning (Felten and Clayton, 2011). "Service-learning is the various pedagogies that link community service and academic study" (Ehrlich, 1996). While its potential lies in preparing students to be engaged citizens, it has many forms of implementation, including direct or indirect services in the Third Sector and community partners in the local neighborhood, on-campus, or even online. During implementation equal priority is given to students, staff/faculty, and community partners. According to Dewey (1966), a democratic society will only work with engaged citizens. Students, faculty, and community partners thereby build reciprocal relationships, which lead to both initial and sustained learning on all sides (Brower, 2011). Service learning was initially viewed as an opportunity to radically change HE and make it more relevant to communities (Boyer, 1996). The largest body of literature about community engagement has been produced in the US (Bringle and Hatcher, 1996; Furco, 2002), based on ideas of pragmatism (Harkavy and Benson, 1998), utilitarianism and communitarianism (Codispoti, 2004), and systemic engagement theory (McNall et al., 2015).

However, service learning as a Third Sector activity, is not free of criticism: Once thought to benefit local communities, it is now criticized for serving HEI goals, such as providing research laboratories for faculty and venues for students to implement applied coursework (Holland, 2005). Instead of helping to bring about transformational change in communities, service learning has become a technical practice with a "charity" orientation and in this sense mirrors a neoliberal approach in the transformation of HE (Raddon and Harrison, 2015). From this perspective, service learning is instrumentalized to appeal to external funders (Slaugther and Rhoades, 2000). Some researchers believe that service learning has positive effects on the social awareness of participants (Dukhan et al., 2009), while others are not that optimistic as evidence on the impact of service learning is missing. It may also reinforce paternalistic structures and stereotypes (Cipolle, 2004). Scholars are concerned with the Third Mission as elite practice (Butin, 2010). Service learning might be a luxury "many students cannot afford, be it in terms of time, finances, or job future" (Butin, 2010, p. 32). In order to prevent service learning from becoming just one more academic practice, students should be equipped to analyze policy and society (Wohnig, 2016).

In Europe, HEI's tripartite mission has only emerged since 2000. The so-called "Third Mission" has over the last two decades been positioned as an equally important part of the universities' social contract in Austria (Resch, 2018; Maassen et al., 2019). This article classifies the developments of the Third Mission in HE in Austria in the form of a policy brief. Austria has a growing community of practice in Third Sector policy, social innovation, and service learning, however, policy developments have never been summarized from a multi-stakeholder perspective.

EUROPEAN HE POLICIES WITH PARTICULAR FOCUS ON AUSTRIA

European Developments

While research in this area in the United States and other countries like Australia has prevailed, the academic discourse in Europe is still highly particularistic. The global network for innovation (GUNI), supported by UNESCO, argued for a renewal of HE with a vision of public service and social responsibility (GUNI, 2009). There is a "relatively enabling policy environment" for Third Mission activities in Europe (Aramburuzabala et al., 2019, p. 2). Spain, Ireland, and Germany have more well documented service learning histories than other European countries, and national networks. Austria's community of practice tends to be defined by scattered practice—a fact also true for other European countries, in which we discern "different levels of maturity and mainstreaming" of service learning (Aramburuzabala et al., 2019, p. 5). In post-communist countries, we observe a dynamic growth of the Third Sector and in parallel a continuing weakness of civic society, which may lead to barriers in the implementation of service learning (Meyer et al., 2019). In Western European countries, we see a stronger democratic culture that encourages students and faculty to actively participate in the community. In 2019, Austrian HEIs made a first move toward an emerging national network for service learning aiming at pulling isolated institutional practice together.

Developmental Steps in HE Policy in Austria

The HE sector in Austria covers 22 public universities, 21 universities of applied sciences, 14 teacher training colleges, and 16 private universities.

Official documents published by the Austrian government emphasize the relevance of an open HE system promoting university extension: "Outreach activities and diversity-sensitive course guidance" cited in the "National Strategy on the Social Dimension of Higher Education" published by the Federal Ministry of Science, Research and Economy (BMBWF, 2017) demonstrates the necessity for new forms of cooperation. Thus, HEIs are asked to "identify and expand collaboration with civic stakeholder groups" (ibid., p. 5). A joint publication by different Austrian ministries emphasizes the "reinforcement of community education approaches" (Republic of Austria, 2011, p. 32) within the "Strategy for Life-long Learning in Austria (LLL:2020)." The "National Strategy on the Social Dimension of Higher Education" (ibid.) was developed as a joint policy document of all HEIs for the first time. In addition, service providers, intermediary bodies, and social partners contributed to the policy development process, which confirms the commitment of HE stakeholders in Austria to the paradigm shift in progress.

In the recently published national government program for the period 2020–2024, one strategic objective is to "strengthen the knowledge transfer between science, industry and society" (Regierungsprogramm, 2020, p. 313). It targets an increased collaboration between science, arts, business, and other stakeholders to develop social innovation. Before 2017, policies on the Social Dimension were missing and generally left to the autonomy of HEIs, so a national strategy was not available. This led to less integrated and disseminated developments in Austria compared to other European countries with a national strategy or network. The title of the policy development ("Social Dimension"), which was used in Austria, allowed all institutions of various backgrounds and disciplines to join the process, as everyone accepted it.

Institutional Practice

In contrast to Germany, Ireland, or Spain, there are neither systematic attempts to evaluate the implementation of service learning, such as meta-analyses (Reinders, 2016), nor any form of overview study on the distribution of service learning in Austria.

Austria's community of practice tends to be defined by scattered institutional practice—a fact this policy brief is overcoming for the first time by pulling isolated institutional practice together. Given that Europe is one of the last international regions to consolidate the benefits of service learning, it is not surprising that there is no published policy brief on the situation of Austria's HE policy in the Third Sector so far. This is well reflected in institutional policies: Service learning is explicitly mentioned in the development plan 2019–2024 of the University of Graz, the development plan 2025 of the University of Vienna, the development plan of the University for Continuing Education at the Danube University Krems, the strategic plan 2019 of the Vienna University of Economics and Business, and in the development plan of the Universities of Education in Austria 2021–2026. It is therefore anchored in several strategic documents, however, not nationally organized. An increasing number of Austrian HEIs have been carrying out service learning courses (Gerholz and Losch, 2015; Resch, 2018). The University of Vienna launched a policy project on service learning in 2015 under the headline of their Third Mission. It was initiated from the rectorate (top management) and contained an awareness raising campaign and interviews with the deans of all faculties (middle management).

In 2010, the Vienna University of Economics and Business launched a community service learning program called *Volunteering@WU*, which aims at promoting learning and social inclusion by stimulating an exchange between students and young people from socially disadvantaged backgrounds (Buber et al., 2019). The program is co-curricular, participation is voluntary, and can therefore be classified as a hybrid of community service and service learning (Seider et al., 2013; Meyer and Schachermayer-Sporn, 2018). The University of Graz applies service learning as one form of social innovation in the Master Business Education and Development as a compulsory subject. Students work with a partner from outside the university, and e.g., develop a marketing concept for organic fruits or organize sales trainings for the long-term unemployed (Slepcevic-Zach, 2017). "Civic Engagement Education and Service Learning in Teacher Education" at the University of Education Upper Austria is a fundamentally new concept for field experience for pre-service teachers: All candidates run through this experience as a mandatory course, including experience in social work, after-school and tutoring programs. This experience offers students insights in diverse living conditions, facilitates an understanding of individual biographies and social contexts (Grogan and Fahrenwald, 2018).

These examples of scattered practice show that in some cases, service learning as one configuration of social innovation forms an integral part of a study program, whereas in other programs students have the opportunity to choose the course as an elective subject. Austria is ready to leap into a new era of a shared community of service learning practice leaving scattered institutional practice behind—a paradigm shift from isolation to partnership.

Actionable Recommendations

Meijs et al. (2019) identified six barriers for implementing service learning: time for implementation, knowledge & expertise, funding, prioritizing service learning on national and institutional level, a coordinating unit, and modes of recognition. We would like to emphasize the last three for Austria:

Prioritizing Service Learning in Policy Development

The implementation of existing policies in the Social Dimension is still vague, needs interpretation, and leads to scattered practice left to the autonomy of HEIs (with a lack of networking and practices shared). Following a self-assessment tool, Austria can be considered at Stage 1 (Critical Mass Building) of a three-stage continuum of development (2: Quality Development; 3: Sustainable Institutionalization; Furco, 2002; Seifer and Connors, 2007). The next steps are to enhance comparative research in the Third Sector and provide funding mechanisms on a national level for this purpose. Policy makers are asked to set incentives for teachers' engagement (Abes et al., 2002).

Leaving Scattered Institutional Practice Behind—Coordinated Action

The future must be shaped by coordinated action on a national and institutional level. First, the emerging network initiated by the authors in 2019 must continue. Second, locating Third Sector activities in university's transfer offices is useful for coordinated action, reporting and monitoring. However, concepts need to be adapted to the respective circumstances such as students' profiles, and urban or rural structures of the HEI.

Networking should not only continue on national level, social innovation and service learning courses should not be considered as stand-alone initiatives, but become increasingly interconnected instead. Central coordinators on faculty level can enable and facilitate cooperation between teachers and provide possibilities to exchange expertise (Pigza and Troppe, 2003).

Modes of Recognition

Eventually, service learning should be an indicator of teaching quality in the evaluation processes of academics. Analyzing the factors that motivate staff to implement service learning, the faculty reward structure plays a significant role, but is generally under-researched (Abes et al., 2002).

DISCUSSION

This policy brief is an attempt to summarize relevant national policy development and institutional practices to shed light on the Austrian developments.

We reviewed the available legally binding documents as key strategic policies for the Social Dimension in HE, which serve as a documentation of developments in Austria. The Third Mission activities of HEIs are still scattered, but ultimately with support from top management, are essential for uplifting this Sector to a strategic and more visible level.

In summary, many institutional practices shape the Third Sector in Austria. Yet, the authors are the first to initiate a common policy brief and to acknowledge cross-institutional learning in this field. Still, there is a lack of empirical research about the effects of policies on a societal, institutional and individual level (Fernandez and Slepcevic-Zach, 2018). We would appreciate a stronger strategic European movement in the Third Sector, however, mainstreaming of service learning can be viewed optimistically if the policy conditions in the Third Sector remain stable. More future research is needed about the Third Sector learning processes of HEIs as organizations. Building a strong Austrian research and practice network across and within disciplines has become an important work for our future.

AUTHOR CONTRIBUTIONS

KR substantial contribution to the policy brief, drafting the work, and critical revising for important intellectual content. MF substantial contribution to the policy brief and drafting the work. CF major contribution to the policy brief and critical revising for important intellectual content. PS-Z, MK, and PR minor contribution to the policy brief. All authors contributed to the article and approved the submitted version.

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The Global Diffusion of Social Innovations – An Analysis of Twitter Communication Networks Related to Inclusive Education

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In recent decades, different social innovations – such as lifelong learning, inclusion or Education for Sustainable Development – have had a huge impact on domestic education systems. In an increasingly globalized world, innovations diffuse across national borders. At the same time, diffusion processes seem to be highly influenced by public and private actors, e.g., international organizations (IOs) or non-governmental organizations (NGOs). Both state and non-state actors use social networks and digital communication platforms, such as Twitter, as channels for the diffusion of social innovations and practices. Inclusive education, which has become the main alternative to special schools for the schooling of children with disabilities, is a widely discussed innovation in education and, hence, represents a suitable case for the study of global diffusion processes and the involved actors. Thus, drawing on social network theory (SNT), the aim of this paper is to examine the structure of the Twitter communication network forming around the social innovation of inclusive education. Empirically, we use social network analysis (SNA) to map the communication network; identify central actors; and infer assumptions about the role of different actor groups. Our results show, for instance, that especially NGOs and IOs hold central positions in the network, which enables them to exert influence on the diffusion of innovative ideas. Overall, the findings of our study indicate how the online communication tool Twitter can play a crucial role for actors who seek to influence the global diffusion of social innovations in education and effect education policies, norms and systems at the global, national and regional levels as such.

Keywords: social innovation, social network analysis, inclusive education, Twitter, global diffusion

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INTRODUCTION

In recent decades, education systems around the world have been confronted with reform initiatives, resulting in a growing number of social innovations related to education. Results of international student assessments such as the program for international student assessment (PISA) or the trends in international mathematics and science study (TIMSSS) – which have demonstrated educational needs and weaknesses concerning educational justice – have urged political actors to develop and implement innovative ideas with the aim to meet the needs of disadvantaged groups

(e.g., persons with disabilities). In an increasingly globalized world, the diffusion of educational reforms and innovations (such as inclusive education) is not limited to national borders. Instead, international organizations (IOs) as well as multinational and transnational actors are influencing educational systems and settings at the global level with significant consequences at the national and regional levels in many countries.

As a result, different concepts and programs – such as the Bologna reforms in European Higher Education or digitalization in schools – have had a huge impact on domestic education policy. These social innovations are often developed in response to general societal change or to meet the needs of disadvantaged groups (e.g., persons with disabilities). We define social innovations as new social concepts with a direct connection to the search for solutions to social problems or challenges (Zapf, 1994; Rogers, 2003; Kolleck, 2014). Hence, social innovations are not only related to the development of new ideas, services or models to better address social issues, but also require a stage of implementation (Kolleck, 2016). In contrast to technological innovations, social innovations entail normative, functional or pragmatic concepts such as lifelong learning, Education for Sustainable Development or inclusive education. As a result, social innovations are neither abstract goals nor intentions but have already demonstrated an effect on social practices. To give an example, they have resulted in social movements, educational reforms, novel pedagogical and organizational practices and changes in educational discourses.

A variety of scholars have tried to identify different mechanisms that influence the diffusion (or 'traveling') of social innovations around the globe (for an overview, see Steiner-Khamsi and Waldow, 2012). Some authors argue that, driven by international, large-scale assessments such as PISA, policymakers take particularly successful countries as examples of best practice and try to transfer specific concepts to their own domestic structures. Scholars refer to such mechanisms as cross-national 'policy borrowing' (e.g., Steiner-Khamsi, 2012). Others emphasize the role of IOs as global players that exert their influence through the setting of standards, the development and dissemination of policies, or the provision of technical and financial assistance (Jakobi, 2009). Aside from these public actors, the involvement of private actors, such as non-governmental organizations (NGOs), philanthropic actors or businesses, is highlighted by a growing number of scholars (for an overview, see Verger et al., 2016b). Overall, it can be noted that the diffusion of social innovations at the global level seems to include a variety of different stakeholders that needs to be considered in the study of such processes.

With its impact on education systems worldwide, the concept of inclusive education has developed into one of the most influential social innovations in education in recent decades. It has experienced a tremendous institutionalization, as manifested in a variety of organizations and social movements. In particular, the social innovation has been adopted as a human right through the creation of the United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD) with its Article 24 on education. This has resulted in the restructuring of educational systems in diverse UN countries, successively replacing special schools with inclusive settings (Kanter et al., 2014; De Beco, 2016). Despite its legitimization in the CRPD, the level of implementation of this concept still differs widely when compared internationally. Scholars argue that although inclusive education needs to be implemented at the domestic level, different stakeholders must build networks and spread different ideas and issues surrounding the topic at the international level (Torres Hernandez, 2008; Biermann, 2016). Hence, we argue that the discourse on the implementation of inclusive education is shaped by a variety of different state and non-state actors, each with its own intentions, interests, and means to influence how social innovations such as inclusiveness are defined, operationalized, and put into practice.

In these discursive battles and processes of international policymaking, information and communication technologies (ICTs) play an increasing role as 'new' channels for information and knowledge diffusion. Social media platforms, such as Twitter, have become increasingly relevant for the dissemination of information and innovation, also in education policy (Conover et al., 2012; Dubois and Gaffney, 2014). Different actors use Twitter communication to build links to other actors and to form debates around specific topics.

However, to date there is only little knowledge about the actors involved in the respective networks of innovation diffusion, the way these actors engage in the diffusion and what role they play in social media discourses. In this article, we address this research gap. Using inclusive education as an example of one of the most successful social innovations in education over recent decades, we investigate

how the Twitter communication network around the social innovation of inclusive education is formed, which actors and actor groups are involved and how they interconnect with each other in order to shape and diffuse the social innovation.

In order to answer these questions, we draw on concepts of social networks and relate these to questions of social innovations. Empirically, we use techniques of social network analysis (SNA) to identify the most central actors in the network and to make assumptions about the involvement of different actor groups. Following this introduction, we describe inclusive education as a social innovation in education and conceptualize it using social network theory (SNT). Thereafter, we give a short introduction to the social media platform Twitter. After describing our methodological approach, we then present and discuss our results. We conclude the article with a short summary of main findings and prospects for further research.

THEORETICAL BACKGROUND

Inclusive Education and Innovation Diffusion

Inclusive education as a concept for the schooling of children with disabilities, in contrast to separate schools or classes, has gained increasing acknowledgment and acceptance over recent decades. With the adoption of the CRPD, the disability rights movement has further made a seminal step in establishing inclusive education as a human right. Article 24 of the convention

highlights that "States Parties recognize the right of persons with disabilities to education" and "shall ensure an inclusive education system at all levels" [Convention on the Rights of Persons with Disabilities (CRPD)., 2006]. This demands that member states take necessary actions to implement inclusive settings in their education policy. However, studies show that even among the signatories of the convention there are still great differences concerning the implementation of Article 24. Most studies that examine different approaches to implementing inclusive education focus on single countries or conduct cross-national, comparative studies (e.g., Ainscow et al., 2006; Powell et al., 2016; Li, 2018). These studies suggest, among others, differences in the role of government or in the various national traditions around the schooling of persons with disabilities, which in turn result in differences in the national discourse about the issue. However, attempts to change these current states are not limited to national borders. As the historical development of the CRPD shows, non-governmental actors such as IOs or NGOs have always advocated for inclusive education (Degener and Begg, 2017). As is the case for other educational concepts, such as lifelong learning (Jakobi, 2009), inclusive education must be conceived of as a social innovation that is diffused globally.

The term social innovation refers to processes of implementing and diffusing new social concepts across different sectors of society. While 'innovation' implies a kind of renewal, 'social' connotes interaction of actors. Social innovations are directly related to the search for solutions to social problems and challenges. Educational innovations are social innovations in educational contexts, such as new forms of educational cooperation or novel learning concepts. It is assumed that the structural properties of social networks have an impact on how social and educational innovations are implemented and diffused. Empirical studies show that the behavior of contact persons correlates highly with an individual's adoption behavior (Rogers, 2003). Implementation and diffusion of innovations are social processes; innovations are accepted and established in social networks and diffused via social relations that are based on these networks. Likewise, education is seen to be a key to implementing innovations.

One main aspect of innovation is the diffusion process. As defined by Rogers (2003, p. 5), "diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system." The concept of diffusion is thereby mostly related to the process itself as opposed to the results (Elkins and Simmons, 2005). Tews (2005, p. 65) adds to these considerations that diffusion comprises "the spreading of innovations due to communication instead of hierarchy or collective decision making within international institutions." Thus, we argue that the sort of communication channel is of less relevance when it comes to innovation diffusion. In theory, stakeholders pass through different stages in their adoption and realization of an innovation, from knowledge of the concept, to persuasion, to adoption, implementation and, eventually, confirmation. In the case of inclusive education, most countries – at least the member states of the CRPD – can be located at the fourth stage, the implementation. According to Rogers' considerations, reflections about adopting or implementing innovations depend highly on the communication with others. Consequently, communication networks emerge from the constant interpersonal exchange about experiences and ideas, with certain stakeholders acting as 'policy entrepreneurs' embedded within them (Mintrom and Vergari, 1998). Hence, "we must understand the nature of networks in order to understand the diffusion process" (Rogers, 2003, p. 331), focusing on the question of which actors use which channels to communicate and which networks are formed by these channels.

It may be argued that inclusive education is not necessarily a 'new idea' because it has been discussed and even implemented in the educational systems of some countries for years. However, as Rogers (2003, p. 12) states, "'newness' of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt." Hence, as Heiskala (2007, p. 54) summarizes, it only matters if the idea is "perceived as new in the context of application." Rogers defines an innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption. It matters little, so far as human behavior is concerned, whether or not an idea is objectively new as measured by the lapse of time since its first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation" (Rogers, 2003, p. 12). Consequently, in this article we conceptualize inclusive education as a social innovation because it has experienced a process of policy implementation and global diffusion, thereby resulting in numerous political, judicial, social, and educational reforms in recent years.

Conceptualizing Social Networks

In recent years, the term 'social network' has attracted a lot of interest. Network approaches are becoming increasingly important in several scientific disciplines. To give an example, the social background and the social relations of individual pupils are regarded as among the most important factors having an impact on school achievement (Sun, 1999). Further, social networks influence processes of learning (Morgan and Sorensen, 1999), socialization (Hennig and Stegbauer, 2012), and innovation (Valente, 2009).

The scientific literature includes several different understandings of social networks. Frequently, SNA is used metaphorically to describe social phenomena (Hwang and Moon, 2009), such as how cultures influence behavior in bounded groups (Wellman, 1988). However, relying on metaphors as the foundation for development strategies and policy advice can be harmful and lead to unintended results (Ostrom, 2011). This article draws on Wassermann and Faust's (1994) definition of social networks, which is broad enough to be combined with different theoretical approaches. Hence, a social network "consists of a finite set or sets of actors and the relation or relations defined on them. The presence of relational information is a critical and defining feature of a social network" (Wassermann and Faust, 1994, p. 20). At the same time, in this article we specify social networks as collective actors that emerge from common interests, topics and problems. Thus, social networks, and their members and boundaries, are defined according to their specific contents and topics.

Network boundaries are fluid, the result of ongoing negotiations and content-related, substantial interactions. Exchange and deliberation facilitated by social networks give them the potential to generate new knowledge and promote ideological and structural change in local systems (Kolleck, 2016).

Conceptualizing the Diffusion of Social Innovations Using Social Network Theory

In recent years, the transfer and diffusion of social innovations has been further theorized using SNT. SNT builds on previous thoughts on the role of social networks and social relations in processes of reform and innovations. It does so by distancing itself from the assumptions of both methodological individualism and methodological structuralism and by highlighting the interactions between structure and agency. Actors are not regarded as islands, but rather as being embedded in social structures (Kolleck et al., 2017b).

To give an example, building on different theoretical approaches, Borgatti and Lopez-Kidwell (2011) develop a theoretical framework that helps to better understand processes of social innovation diffusion and communication networks such as Twitter (Kolleck et al., 2017a). This theoretical framework is built upon the assumptions formulated by Granovetter (1973); Burt (1982), and Coleman (1988) to conceptualize relational phenomena: the backcloth and the traffic of social networks. While the backcloth offers the infrastructure that enables or constrains the traffic, the traffic refers to what flows through the network (e.g., information on inclusive education). Hence, the backcloth serves as the conduit through which the traffic or social innovations flow (Borgatti and Lopez-Kidwell, 2011).

One main interest in applying SNT is to gain information on the position of and the structure surrounding an actor in a network; that is, its embeddedness. The advantage resulting from an actor's embeddedness in his/her relational neighborhood has been conceptualized in different ways. While Granovetter (1973) argues that the network structure or 'context' in which an actor is embedded matters, others stress the importance of the actor's position. Burt (1982) developed such a conceptualization of positional advantage as a source of social capital. In his study on structural holes, he finds that an actor increases his/her social capital by being in a unique position that allows only this actor to connect several clusters in the network. By exploiting structural holes and acting as a broker between clusters, this actor has an informational advantage and increased leeway for maneuver (Sabatier and Jenkins-Smith, 1993; Christopoulos and Ingold, 2015).

For the theoretical framework used in this article, this network theoretical perspective is relevant because it allows us to neatly distinguish between the structural conditions (e.g., centrality) and the actual flows (e.g., exchange of information on inclusive education). Hence, we extend the existing literature by using this network theoretical perspective to examine the Twitter communication network related to inclusive education. In this way, we specify the network in order to make assumptions about the involvement of different stakeholders and their interconnections in diffusing information on inclusive education.

SOCIAL NETWORKING ON TWITTER

The microblogging service Twitter is one of the most popular social media platforms worldwide, with over 300 million accounts and 500 million messages per day (Steinert-Threlkeld, 2018). With its global scope and its flat hierarchy, it allows users from all over the world to publish short messages of up to 280 characters (so-called 'tweets') and to connect with other users through mentions, replies or retweets. To mention someone, users simply put the @-symbol in front of another username. In this way, the mentioned user receives a notification. Replies are mentions at the beginning of a tweet and they are often used for actual (public) conversations. Retweets are tweets originally written by others, which are republished by a user. Retweets are often used to spread information to new audiences, but also to comment on a specific tweet (Boyd et al., 2010). Moreover, users can engage in specific discussions by using hashtags (adding the #-symbol in front of a keyword). Hashtags are usually established either by users writing about a specific topic or are predefined in advance of a specific event. Once a hashtag is established, users can easily contribute to the same discussion and follow the discussion by subscribing to the hashtag.

Having started as a private blogging service, Twitter has now become a news and information medium that is widely used by public stakeholders, such as politicians, government agencies, or NGOs (Kwak et al., 2010). These political actors use the platform to communicate with the wider public, to promote ideas, and also to mobilize and connect to others (Conover et al., 2012; Dubois and Gaffney, 2014; Guo and Saxton, 2014). Especially connecting to others offers the opportunity to exchange information and, by doing so, spread ideas and innovations across a broader network. While there has been limited research to date on the use of Twitter in education policy, it can be assumed that political actors in this field participate in global networking activities on Twitter.

METHODOLOGICAL APPROACH AND MEASURES

Empirically, we operationalize our theoretical thoughts on social networks and social innovations by drawing on techniques of SNA in order to examine the Twitter network that has formed around the discussions about inclusive education. "Networks are a way of thinking about social systems that focus our attention on the relationships among the entities that make up the system" (Borgatti et al., 2018, p. 2). The main idea of analyzing social networks is to shift the focus from attributional information to the relational aspects of the researched subjects, that is, the way they are embedded in a network (Wassermann and Faust, 1994; Jörgens et al., 2016). This approach contrasts with more traditional methods of social sciences, such as interviews or surveys, and can therefore provide a different type of information. As noted by Nooy et al. (2011, p. 5), the main

objective of SNA is "detecting and interpreting patterns of social ties among actors," thereby allowing for a better understanding of the dissemination of ideas, arguments and innovations (Kolleck, 2016). Social networks consist of a set of actors (nodes) and the connections between them (edges; Borgatti and Halgin, 2011). The nodes in a social network are not necessarily individuals but can also represent groups or organizations. Edges can comprise information exchange, interactions or all sorts of relationships (Wassermann and Faust, 1994). Translated to a Twitter context, the nodes represent Twitter accounts and the edges represent retweets or mentions. To determine the direction of the retweets we refer to Kumar et al. (2014) who suggested that a link goes from user A to user B if A retweets B. This understanding of a retweet is closer to a traditional network theoretical perspective as the actual action of retweeting is employed by A whereas B remains passive.

Recently, techniques of SNA have been increasingly applied in educational research (for an overview, see Zander et al., 2014; Menashy and Verger, 2019), as well as in the study of policy implementation processes (for an overview, see Lecy et al., 2014). Usually, the main focus of these studies is the identification of particularly central actors or organizations – where centrality is understood as the potential power to slow down or accelerate flows of ideas or innovations in a network, as well as gaining better access to information due to an actor's position (Borgatti et al., 2009; Nooy et al., 2011). For the present study, our main interest is the network that has formed around the Twitter debates on the topic of inclusive education. We assume that specific public and private actors try to actively take central positions in the Twitter network in order to exert influence on the information flow. Hence, in order to identify particularly central actors, we conduct SNA to calculate different centrality measures. Using different centrality measures allows for a more comprehensive description of the network.

The most common centrality measure is degree centrality, which can be further divided into in-degree and out-degree for directed networks.[1] The in-degree counts the number of incoming ties, whereas the out-degree represents the number of outgoing ties. On Twitter, the in-degree means the total number of retweets, mentions or replies a Twitter account has received and can therefore be conceived as a measure of prestige or popularity. In contrast, the out-degree measures the number of mentions or retweets a user published and is defined as the extent of activity of Twitter users, as well as a measure of their expansiveness (Borgatti et al., 2018). For the present study, we calculate the centrality measures to identify particularly active and popular accounts. Against the backdrop of processes of policy diffusion these are rather simplistic measures and prone to error if used to assess the individual role of the accounts in the communication network and their centrality or influence on the actual diffusion of social innovations.

Two more complex and more valid measures to calculate centrality and influence in processes of innovation diffusion are betweenness centrality and eigenvector centrality. "Betweenness centrality is a measure of how often a given node falls along the shortest path between two other nodes" (Borgatti et al., 2018, p. 201). Hence, these measures provide a more profound basis to measure an actor's centrality, influence or ability to control the flow of information in a communication network. Assuming that information is likely to take the shortest path to flow from one actor to another, being on many of these shortest paths allows an actor to further pass on information or to stop the flow. Eigenvector centrality, in contrast, is calculated in relation to the centrality of the nodes it is adjacent to and is often interpreted as a measure of popularity in the sense that an actor is popular if it is connected to other popular actors. In this way, even actors with only few connections can hold central positions in a network (ibid.). These additional centrality measures can provide further insight, not only into the Twitter activity of the different actors but also into their embeddedness in the network. Hence, in contrast to degree centrality, these measures consider the embeddedness of different actors in the diffusion network, allowing for assumptions about their placement within more complex network structures. This, in turn, enables further assumptions about the influence different actors might have on the diffusion of innovations.

Data Set

In order to collect Twitter messages relevant to the CRPD and inclusive education, we gathered data that was published during the conferences of states parties (COSPs) 2013–2017. The COSPs were chosen for the data collection because – as an integral part of the CRPD (Article 40) – they represent a crucial platform for different actors to discuss the implementation of the convention. We collected the data over the whole duration of the conferences and added one day before and after to cover all relevant data. In addition to tweets containing hashtags directly linked to the convention and the conferences (e.g., #CRPD or #COSP10), we also searched for disability-related hashtags for specific years, such as #post2015 in 2015 or #thisability in 2013 and 2014.[2] Overall, the data set contained 44,545 tweets. As we had a particular interest in the network around the debates on inclusive education, we further searched for related messages using the following search syntax:

educa*[3] OR article 24 OR sdg4[4] OR school OR (child AND inclu*)

This filter led to a reduced data set of 1,638 tweets, of which we generated an education-specific network consisting of 986 nodes and 1,793 edges. The edges represented 1,557 retweets (86.84%) and only 236 mentions (13.16%). Although we were not able to conduct more detailed analyses of the data due to the still high number of messages, we added further information about the actors in the network by assigning them to the

[1] In contrast to undirected networks, where the ties represent symmetric relationships such as shared membership in a group, ties in directed networks have a sender and a receiver (e.g., a friendship network).

[2] The complete search syntax can be found in the **Appendix**.

[3] To cover education (engl./fr.) and educación (esp.) for the languages mainly used in the data set.

[4] The fourth sustainable development goal (SDG) proclaims quality education and is therefore widely used in the context of inclusive education.

different organization types. The categories that were generated inductively throughout the process included:

- Businesses (e.g., Ai Media, Karlen Communications),
- governmental actors (e.g., the United Kingdom Department for International Development, the United States Agency for International Development),
- IOs [e.g., the United Nations Children's Fund (UNICEF), World Bank],
- general NGOs[5] (e.g., Human Rights Watch, Lumos),
- disabled people's organizations (DPOs; e.g., Inclusion International, Disabled Peoples' International),
- research [e.g., Foro de Educación, Institute of Social and Policy Sciences (I-SAPS)],
- media (New York Times, Driven by Health), and
- private persons (including users that could not be assigned to other categories).

RESULTS

Aside from private actors ($N = 446$), NGOs represent the largest group in the data set with 127 accounts, followed by DPOs ($N = 109$) and IOs ($N = 104$). A slightly smaller number of accounts can be assigned to businesses ($N = 91$). Only a small proportion of users in the network can be observed for research-related accounts ($N = 50$), governmental actors ($N = 43$) and the media ($N = 16$). Overall, it can be noted that the Twitter network forming around inclusive education consists of a diverse set of actors.

The Twitter network was visualized using Gephi, an "open-source software for the visual exploration of networks" (Heymann, 2014, p. 612). For a better interpretability of the visualized network, we applied the ForceAtlas 2 layout, an algorithm that makes adjacent nodes approach and unconnected nodes repel (Jacomy et al., 2014). **Figure 1** shows the graph of the network, including the actor group affiliation and the eigenvector centrality of each node. To keep the graph readable, it only represents the main component, that is, the largest set of nodes in which every node is somehow connected to each other. Consequently, the presented network contains 826 nodes (83.77% of the overall education network) and 1,646 edges (91.8%). The high percentage of nodes included in this main component suggests that the Twitter network on inclusive education in the context of the CRPD does represent – to some extent – a cohesive group of interconnected nodes with only a few loose islands. Some aspects of the graph are noteworthy. First, the network consists of one main body containing the most central nodes (according to eigenvector centrality) and some smaller groups that are loosely connected with this main body. The most central actors are mainly IOs, NGOs, and DPOs. As for the distribution of different actor groups, from this graph

[5]'General NGOs' are distinguished from DPOs on the basis that they do not have a singular thematic emphasis on disability rights but rather a broader or different agenda; however, throughout the paper we sometimes refer to general NGOs and DPOs collectively as 'NGOs' as they represent the same type of organization.

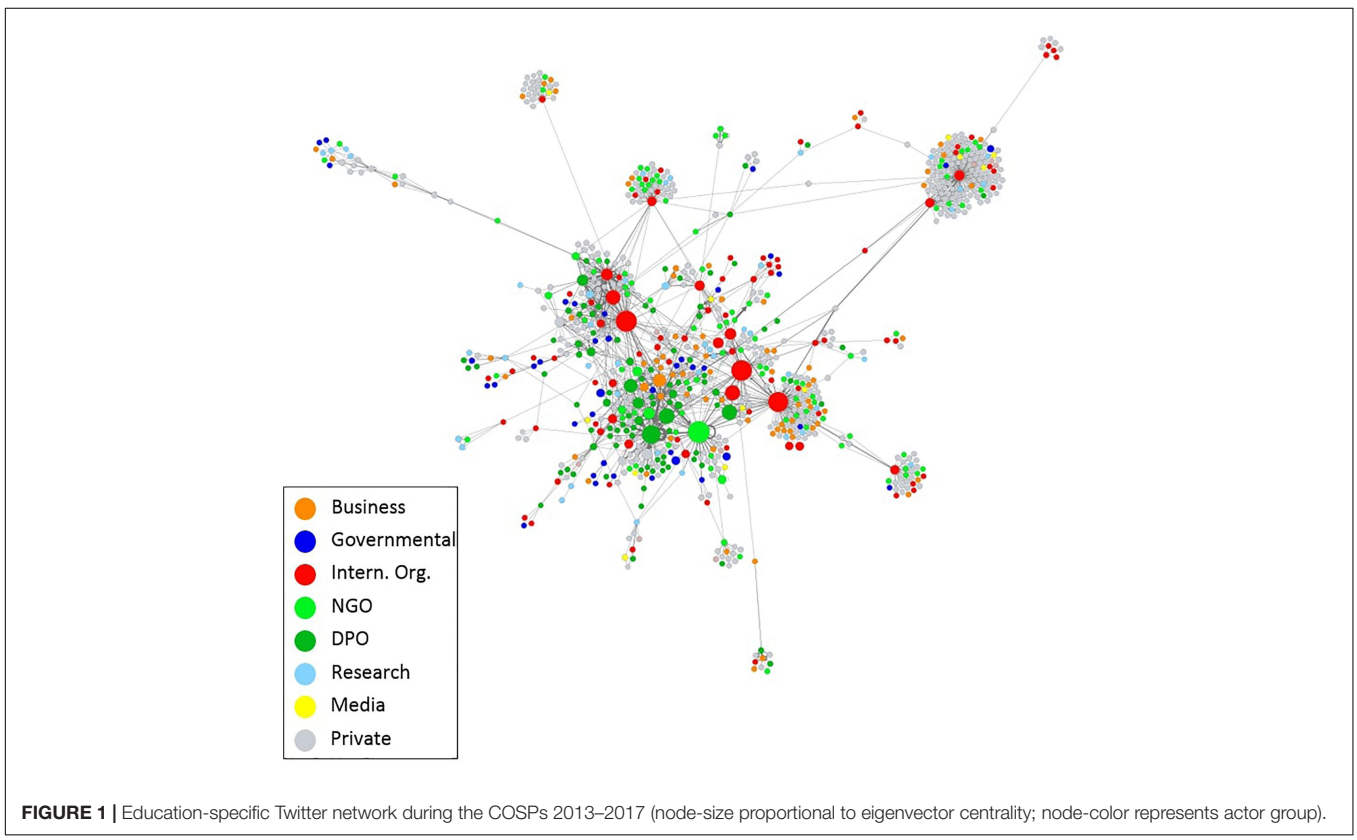

FIGURE 1 | Education-specific Twitter network during the COSPs 2013–2017 (node-size proportional to eigenvector centrality; node-color represents actor group).

no observable patterns can be identified. Only a 'green nest' in the lower part of the main body suggests a close connectivity of different NGO-related actors. Others, such as governmental or research-related accounts, are rather randomly located in the graph. This unsystematic arrangement could be regarded as an indication that the involvement of many different actors may shape the implementation of inclusive education in many ways.

In order to specify the most central nodes with respect to different dimensions of centrality, we calculated the in-degree, out-degree, eigenvector and betweenness centrality measures for the network. **Table 1** presents the top ten actors according to in-degree. The account that received the most mentions and retweets is the UN Entity for Gender Equality and the Empowerment of Women (in short, UN Women). This is particularly noteworthy because this agency is neither necessarily concerned with education-related issues, nor is the topic of inclusive education explicitly directed at girls and women. UN Women is followed by the education-related account of UNICEF and – at some distance – UNICEF's main account. Four further UN-related accounts and the World Bank show that users tend to address IOs with their activities in the network. Only two of the leading NGOs in the field (Inclusion International and Lumos) break this dominance, suggesting that civil society actors are not popular addressees for this sort of online communication. This distribution suggests that other users address the formally influential Twitter accounts (i.e., the IO-related accounts) in order to diffuse the innovation by using their wide reach.

In respect to activity in the network, **Table 2** displays the ten users with the highest out-degree. By far the most active user is Karen McCall, a disability rights activist and founder of the company Karlen Communications which provides accessible documents. Other active accounts belong to NGOs, predominantly DPOs, such as Sightsavers, Inclusion International or the International Federation for Spina Bifida and Hydrocephalus (IFSBH). Also, more accounts of individual persons seem to take the initiative in mentioning or retweeting others, such as, for instance, the chair of the Accessibility for Ontarians with Disabilities Act (AODA) Alliance, David Lepofsky, Sightsavers' Head of Multilateral Engagement and Campaigns, Natasha Kennedy, or the global disability advocate Edmund Asiedu. Hence, in contrast to the results of in-degree centrality, aside from UNICEF, the active roles in the network seem to be taken by private actors, indicating a different approach to diffusing the concept of inclusive education: these actors seem to actively address others (potential partners) to exchange ideas and information concerning the concept itself and its implementation.

TABLE 2 | Ten most central users according to out-degree.

Username	Real name	Out-degree
KarlenInfo	Karen McCall	35
Sightsavers_Pol	Sightsavers' Policy and Research Team	21
InclusionIntl	Inclusion International	17
DavidLepofsky	David Lepofsky	16
lumos	Lumos	15
Kennedytasha	Natasha Kennedy	13
UNICEFEducation	UNICEF Education	12
ifsbh	International Federation for Spina Bifida and Hydrocephalus	12
AsieduEdmund	Edmund Asiedu	11
aodaalliance	AODA Alliance	11

AODA, Accessibility for Ontarians with Disabilities Act.

More detailed insights into the actors' roles in the overall diffusion network can be drawn from the distribution of eigenvector centrality. As can be seen from **Table 3**, there are several actors with high values in the network. The most central account in this regard belongs to the NGO Lumos, which was founded by the author Joanne K. Rowling and which aims to bring orphaned children back to their families.[6] Other accounts with similarly high values belong to leading UN agencies and initiatives, underlining their important role in the network. The only individual person in this list is Connie Laurin-Bowie, the Executive Director of Inclusion International, which further reinforces that organization's central position. Thus, the most central positions in terms of popularity are held by key actors in the field, especially UNICEF and leading NGOs.

Finally, **Table 4** presents the top ten accounts according to betweenness centrality. In this regard, the most central account is the UN's Global Education First Initiative. This five-year initiative was launched in September 2012 to strengthen the Education for All goals and the education-related Millennium

[6]https://www.wearelumos.org/who-we-are/

TABLE 1 | Ten most central users according to in-degree.

Username	Real name	In-degree
UN_Women	UN Women	136
UNICEFEducation	UNICEF Education	105
UNICEF	UNICEF	69
InclusionIntl	Inclusion International	64
Lumos	Lumos	59
UNGEI	UN Girls' Education Initiative	53
GlobalEduFirst	Global Education First Initiative	49
WorldBank	World Bank	49
Education2030UN	Education 2030	48
AustraliaUN	Australian Ambassador to the UN	41

TABLE 3 | Top ten users according to eigenvector centrality.

Username	Real name	Eigenvector centrality
lumos	Lumos	1.0
UNICEF	UNICEF	0.95
GlobalEduFirst	Global Education First Initiative	0.92
UNICEFEducation	UNICEF Education	0.89
InclusionIntl	Inclusion International	0.80
claurinbowie	Connie Laurin-Bowie	0.61
GLOBI_inclusion	Global Observatory for Inclusion	0.58
GEFI_Youth	Youth Advocacy Group	0.57
WorldBank	World Bank	0.55
ZeroProjectorg	ZeroProject	0.48

Development Goals. Aside from already mentioned accounts – such as Karen McCall, Inclusion International, or Lumos – among the most central accounts are also the Global Observatory for Inclusion, a global advocacy network, or the disability rights advocates Kimber Bialik and Andrea Pregel. Given the underlying meaning of this measure (i.e., the identification of brokers between different parts of the network), the diffusion of the social innovation seems to be supported by some actors that are particularly important in forwarding ideas and information. Consequently, these actors might be able to shape the concept in favor of their own interests.

Overall, concerning the diffusion of the concept of inclusive education the results of the current study show that the most central accounts in the Twitter communication network belong to IOs and NGOs. Hence, these actors can be assumed to have a certain potential to influence the diffusion and shape of the concept of inclusive education. However, a closer look at different centrality measures suggests the distribution of specific roles according to actor groups. While IO-related accounts are rather passive, yet still influential actors, because they are used as potential levers for information, in particular private actors such as NGOs and businesses try to benefit from the opportunities on Twitter to further diffuse ideas concerning the implementation of inclusive education.

DISCUSSION

The aim of the present paper was to examine the Twitter network forming around the topic of inclusive education. In order to better describe global diffusion processes of social innovation in education, we drew on Twitter data as a data source that covers a variety of different stakeholders involved in debates on inclusive education at the global level. Based on SNT, we applied SNA to map the network and to identify the most central actors. Calculating different centrality measures allowed us to specify the diverse actors and actor groups to a more detailed extent.

The visualization of the main component of the education-specific network in the context of the CRPD suggests that the actors participating in this debate use Twitter to connect to each other and to exchange information. Whereas the opportunity to engage in such diffusion processes is often limited to a few influential actors, Twitter – due to its accessibility and flat hierarchy – enables less powerful and known stakeholders to have their information further distributed and to span geographic and structural boundaries. Following Tews' (2005, p. 65) idea of innovation being diffused "due to communication instead of hierarchy," the communication platform Twitter seems to provide ideal channels for low-threshold exchange of information on social innovation. However, although the users seem to be well connected, a main group in the center of the network, containing mostly central IO- and NGO-related accounts, seems to dominate the network.

TABLE 4 | Ten most central users according to betweenness centrality.

Username	Real name	Betweenness centrality
GlobalEduFirst	Global Education First Initiative	15,830.9
KarlenInfo	Karen McCall	12,782.0
GLOBI_inclusion	Global Observatory for Inclusion	12,402.7
Inclusion_Intl	Inclusion International	11,686.2
lumos	Lumos	11,454.8
kimberbialik	Kimber Bialik	11,436.4
UNGEI	UN Girls' Education Initiative	11,343.0
UNICEFEducation	UNICEF Education	11,192.4
A_Pregel	Andrea Pregel	10,995.7
Kennedytasha	Natasha Kennedy	10,221.4

Looking at the centrality measures in more detail, it can be noted that the network contains a diverse set of central actors who occupy central positions in different ways. A striking difference can be seen between in-degree and out-degree in terms of actor group affiliation. Whereas the most active users, i.e., the users with the highest out-degree in the network, mostly belong to the private sector, those with the highest in-degree are mostly IOs. These differences lead to first assumptions about different roles of the actors and actor groups in the Twitter network. The particularly high activity of Karen McCall is in line with the increasing tendency of private businesses to engage in (global) education policy (e.g., Verger et al., 2016b). However, Menashy (2016) distinguishes two forms of business participation in education: whereas (often successful and leading) businesses participate in a form of corporate foundations as nearly independent organizations, others attempt to implement products or projects in the respective domain. Business actors participating in the Twitter network on inclusive education might be motivated to spread their ideas and products in the network and to possibly build new connections. A high level of business activity in the field of inclusive education is generally not too surprising given the increasing focus of ICT businesses in particular on the broad field of assistive and accessible technologies (e.g., Goggin and Newell, 2007; Stienstra et al., 2007).

In contrast, the high activity of civil society actors in retweeting and mentioning might lead back to different interests. The results suggest that these actors try to benefit from the accessibility of Twitter in order to diffuse their information to a broad and global audience. As could be shown for the promotion of women's rights in the context of the UN Convention on the Elimination of All Forms of Discrimination Against Women, NGOs make a lot of effort to build transnational networks in order to spread ideas about the implementation of human rights conventions (Zwingel, 2005). Hence, DPOs such as Sightsavers, Inclusion International or the IFSBH can be assumed to use Twitter not only to share information but also to build coalitions with others to increase the visibility of the topic of inclusive education. Similar observations were also made by Svensson et al. (2015), who investigated how NGOs used Twitter to shape the concept of sport-for-development, a social innovation introduced to promote social change using sport. They found that NGOs particularly use Twitter to directly engage with other stakeholders in order to form communities and build collective action.

The top ten for in-degree presents a completely different image. IO-related accounts seem to attract particular attention

and the reasons for retweets and mentions of IOs may vary. On the one hand, less influential users might mention accounts with a wide reach (that is, a high number of followers) in order to increase their own visibility or that of a specific topic. This indicates that IOs, such as the UN, serve as levers in the inclusive education Twitter network. A similar pattern has already been noted by Rogers (2003, p. 317) who distinguished *change agents* that "try to utilize *opinion leaders* to leverage diffusion activities." In the case of the Twitter network on inclusive education, DPOs and other disability rights advocates can be seen as change agents that take advantage of the visibility of opinion leaders, such as the UN, in order to diffuse their ideas. On the other hand, retweets can be used to amplify tweets to new audiences, thereby spreading ideas to a wider public (Boyd et al., 2010). Hence, IOs seem to benefit from the retweeting activities of others. Overall, Ausserhofer and Maireder (2013, p. 293) state that "the more people mention or retweet a specific account, the more authority is attributed to it." For the observed Twitter network this indicates a form of validation given that the most retweeted and mentioned accounts represent the presumably most influential organizations in the global policy field of inclusive education. It can also be seen as indication of the very central role of IOs in the global diffusion of educational innovation and further confirms findings from studies on the use of Twitter in other cases of social innovation. For instance, Kolleck et al. (2017b) examined the Twitter network forming around Climate Change Education, an innovative approach to integrating the issue of climate change into education, and found the secretariat of the UN Framework Convention on Climate Change (UNFCCC) to hold a particularly central role in the Twitter communication network.

The results for eigenvector and betweenness centrality reveal additional information about the network and its central actors. In regard to eigenvector centrality as a measure of popularity in the sense of being connected to other popular nodes, the results are not too surprising. The list of the most central nodes mostly contains accounts that belong to leading public and private organizations. Hence, these leading accounts appear to display a high level of interaction among themselves. This, in turn, can cautiously be interpreted as their attempt to build coalitions of influential actors for the advocacy of inclusive education.

In contrast, the list of the most central users in terms of betweenness centrality is more diverse as it contains leading NGOs, such as Lumos or Inclusion International, UN-related accounts, businesses, as well as less known individuals (with affiliations to organizations). Although the relevance of betweenness centrality on Twitter is certainly disputable – given that users do not usually depend on the mentions of others to receive new information – for completely unconnected nodes, the brokering user can still have some influence. Hence, especially the rather unknown users can benefit from their brokerage position. Furthermore, being the 'missing link' between users that are not connected on Twitter can open up the discussion on a certain topic to new ideas and, thereby, support the diffusion of innovations. This brokerage position, as described by both Granovetter (1973) and Burt (1982), attributes a certain role to specific actors that has already been discussed broadly in the literature. Verger et al. (2016a) define those in brokerage positions as policy entrepreneurs and boundary spanners who are indispensable in the (global) diffusion of social innovations in education.

Limitations and Conclusion

When looking at both the visualization of the network and the most central actors, the lack of governmental actors is remarkable. This suggests that Twitter as a means for the diffusion of innovation is mostly used by non-state and intergovernmental stakeholders, while governmental actors seem to prefer traditional channels for their information exchange. Hence, the results from analyses of Twitter data can only serve as evidence for diffusion processes taking place on Twitter, as some main political actors do not participate in activities on this platform. To gain a more comprehensive picture of the global policy network forming around the debate about inclusive education, additional network data needs to be collected. Future research could examine to what extent Twitter networks might mirror offline processes in general.

Another limitation of the present study is the focus on the type of activity, neglecting the content of the tweets. Although the main information regarding the diffusion of innovation is the activity of mentioning or retweeting another actor (and the resulting network), considering the content could increase knowledge about the diffusion processes on Twitter. Due to the large number of tweets, this would have gone beyond the scope of this study. However, a qualitative content analysis of tweets could be applied in future studies, thereby providing additional information on the diffusion of social innovations in education.

Finally, the global scope of the network and its lack of (geographical) boundaries make it hard to infer connections to national policymaking processes. It is therefore difficult to observe relations between the discursive processes at the global level on Twitter and the actual implementation of inclusive education at the national level. In order to investigate the nexus of global and national policymaking and the impact of diffusion processes, future research in this field needs to collect information on the national affiliation of certain actors. In this way, connections could be drawn between global and national policy networks.

Overall, it can be noted that a Twitter network is forming around the topic of inclusive education and that it contains a variety of different actors who engage in the diffusion of the social innovation. Some actors stand out by occupying central positions according to several perspectives. On the side of the UN, a leading position is held by UNICEF, which is not necessarily the primary UN agency for disability rights but which nonetheless has a clear agenda and an explicit focus on the rights of children with disabilities as "one of the most marginalized and excluded groups in society."[7] Hence, its strong engagement on inclusive education as one main vehicle for the inclusion of children with disabilities seems logical. However, it is notable that the official CRPD secretariat is not visible in the network. Whereas in other studies on the Twitter networks around the UNFCCC the secretariat

[7]https://www.unicef.org/disabilities/

was observed to play a central role even within an education-specific subset (Kolleck et al., 2017b), in the inclusive education network the lead is taken by others. Although the actual impact of such processes cannot be investigated with the approach used for the present study, it can set the ground for further research on the implementation of inclusive education, in particular, and the diffusion of social innovations in education, in general.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available due to data protection reasons.

AUTHOR CONTRIBUTIONS

NK and JS conceptualized and conducted the study and drafted the research manuscript. JS completed the analyses. Both authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2020.492010/full#supplementary-material

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Organized Futures. On the Ambiguity of the Digital Absorption of Uncertainty

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Digitalization primarily takes place in and through organizations. Despite this prominent role, however, the importance of organizational structure-building processes in the digital transformation is still underexposed in discourse. The fact that ongoing digitalization is linked to an established phenomenon and its own logic, is regularly not addressed due to the attraction potential of the semantics of the digital revolution. Digital revolution and the reordering of societal relationships, though, manifest themselves primarily in processes of reorganization. Structural automation processes in the ongoing digital transformation are limiting the scope for action, necessitating forms of structural structurelessness in organizations that cultivate opportunities for chance. Since organizations realize their operations as a dual of structure and individual, and the principle of organization is therefore based on the complementarity of structural formality and unpredictable informality. The paper discusses the topicality of the classical form of modern organization in the digital age and reflects on approaches to a contemporary design of spaces of opportunity. The reflexive handling of future openness is the central task of management and leadership in order to enable variation and innovation in organizations.

Keywords: organization theory, management, digitalization, innovation, spaces of opportunity

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INTRODUCTION

Digitalization primarily takes place in and through organizations. Despite this prominent role, however, the importance of organizational structure-building processes in the digital transformation is still discursively underexposed. Digitalization narratives regularly highlight a serious upheaval that affects or will affect all spheres of social life. As a specific form of societal crisis communication, narratives of disruption in particular are part of the semantics of the digital revolution. But unprecedented challenges also require unprecedented solutions. With regard to the digital transformation, hope and alarmism therefore regularly go hand in hand. Because of the attraction potential of the semantics of revolution, however, the fact that ongoing digitalization also has something to do with an established phenomenon and its own logic is regularly not addressed. However, digitalization primarily refers to the form of modern organization and its fundamental affinity for data. Narratives of disruption, though, overshadow the importance of organizational structure-building processes in the digital transformation. Organizational structures generate and constrain organizational opportunities. The associated historically grown continuity of data-driven control affinity suggests the use of software solutions. The structure-effective use of software solutions is along a continuity line of the design of modern organizations. Digital revolution and the reordering of societal relations therefore manifest primarily in processes of reorganization. However, this line of continuity in the formation of organizational structures is not identical with the

fact that societal relations remain the same. Rather, the scope for action and decision-making in organizations is reconfigured through the use of software solutions. The fact that the ongoing digital transformation limits organizational scope for action through processes of structural automation necessitates forms of structural structurelessness as educational arrangements that cultivate opportunities for chance. For organizations realize their operations as a dual of structure and individual. The principle of organization is therefore based on the complementarity of structural formality and incalculable informality. Especially an educational perspective traditionally understands how to deal with uncertainty and the opacity of social processes based on the unpredictability of the individuals involved. To continue their operations and foster innovation, therefore, organizations rely on educational practices of context management that productively turn the unpredictability of social-dynamic interaction through the use of methods. This is particularly the case when innovation addresses structural changes and is not limited to the level of semantics. For this reason, innovative solutions in the digitized era should not be understood as exclusively technical or computational, but are also, above all, social solutions. Variation and innovation emerge on the basis of social processes. The paper discusses the topicality of the classical form of modern organization and reflects on the potential of a contemporary arrangement of spaces of opportunity in the digital age. Reflective handling of future openness is the central task of management and leadership in the digitized era of modernity in order to enable variation and innovation in organizations.

THE DIGITAL TRANSFORMATION OF SOCIETY

The terms work 4.0 and industry 4.0 refer to a connection between digitalization and the previous waves of industrialization. After mechanization, electrification and automation, the algorithm-based interlinking of control units and the internet of things are also claiming their own index number. As the latest variant of industrial upheaval, the digital revolution is seen as fundamentally reordering societal relationships, value creation processes and the character of workplaces (Tapscott 1996). A steadily increasing data throughput shortens innovation cycles, while at the same time accelerating the speed at which ideas, products and services are disseminated (Lupton 2015). The transformation of modern conditions is accelerated in a computational way and the more and more digitized modernity reveals features of the next society (Baecker 2007). This is also represented by the acronym VUCA, which corresponds to the common scheme of modernization theories (Reckwitz 2016) in that it serves the idea of a function of increase.

In contrast to previous technology-driven industrial revolutionary upheavals, however, the digital transformation is not only fostering the emergence of new markets. Classically location-based organizations are being pressured into action. Digitalization relativizes the principle of being bound to one location (Manhart and Wendt 2019). Data streams that do not stop at territorial borders or the boundaries of organizations are increasingly relevant to growth and existence (Turco 2016). This also means, however, that questions of social and economic development increasingly come into view organizationally via processes of technical information processing (Zuboff 2018). For this reason, organizations are making increasing use of software solutions as part of their structure-building processes. As a result of increased environmental dynamics, digital-based applications should enable monitoring, control and thus also planning reliability. Digitalization in organizations follows the aspiration to avoid the well-known rationality pathologies of the organization (Brunsson 2006) - the idling of planning and its unintended effects. Digital transformation regularly means reorganization. Accordingly, the organizational worlds are changing in shape and, as a result, the relationship between organizational structures and the individuals involved is changing as well. It is remarkable, however, that the digital project is part of a long-term process in terms of how organizations deal with external and internal intransparency and the associated uncertainty. Societal complexity is inextricably linked to the principle of organization (Manhart and Wendt 2020), although organizations are internally based on the principles of regularity and procedurality (Luhmann 1976). However, the regularity and the organizational affinity for order are rarely addressed in view of the progressing digitalization. This is because supposedly more significant issues are regularly in the spotlight. The Future of Work (Herzog 2019), issues in the context of Big Data (Mayer-Schönberger and Cukier 2013), and thus also the question of what constitutes sociality in the digital age (Muhle 2018). But the principle of organization actually relates more to the present and future of societal conditions than supposedly overshadowed routines and processes would suggest (Wendt 2020a). The digital project is closely linked to the functional logic of organizations.

ORGANIZATION AND THE FORGETFULNESS OF THE FUTURE

The principle of organization serves to ensure orderly processes and regulated procedures. For this reason, organizations rely on the mechanism of structure formation (Luhmann 2006). Chaos, irregularity and randomness are not structural principles of organizations. Workplace descriptions, responsibilities and hierarchical constellations function as order-giving factors by systematically limiting the possibilities of action of the individuals involved (Whyte 1956). In organizations, only certain things are possible. Securing organizational expectations and guidelines for action therefore takes on a central role. Organizations, after all, realize their operations as a dual of structure and individual (Wendt 2019; Wendt 2020b; Wendt 2021). Organizational expectations and associated behavioral requirements meet individual demands, interests and abilities. However, the idiosyncrasies and opaqueness of the individuals involved mean that organizations always face uncertainty, which must be contained. The opacity of organizational members, the fact

that their inner lives remain unpredictable, is precisely the problem that forces the differentiation of structures in order to create predictability.

The decision-making processes of organizations are always limited by structure-building processes. But that also means that organizations often focus more on the past than the future. In fact, the principle of organization stands for a specific form of time binding. Organizations aim to anticipate their own future through processes of structure formation, because structural specifications are simultaneously a prediction of needed behavior (March and Simon, 1958). Who has which task? When, where and how is it processed? The principle of organized division of labor is based on a planned anticipation of the future (Wendt 2019). Organizational structures are mechanisms of limiting contingency, and the answer to understanding the future is found in the structure-building processes of the past. Organizational routine, which is procedural and regulated, has the function of avoiding randomness and of making the organization not dependent on the individuals involved, in order to avoid putting its own time stability at risk (Coleman 1979). Organization means anticipating through structure formation what will happen and in this respect is a special mode of preoccupation of the future (Wendt 2019, Wendt 2020b). Structures determine options for action and, by structurally shaping them, determine the future of the organization (Chandler 1962). The order of the organization is therefore also the price for opportunities remaining unused. Determining options for action has a negative impact on the potential for flexibility. Routine and change are conflicting. Routine generates the need for change, while change depends on certain procedures, which in turn leads to the routinization of action executions (Brunsson and Olsen 1993). As a result, the challenges of the future are regularly pushed aside in the organizations' day-to-day routines.

Organizations fundamentally depend on the reciprocity of structure and individual (Barnard 1970). Reflecting on organization requires the assumption that individuals act in a structurally preformed setting and thus in a self-determined manner in externally determined contexts. Structural guidelines and organizational expectations are general guidelines that need to be respecified in the organizational day-to-day operations. Unless one assumes a technical relation, there is a moment of uncertainty in the difference between specification and respecification (Wendt and Manhart 2020). The practice of the organization is constituted in the field of tension between person-independent processes of structure formation and person-bound characteristics and competencies that are inseparably linked to the individuals involved. Individuals have abilities, skills, and knowledge that are performatively proven; this does not apply to structural specifications. The fact that the mechanism of organization integrates motive generalization in addition to behavioral specification (Luhmann 1975, p. 13) implies that assumed individuality must be shaped in the process of planning (Lehmann 2011). This construction in particular shows the educational demand level of organizations, since the willingness to acknowledge artificial measures is based on reflexive distancing.

Working on the structure of the organization classically corresponds to the task of management (Wendt 2020a). Since the beginning of modern management theory, the goal of successful organization has been attempted to be realized through various forms of structure formation. These include, for example, methods of measuring work processes (Taylor 1919), the calculation of the organization (Gutenberg 1929) or the visualization of organizational action (Gilbreth 1921). The classic management aspiration is to contain the uncertainty of the moment with the help of structure-forming processes and thus to guide behavior in a goal-oriented manner in order to ensure that organizational processes are free of disruptions. Opening and closing organizational spaces of opportunity occurs through work on the structure of the organization. In constraining and generating opportunities at the same time, the management of organizations therefore realizes itself as a genuinely educational practice (Wendt 2020a; Manhart and Wendt 2020). The action-guiding efficacy of organizational structures disposes over opportunities and the extent to which person-bound potentials can be expressed.

In order to ensure its routine functioning and to establish reliable procedures, the organization uses a series of practices of blocking spontaneous and arbitrary actions. Forms, files and lists define what is possible within the organization. As a result, the use of regulatory notation systems leads to a data affinity of the organization. An available data base relativizes the fluidity of the moment and enables case-based processing across different responsibilities, departments and hierarchical levels, which is not dependent on single individuals. The logic of the organization suggests the use of digital structure-building tools and thus forms of data-based contingency management. The organization's affinity for data and the increasing effectiveness of algorithm-based structure formation mean that reorganization and digitalization are increasingly becoming synonymous. Progressive digitalization in particular can work into the hands of the organizational forgetfulness of the future.

DIGITALIZATION AS REORGANIZATION

Understanding the form of modern organization as a dual of structure and individual makes it possible to focus on the path of organizational theory and management theory into the digital age along a predefined line of continuity (Wendt 2020a). From this perspective, digital transformation is less a revolutionary event than a continuation of existing organizational options. With this in mind, the fact that software solutions are becoming increasingly influential in organizational structuring (Aneesh 2009) is not exclusively new and digitalization-related, but should also be understood as a further chapter in the history of how modern organizations are structured. Software solutions also determine what is possible within the organization. Novelty is a matter of perspective. The new is already contained in the old, just as the old can still be found in the new (Manhart 2014). This also applies to organizational structure formation. In the history

of organization and management, new chapters stand not only for the continuation of established conditions, but also for updating them.

The ongoing digitalization implies that the part of algorithm-based computing processes is increasing in organizations. Algorithm-based software solutions such as digital documentation applications, standard business software, or digital case management systems extend the course of form use, file regularity, and list formality, which have always been applied as forms of data-based control in organizations on the planning side (Wendt and Manhart 2020). While the use of files, lists and forms already preforms the available options for action, this also applies to software solutions that represent a new i.e., digital, form of structuring processes (Kelkar 2018). Organizational options, however, are now increasingly found visualized on screens in the form of tabs and buttons, or are depicted on displays as in app-based platform solutions. What is possible in organizations now results from input possibilities and is shifted towards dynamic interfaces. Thus, shaping organizational opportunities shifts toward the side of organizational structure formation.

In the course of digitalization-induced reorganization, the relationship between structure and the individual is changing in that individual scope for action is being rearranged (Pors 2015). Human consciousnesses cannot be involved in the computational operations because of their speed. During application, the mathematical routine behind it remains hidden (Pasquale 2015). Due to the fact that the participation of individuals remains limited to the observation of structural specifications mapped onto displays (Pariser 2011), individual scope for action dwindles in organizations. Despite the supposed analogy of "analog" and "digital" structure formation (Büchner 2018), a readjustment of the initial constellation is the consequence. The computational routine of the software creates a substitutability of the user (Acemoglu and Restrepo 2019). Based on computation, the principle of independence of persons reaches a new high (Reichmann 2019). On the operational level, calculation-based connectivity makes person-bound potentials such as experience-based intuition, moment-dependent perceptual ability, or case-based application knowledge superfluous (Beer 2017). Processing algorithms are not contingent, so alternatives are computationally excluded (Bartlett 2018). Structural elements of organizations become fixed coupled (Heiland 2018). The linkages of numbers are mathematically regulated and so the claim to conceptualize the organization as an interconnection of technical relations (Ezzamel et al., 1990) in planning terms can be realized in the form of a calculating machine. The classic data affinity of the organization is thus supported by new tools (Wendt and Manhart 2020). This is extremely functional for ensuring organizational processes.

Software solutions shift the organizational dual of structure and individual toward the side of structure. From this perspective, digitalization is a mode of dealing with uncertainty resulting from the participation of individuals. The undermining of organizational expectations in organizations is always a consequence of the peculiarity of the individuals involved and, at the same time, of practices that are not calculable. Classically, this is illustrated by the distinction between formality and informality (Tacke et al., 2015). For forms of oral tradition and related forms of collegiality it must be assumed that, first, they depend on the individuals involved and, second, as language-based communication, they always provide opportunities for misunderstanding. Because empirically, consensus is pure chance. This uncertainty, typical of communication, is erased by computational connectivity (Manhart 2018). Thus, the relevance of communicative practices (Fahrenwald 2011) is coming under pressure, because the outsourcing of structure-guided work processes into datafied orders (Duttweiler 2018) reduces individual scope for influence and possibilities for communicative negotiation. There is no need to think about how something is possibly meant. No content is to be deciphered and thus the necessity of negotiation, of person-dependent interpretation and therefore also the meaning of individuality recedes to the background. Number links and arithmetic operations are not contingent, so that the yes-no form (Luhmann 2005), which constitutes language use, does not apply.

Understanding digitalization as reorganization implies understanding the work on the organizational structure as the increasing establishment of a computation-based auto-logic. Progressive digitalization therefore points to the basic problem of every organization and refers to the question of the topicality of the organizational structure-individual duality. The classical principle of organization, after all, is based on the complementarity of structural formality and unpredictable informality (Roethlisberger and Dickson 2017). Predictability and unpredictability mutually increase each other.

ORGANIZATIONAL SPACES OF OPPORTUNITY AS A COUNTERBALANCE TO ADVANCING DIGITALIZATION

At first glance, when structural performance increases, the organizational relevance of the individuals involved decreases through forms of digital structuring (Danaher 2016). However, if the scope for action is reconfigured in this way, in a contrary momentum, increasing relevance is attributed to spaces of opportunity in organizations, in order to maintain the complementarity of structure and individual (Wendt 2020a). Understanding digitalization only as a decline in the relevance of individuals therefore falls short. Organizations need alternatives for decision-making in daily business (March and Simon 1958). Organizations need uncertainty, which is not absorbed computationally and thereby inhibited. This also applies to innovation that does not result from the logic of computational routine, but rather stands for leaving the path of routine (Besio 2018). This cannot be achieved by a computational continuation of the past.

The recalibration of the structure-individual duality of the organization is a central challenge of management and leadership in the digital age (Wendt 2020b). Instead of the structure-guided excommunication of chance, it is about the reintegration of the unpredictable. Organizations therefore

face the task of structurally enabling opportunities for forms of reciprocal attention and reference. Spaces of opportunity in organizations must therefore be conceptually thought out to get members out of their offices, dissolve the anonymity of the cubicle, and productively turn the structure-led juxtaposition around (Chesbrough and Bogers 2014). Encounter, conversation, and thus controversy become organizational resources (Page 2007). Being communicative practices, they are an attempt to conceptualize the openness and contingency of the future not as an unpredictable risk, but as a reservoir of organizational opportunities. The starting point of management theory as a practice of arranging behavioral specifications with an affinity for order is therefore transformed in current concepts into the antidote of contingency-free computational operations (Wendt 2020a). Systematically excluding future openness through the mechanism of structure formation is recognized as a problem that leads to path dependencies, inflexibility, and the risk of lack of alternatives. Future openness and associated hopes take the place of future forgetfulness in contemporary management. Variation and innovation are the result of a practice that understands contingency as a productive force.

In order to sufficiently irritate themselves and not close the sources of unpredictability, organizations therefore resort to certain participatory methods and practices of fostering innovation (Schröer and Wendt 2018). Interaction-based and methodologically structured processes (Brown 2009) thus become the complement of increasingly efficient forms of computational structure formation. At the level of connectivity, the organizational complementarity of structure and individual, or calculable formality and incalculable informality, is equivalent to the difference between computation and communication. Methodological approaches and participatory methods such as simulations, gamification or scenario development, large group methods or innovation labs are examples of this. They aim to productively turn the disordered and controllably unavailable dynamics of social interaction within the organization's orderly context (Manhart et al., 2020). Instead of relying on organized computing and interference-free processes of digitalization, the focus is on communication and the uncertainty that is always associated with it as a consequence of the mutual lack of transparency of the individuals involved (Manhart and Wendt 2019). This means that the unpredictability of social interaction is systematically exploited. The organizational tension between closedness and openness is thus intended to be effective less as a restriction of opportunities and more as a catalyst for alternatives. However, the openness resulting from the intransparent and unavailable mutual references in social interaction is always unpredictable (Wendt 2019). Communication logic, after all, does not follow the logic of regulated and orderly procedures. The potential of communication is based significantly on productive coincidences, which are enabled by the simultaneous presence of the individuals involved. Methodically, the focus is primarily on the potential of the individual and the communicative generation of contingency, not on a computational negation of contingency. Computational processes recombine and analyze what is already available and are thus always oriented to the past. The future, however, requires alternatives, and that means unused opportunities.

Dealing methodically and productively with future openness is a traditional educational challenge. The paradox of structural structurelessness that marks the organization's production of contingency in order to provide the necessary openness for participation opportunities therefore follows a corresponding line of discourse. Since the question of how freedom can be cultivated through coercion (Kant 1964, p. 711) at the latest, organized education has been familiar with its role as paradox management (Handy 1994). The reciprocal limitation and production of opportunities is constitutive for the principle of organization. Organizational opportunities are always a consequence of structure-guided constraints. In organizations, negation and production of contingency relate to each other in a reciprocal way. Conceptualizing organizational spaces of opportunity therefore presupposes the reflexive handling of contingency.

Participatory methods and approaches to fostering innovation represent the renaissance of chance in the digital age. As a result, ironically, the hope of the organization becomes what was identified in the rise of management theory as the cause of the organization's failure to achieve its targeted daily routine of frictionless operation: the intransparency of the individual. Now, however, the singularity of the individual becomes relevant in the context of social dynamics, as is also practiced in the context of non-directive approaches to counseling (Wendt 2016; Wendt 2019). Variation and innovation are always results of social processes. Organizational educational interventions cultivate chance and with it the hope for irritation and variation, for novelty and innovation (Wendt 2021). They exploit the nonlinear dynamics of interactionist immediacy through a methodical support. Only the potential of chance offers the opportunity to leave the well-trodden path of routine. But in doing so, they also cultivate opportunities for individual participation. Simulations, gamifications or scenario development, the use of large group methods or innovation labs are therefore also about the democratization of the production of chance.

Relying on the systematic production of contingency and thus on the methodsupported production of alternatives in organizations is an approach that can be justified from three different perspectives. A normative perspective of claiming participation and spaces of opportunity for their own sake is only one possibility. But a normative critique, like a critique of the instrumentalization of the individuals involved, sometimes falls a bit short. The ability to develop ideas, to judge in a balanced way, the courage to make decisions and to take responsibility for them are not limited in their relevance to organizations. Despite all the justified criticism of the increasing responsibility of organizational members (Hartz 2011) due to participatory practices, the skills and abilities required to deal with contingency and complexity do point beyond the boundaries of the organization. Especially in light of the current conjuncture of complexity-reducing descriptions (Nassehi 2017), the required

practice in dealing with uncertainty marks a central relevance for modern democracies (Manhart and Wendt 2020). Societal participation always means participation in organizations.

But for the organization, two other distinct reasons are equally important. The different modes of numerical and communicative connectivity, first, offer an approach for a semiotic argument. The mutual stabilization and enhancement of both modes on each other is constitutive for the principle of organization. Organizations cannot be reduced to an exclusive form of connectivity. This is because while linkages of numbers are not contingent, this is precisely not the case for communication and decision making (Wendt and Manhart 2020). When computing is done, no decision is made (Provost and Fawcett 2013). This leads to the third, an organizational or decision-theoretical argument. The fundamental necessity of alternatives for organizational decision-making processes and the associated contingency are at stake here. Without alternatives, there is nothing to decide. Niklas Luhmann made the corresponding statement that the organization would cease to exist in a state of complete self-determination (Luhmann 2006, p. 186). The organizational structure has the function of making decisions superfluous through the ordering of processes, whereas variation and innovation presuppose the social production of alternatives. Understanding organizational spaces of opportunity as forms of methodically generated complexity therefore also implies that variation and innovation in organizations is the result of a social process. Innovation is always social.

Contingency, complexity and future openness appear less as a risk for organizations in this context, and more as a potential to be exploited. Using and productively turning the complexity of social-dynamic interaction, as context management, however, comes down to paradoxical models of intervention. In this way, not only has the path to the age of digital organization already begun in the past. There is also a corresponding course line for the productive handling of contingency. The proximity to classical figures of educational reflection is evident, because already theories such as von Humboldt, 1960, Schleiermacher (2000) or Rousseau (1971) focus on contingencies that the world as a space of experience holds in store. Complexity generated by educational practices of context management therefore points to the topicality of classical educational theory, which early on addressed the issue of dealing with unpredictability. Not acknowledging the unpredictability of individuals and the dynamics of social interaction, educational problems would be part of machine theory, which addresses the frictionless and person-independent processing of information (Wendt and Manhart 2020). The classical concept of Bildung in particular is based on productive confrontation with the unintentional contingencies of the environment and addresses a reflexive form of self-organization (Manhart 2003; Manhart 2018). Contemporary approaches and methods are therefore not without presuppositions, but stand in a direct line of educational reflection.

UNPREDICTABILITY AS THE KEY TO THE FUTURE OF THE ORGANIZATION

The assumption that time will not forgive those who try to resist change in circumstances is part of the semantics of disruption. But at the latest when narratives of disruption become routine, it is important to reflect on the complex reciprocity of old and new. At the moment, the world of digital modernity is still the world of organization, in which structure and individual meet and therefore more than can be modeled via computational calculations and structure-forming processes.

The focus on technical links is contrasted with a spectrum of genuinely educational methods that are the result of reflection on the educational technology deficit (Luhmann and Schorr 1982). The reflexive handling of contingency therefore also functions as a complement and regulator of the ongoing digitalization. Organizational structures are compatible with democratic principles, but they regularly do not coincide with them. So the decisive question of digital transformation is the question of the individuals involved and the cultivation of their scope for action. Methodologically, this requires organizational spaces of opportunity as forms of structural structurelessness (Wendt 2020a). Taking advantage of the openness of the future is not a matter of course, considering the need for structure-building processes for organizations and their affinity for data. Variation and innovation, however, require openness to results. Participatory methods and approaches of fostering innovation are realized in dealing with contingency and are based on the reflexive handling of unpredictability. In order to be able to function as a counterbalance to the increasingly computational organizational structures resulting from digitalization, the dynamics of social interaction is seen as a source of opportunities. Solution finding and decision making in organizations do not follow a computational logic (March 1988). They are and remain unpredictable and are based on a practice that cannot be controlled in a linear-causal way due to its intransparency. The logic of organizations and their structure are therefore not the only educational issues. The same applies to methodical support for variation and innovation. In organizations, they emerge on the basis of dynamic social processes.

The reciprocity of structure and individual were constitutive for organizations until the digital age. In the digital transformation, the intra-organizational distinction of the different connectivity of numerical and communicative logic is updated. Focusing on the algorithm-based recombination of existing elements and the growing efficiency of structure formation processes, the thesis of the inferiority of the individual is obvious (Grunwald 2018). This raises the (not least socio-political) question of the non-organizable remnant that cannot be systematized in terms of computation (Nassehi 2014). In contrast, focusing on the indispensability of individuality and social dynamics for the functioning of the classical form of modern organization (Burns and Stalker, 1961), it becomes clear that the reflexive handling of contingency cannot be substituted computationally. The challenge of recalibrating the duality of structure and individual therefore frames an organizational education research program. The changing relationship between formality and informality, numerical and

communicative self-logic, and the updated decision making allow a variety of necessary empirical questions.

One question that is currently not yet answered is: What comes after digitalization? To avoid anticipating the answer in the direction of computational self-logic, an understanding is required that organizations cannot be reduced to the execution of routines. Formalization gaps (Simon et al., 2008) present opportunities that are a prerequisite for variation and innovation. To achieve this, it is necessary to reflect on the organizational tension between restriction and enabling. History of organizational theory as a history of de- and reconstruction of classical assumptions of rationality (Becker et al., 1992) illustrates that the end of former certainties and the recognition of limits of planning and control enables hope for a future that is not yet fixed. The future holds various alternatives only because of its openness. The dialectic of organization runs counter to the dialectic of digital progress in this respect: Unpredictability offers the key to the future of organization.

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Social Innovation in Education and Social Service Organizations. Challenges, Actors, and Approaches to Foster Social Innovation

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Social innovation became a widely discussed topic in politics, research funding programs, and business development. Recent European and US economic and science policies have set aside significant funds to generate and foster social innovation. In view of current challenges such as digitization, Work 4.0, inclusion or migrant integration, the question of how organizations can be empowered to develop new and innovative approaches and service models to social challenges is becoming increasingly urgent. This especially applies to organizations in the fields of education and social services. In education, implementing new ideas and concepts is usually discussed as educational reform, which mostly addresses changes in policy agendas with consequences for national and international education systems. The concept of social innovation however has a different starting point: the source of new ideas and services are identified new, emergent needs in society or re-conceptualized. Such need-based perspectives might bring new impulses to the field of education. Therefore, this paper identifies important existing strands of social innovation research, which need to be considered in the emerging academic discourse on social innovation in education. Looking at social innovation through an education research lens reveals the close relation between learning, creativity, and innovation. Individuals, teams, and even organizations learn, engage in creative problem solving to create new and innovative products and services. From an organizational education perspective, the questions arise, how social innovation emerges and even more important, how the process of developing social innovation can be supported. After a brief introduction in the concept of social innovation, the paper discusses therefore the sites, where social innovation emerges, social innovators, approaches to foster social innovation as well as promoting and hindering factors for social innovation.

Keywords: hybrid organizations, social service organizations, social innovation networks, social innovation (SI), social entrepreneurs, organizational education

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SOCIAL INNOVATION

Social innovation is the term used to describe new products, services, or new combinations of social practices aimed at meeting emerging or previously neglected societal needs (Caulier-Grice et al., 2012). Examples range from the spread of car sharing to the development of social housing. In contrast to an invention, such as a new technology, innovation is only mentioned when the created

solution is also disseminated to society. However, the concept of innovation describes not only absolutely new, but also relatively new patterns of action.

A business model, a product, a service, or a production method can be innovative. There are no strict criteria to categorize something as new or innovative if it is developed and disseminated. The classical moment of creative destruction is rather pushed into terms like disruption or revolution. Therefore, a distinction is made between disruptive (fast, radical, market-changing) and incremental (evolutionary) innovation (Christensen, 1997).

There are also more normative positions that understand social innovation as aimed to change the social structure to empower the disadvantaged, which are thus strongly oriented toward the idea of a more just society (Moulaert et al., 2010). More widespread, however, is an understanding of social innovation that is primarily concerned with the description of new solutions to social problems in order to improve the social situation in general (Phills et al., 2008) or even more pragmatically as "intentional, targeted recombination, or reconfiguration of social practices" (Howaldt and Schwartz, 2010).

On the one hand, innovations are described as social due to their reference to a social area. They are oriented either to the internal affairs of those involved or to external stakeholders and exhibit organizational, institutional, or procedural patterns of order (Gillwald, 2000). In a narrower understanding, "social" is qualified by the reference of the innovation to a socially accepted but unmet need. This implies the legitimacy of the innovation, which can be established in public discourse. Through the dissemination of newly discovered solutions, social innovations become the basis for social change (Ogburn, 1957) and are thus the subject of modernization theories. Another way to conceptualize "social" is that the diffusion of certain innovations happens mostly though organizations with primarily social purposes (Mulgan, 2006).

Social innovations can work at the macro level as socio-political reform, changes in regulatory frameworks and institutional norms, at the meso level as new business models, new services, new management practices, and at the micro level as the strengthening of user participation and new professional practices that generate added value for the addressees. Social innovation in social service organizations can be, for example, the development of new or improved demand-oriented social services, improved forms of advocacy or models for the new or more effective use of existing resources.

In the field of education, innovation has been a topic since decades, however often linked to the notion of government driven education reform programs (Biesta, 2010). Despite the wide range of social innovation initiatives in an education ecosystem, like social entrepreneurial activities in school development, school reform, social work in schools, and more, there are still few conceptual and theoretical papers that frame the distinctiveness of social innovation in education. Whereas, government driven education reform programs often choose a top-down approach, social innovation processes usually start from an analysis of human needs (of a specific social group or user group) and cater creative solutions to those needs, which could rather be characterized as a bottom-up approach. However, successful and sustainable socially innovative solutions are not isolated events but usually depend upon favorable environmental conditions. Part of such an environment are regional social innovation networks (including supporters, promoters, investors, knowledge providers, intermediaries, and entrepreneurial actors) (Terstriep, 2016) as well as the domain specific environment, i.e., the national, regional and local education system. As research on education reform in different countries suggest, most education systems are not perceptive or supportive to bottom-up reform initiatives and innovation, due to their bureaucratic governance system and accountability regimes (Biesta, 2015). Therefore, I suggest to look at initiatives in the related and intertwined field of social service provides, which is in most European countries highly regulated and dependent on public funding, to analyze the occurrence, emergence and early success stories, and identify learning for the field of education.

EMERGENCE OF SOCIAL INNOVATION AND THE ROLE OF HYBRIDITY

Social innovation often emerges at or across the boundaries of two or more social sectors, i.e., between market, state, and civil society. Organizations located at these intersections are described as hybrid organizations. Hybrid organizations are characterized by several action-guiding logics or theories of action, such as a market logic and a logic of solidarity. Such diversity is seen as a source of creativity and innovation. Therefore, hybrid organizations are often attributed special innovation potential in the discourse on social innovation (Molina, 2010).

Hybrid organizations are organizations that move between social sectors, such as between the state and civil society, state, and private sector (public-private partnerships) or civil society and private sector (social enterprise) (Billis, 2010; Jäger and Schröer, 2014). Different criteria can be used to determine the hybridity of organizations, such as ownership, governance, operational priorities, personnel, and other resources (Billis, 2010). Hybrid organizations can either be explained as being located on a continuum between non-profit and forprofit or forprofit and public sector (Billis, 2010), or hybridity can be interpreted as a self-evident characteristic of third sector organizations (Evers and Ewert, 2010). A third option would be to regard hybrids as cases of deviation from the organizational norm of one sector. Billis so-called prime sector approach is based on the assumption that every hybrid organization has something like a primary sector in which it has its source and roots and which usually determines its governance principles: "My working hypothesis is that organizations will have "roots" and have primary adherence to the principles of one sector. This is based on the inherent contradictory distinctive and conflicting principles (rules of the game) for each sector" (Billis, 2010, p. 56). The primary adherence to the principles of one sector is justified by institutionalized principles of the respective sectors ("robust set of core distinctive principles" (Billis, 2010, p. 66), e.g., profit maximization vs. distribution of profits) and

by reference to the ownership issue. One of the governance requirements of an organization is that the accounting, tax, and legal supervision departments must know which legal, tax, and accounting principles an organization operates and should be treated according to. It is precisely the necessary compliance, for example with tax regulations, that limits the supposed equivalence of organizational rationalities at the end of the day. The institutional anchoring of the organization thus requires clear governance rules and structures, which must also be defended and enforced against other logics of action. For example, a social enterprise recognized as a non-profit organization must not expand its market-based activities to the extent that a non-profit status is legally or fiscally questioned. This is an argument worth considering against the description of organizational hybridity as a continuum between private and non-profit or public and non-profit: "Thus, hybrids are not on a continuum but have a clear cut off point evident when principal owners take the boundary-shaping decisions (closures, conversions mergers etc.) according to the principles of the different sectors" (Billis, 2010, p. 57).

Hybridity is not static, rather is it possible to distinguish between different *degrees of hybridity* of an organization. For example, there are non-profit organizations in which hybridity has already sunk deeper on the supervisory level (board members from the local authority or private sector) as well as at the operational level (volunteer organization starting to hire permanent staff members). Such changes affect organizational processes and accountability and steering mechanisms, because a completely different level of reliability of the organization is required. Similarly, a distinction can be made between established and grown hybridity: Some hybrids are founded as such, e.g., as a social entrepreneurial spin-off of a traditional non-profit organization, whereas others have evolved toward hybridity over time (Billis, 2010)[1].

In conclusion hybrid organizations are characterized by different blends of social and profit-driven purposes and activities, the co-presence of different sector-specific logics of action and control, which cause organizational fields of tension and in some cases to massive ambiguities in organizations: for example, which governance rules should be followed, which logics of action should guide managers in a situation or which organizational identity should be expressed. The *identity* of hybrid organizations can be explained from an individual focused perspective as identification of organization members with certain organizational subcultures or managers exerting direct or indirect influence. From a structuralist perspective, identity appears as a purposeful stable structure that influences organizational events and management practice. Studies examine, for example, cultural values, organizational histories, or the organizational use of language. Practical-theoretical approaches consider identity as a discursive practice for, among other things, "making the world," which reproduces the structure again through action and thus solidifies it. Such multiple identities can remain unconnected, coexist, or be integrated (Jäger and Schröer, 2014). In most cases multiple identities create a field of tension or ambiguities can be examined as dilemma or opportunity. Hybridity often occurs as a dilemma in relevant management and or governance decisions, as explained earlier. It also offers opportunities, as organizational hybridity allows for the development of value creation that draws from the advantages and resources of different sectors. Many value propositions and business models of social entrepreneurs and social enterprises demonstrate such opportunities (Schröer, 2015).

A similar argument about the opportunity of ambiguity and being exposed to more than one logic of action can be found in Meyerson and Tompkins (2007) analysis of change agents. The effectiveness of change agents is attributed to their embedding in multiple institutional environments. While a stable, highly institutionalized context tends to prevent change, constant exposure to different, perhaps even contradictory institutional contexts triggers change (Meyerson and Tompkins, 2007, p. 309). Reasons are seen in the loosening of cognitive anchoring in a context, but above all in the willingness and ability of the actors to become aware of consistency gaps by comparing institutional contexts and to question them. As a result, it is precisely these actors or groups who are particularly likely to become actors of change, who are particularly acutely exposed to multiple institutional contexts and who often perceive conflicts between guiding values and ideas in these contexts. However, such actors often occupy a marginalized position in organizations, which is why their change strategies are often under-equipped in terms of implementation power and resources. Against this background, the secondary analysis of Meyerson and Tompkins case appears particularly interesting, as it shows how embedding in different institutional contexts can be combined with the legitimacy of positions and the legitimacy of actors in different change-relevant communities in order to overcome precisely such obstacles of marginality and under-resourcing.

While the argumentation takes its starting point in the institutional embedding of organizations and actors in various social sectors, the arguments for resulting effects take up actor, cognitive, and cultural aspects. Although the dynamics between public sector, private sector, non-profit sector, and when it comes to innovation academia can be highly conflictual and challenging to actors who operate in an environment located at the borders of these sectors, the previous chapters also demonstrate its productive and creative potential. It becomes clear that ambiguous or hybrid identity can be functionally useful (Jäger and Schröer, 2014); the loosening of cognitive anchors and distance serve as prerequisites for the ability to critique (Meyerson and Tompkins, 2007), the raising of creative potentials through the recognition of diversity and targeted learning and decision training opportunities, or the necessity of a translation function between different rationalities (Schedler and Rüegg-Stürm, 2013).

[1]This line of argumentation emphasizes that in hybrid organizations, which operate in several institutional contexts, it is quite necessary and useful to differentiate how strong which institutional influence is in relation to certain decisions. This argument is particularly plausible against the background of the discussion about non-profit organizations and social enterprises, in which, at least since the late 1970s, the work of Edward Skloot and Dennis Young has pointed to the growing tensions between economic goals and goals of public welfare. Since then, the literature on nonprofit management has contained many suggestions on how to maintain a balance between the various goals, demands, and stakeholders.

SOCIAL INNOVATORS

Social innovation does not only emerge in existing organizations, its emergence is often attributed to individual actors, i.e., innovators or entrepreneurs. The most established strand of research therefore focusses on the individual level of (social) entrepreneurs as innovators. Just as Schumpeter (1912) in early innovation research identified the actor type of the entrepreneur as crucial, for some years attention in social innovation research was focused on the so-called social entrepreneurs, in recent years the research also includes social "intrapreneurs" who implement social entrepreneurial actions and social start-up practices in existing organizations (Schröer and Schmitz, 2016).

Social Entrepreneurs develop and implement solutions for social problems by entrepreneurial means (Dees, 2001; Drayton, 2006). Schumpeter's creative and destructive entrepreneur became a programmatic figure of social entrepreneurship and thus a bearer of hope for social change. Schumpeter understood innovation as a complex design situation in which social conditions are as relevant as the characteristics of the invention itself. According to him, a new idea must always prevail against the familiar and against resistance. In current approaches, this demanding process is broken down into the innovation functions of developing, testing, and disseminating social services, which make the concept of the feasibility of social change through entrepreneurial initiative attractive for current socio-political discourses. Although the term social entrepreneur encompasses various social phenomena (Mair and Marti, 2006), two dominant strands can be identified. On the one hand, since the 1980s at the latest, the Anglo-Saxon debate on non-profit organizations has pointed out that, in view of increasingly unreliable state funding of social services and strong fluctuations in the volume of donations, other sources of income need to be increasingly developed (Skloot, 1983; Young, 2008). The term social entrepreneurship was introduced for non-profit organizations that generate income on (quasi) markets. On the other hand, the term is used in the Schumpeterian tradition. In the relevant literature on social entrepreneurs (Mort et al., 2003; Mair and Marti, 2006; Martin and Osberg, 2007; Defourny and Nyssens, 2010; Andersson, 2011) their central competences and orientations are mentioned, which can be summarized in four dimensions:

- Implementation orientation: innovator, proactivity, reflection, simplicity, focus, pragmatism
- Self-reference: Competence awareness, competence reflection, persuasiveness, strong value base
- Relationship to others: empathy, mindfulness, ability to work in a team, motivator, idea sharing
- Networked thinking: translation, sustainability, overview, commitment, economic sensitivity (Schröer, 2017).

Social Intrapreneurs on the other hand operate as entrepreneurs in existing organizations. Their entrepreneurial activity is reflected in the development and implementation of new products, services, or processes in the organization of origin. Intrapreneurship can mean the development of new business areas within the existing company, or the founding of subsidiaries, as well as the development of new organizational routines and procedures, which can also take place without the knowledge or explicit mandate of management (Stopford and Baden-Fuller, 1994). Within the "Social Intrapreneur Framework", Schmitz and Schröer (2016) have pointed out that intrapreneurs are characterized in particular by the following criteria "Social Mission Orientation, Business Acumen, Striving for the New, Vibrant Character, People Relations, Knowledge Relations, Organizational Commitment, Outsider-insider Perspective" (Schmitz and Schröer, 2016, p. 14). The framework suggests that personality traits support intrapreneurship even if there is resistance in the organization.

Not only individual actors become innovators, but also teams and networks of actors play an important role in processes of social innovation. These can either be networks of informal exchange or innovation teams deliberately set up to promote innovation. Then there are either departments of an organization, e.g., the research and development department, or a staff unit for innovation management, which can be regarded as innovation drivers. Finally, entire organizations or organizational networks can also be important innovation drivers, such as the cooperation between social start-ups and established institutions or even entire regional social innovation networks (Rehfeld and Terstriep, 2013). Civil society organizations and innovation networks with the participation of civil society actors and their embedding in the local context play a particularly important role in social innovation (Rey-García et al., 2016).

In describing and analyzing the role of innovators, such as entrepreneurs and intrapreneurs the research started focusing on certain competencies, which are seen as crucial for bringing about innovation. In the entrepreneurship literature we find analysis of entrepreneurial competencies, which led to the development of an entrepreneurship competence framework (EntreComp) as a common reference framework. In this framework, Bacigalupo et al. (2016) conceptualize entrepreneurship as a key competence, which is applicable to individuals and groups and is defined as follows: "Entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social" (Bacigalupo et al., 2016, p. 10). The key competence refers to the process of creating ideas and opportunities (creativity), mobilizing, and preserving resources as well as putting ideas into action (planning, cooperation, coping with risk, and ambiguity). The relatively young and interdisciplinary research field of entrepreneurial learning and entrepreneurship education addresses the question, how to best educate people with entrepreneurial competencies (Deakins and Freel, 1998; Politis, 2005; Hölzle et al., 2015). Research in education mostly focusses on *creativity* and creative problem solving, but rarely links this individual or team competency to the organizational capacity to innovate (Manhart et al., 2020).

Another link between innovation and educational research is the relation between learning and innovation. Innovation is mostly seen as the result of an (organizational) learning process. Learning, one could argue, leads to innovation. From an educational point of view however, learning is dealing with and creating something new. What one learns is always

new, otherwise one would not need to learn it. And learning processes are inherently open in their results. Their evaluation as creative or innovative is done in retrospect, for example by the leadership of the organization. In the learning process itself, the difference between old and new, creative, and innovative is not relevant. As educational research and learning psychology suggest, individual learning takes place based on complex self-organizing structures that are largely unavailable to consciousness (Manhart, 2016, 2018). Organizations do not have a conscious, which does not hinder them to learn. But organizations cope with inconsistencies, opacity and contingency and thereby learn. Therefore, we can argue that the concept of innovation is based on the results of internal learning processes (Manhart et al., 2020).

APPROACHES TO FOSTER SOCIAL INNOVATION

In the current debate, the possibilities of managed support of social innovations are assessed quite differently. There is an ongoing controversy between classical innovation management procedures, which provide for a planned, rational, methodical support of distinct phases of the innovation process and insights of complexity and practice theory emphasizing the complexity, uncertainty, emergence, and thus low predictability of innovation processes. While it would be plausible to conclude that the latter would lead to an overall skeptical attitude toward ideas of managerial support and would emphasize the necessary improvisation in everyday organizational life or the embedding of knowledge and new solutions in relational and collective practice instead. However, such emphasis on improvisation can be aligned with possibilities of creating informal spaces for innovation processes and in an open model of innovation processes.

In this current "open innovation" model (Chesbrough, 2006), innovation is understood as open process based on both external and internal knowledge. The approach is based on the recognition that not all the best employees work for just one company and that some ideas developed in one company can be much more valuable for another. Accordingly, information processing and product development take place in the interplay of internal and external actors. At the end of the process there are patterns of action, products and services that are not only disseminated in the core markets of the commissioning organization, but also in niche markets, new markets or even markets of development partners (Chesbrough, 2006). Chesbrough and Di Minin (2014) have also applied this approach to open social innovations.

In order to differentiate existing approaches to promote new or improved demand-oriented social services, a four-field matrix is proposed here (cf. **Table 1**). The focus of innovation promotion is on the one hand characterized by formal or informal structures and procedures. Formal structures and procedures follow the idea of managed support of innovation by establishing structures and procedures with clear goals, rules for decision making, and recognizable responsibilities for innovation within the organization. Whereas, an informal approach is based more on establishing informal communication channels, meetings, and networks, increasing flexibility in the mastery of tasks. The second category to organize innovation support approaches is the location of the support unit, i.e., where the innovation support staff is situated, within or across organizations.

TABLE 1 | Innovation support matrix.

		Location of innovation support	
		Internal	**in-between organizations**
Approach to support innovation	Formal structures and procedures	■ Innovation manager ■ Information management ■ Innovation center ■ R&D division	■ Innovation hubs ■ Incubators ■ Social innovation labs
	Informal structures and processes	■ Informal ■ Meetings ■ Innovation teams within organization	■ Innovation partnerships (co-creation) ■ Regional social innovations networks or clusters

The upper left quadrant shows approaches to support social innovation, which focus on the organization and follow a classical management idea, based on formal structures and procedures. Examples are supporting innovation by sharing and distributing information about newly found solutions and new technologies within the organization in a variety of ways; consistent personnel development to enable employees to acquire an entrepreneurial mindset and skillset; or the creation of an innovation management staff position. Another example are so-called innovation centers, which usually follow strategic goals of the organization to develop new impulses in certain business fields, which are then driven forward in the innovation center.

In addition, there are also internal informal approaches to promote innovation (bottom left): Nock et al. (2013) state that up to now, innovation promotion in the social economy has mostly been done in such informal ways, e.g., in committees with a meeting culture that invites to discuss innovative approaches. Other informal approaches aim to develop an innovative organizational culture that gives innovative employees freedom and ensures that they feel comfortable in the company. Cross-divisional cooperation in innovation teams is strongly networking-oriented. This involves setting up multidisciplinary, multi-professional teams across the line organization, which focus on developing innovation.

In the area of cross-organizational structures and processes, the upper right quadrant contains Innovation Learning Labs, in which companies seek to develop new products and services in cooperation with universities and based on research results. Well-known examples of this can be found in the field of dementia research (Catholic University of Leuven). Business models are also developed in incubators and innovation-hubs, which provide founders with shared office-, work- or meeting-rooms, are lower threshold.

Informal processes exist both in the organization and across organizations (right lower quadrant), such as partnerships between large, established, and young, small but dynamic social start-ups. The most challenging form are regional innovation clusters or regional social innovation networks.

PROMOTING AND INHIBITING FACTORS FOR INNOVATION IN SOCIAL SERVICE ORGANIZATIONS

Research on social innovation also deals with the framework conditions that promote and hinder innovation development. Such framework conditions can be identified at the macro level of politics and business (e.g., innovation regions), the meso level of the organization (innovation promotion, innovation management) and the micro level of individual actors (heterogeneous teams).

Social service organizations act in the area of conflict between operational stability and flexibility. An obstacle to innovation development is that innovation is often perceived as a deviation that threatens the reliable performance of the core business. However, a functioning core business is the financial prerequisite for being able to invest in innovation processes at all. This perception of deviance is often accompanied by concerns about the devaluation of organizational and individual knowledge, which is replaced by new knowledge, and the disruption of established routines. Added to this is the fundamental uncertainty of the success of new solutions. This results in resistance to innovation and innovators in many organizations. Other obstacles to innovation processes include lack of (development) time, space, and resources (e.g., venture capital) as well as insufficient communication about innovation approaches. Rigid hierarchies are also perceived as an obstacle to innovation processes because direct superiors may not recognize innovation potential (see Nock et al., 2013; Schröer and Händel, 2019).

By contrast, professional and managerial staff in social work name several conditions that promote innovation. At the macro level, these include, first, corresponding specialist discourses and an innovation-friendly political climate, ideally with government funding opportunities for the development of innovative solutions and a vibrant civil society. Welfare associations with their associational structures can also contribute to innovation-friendly framework conditions by stimulating networking and cooperation, initiating project incubators where appropriate (such as Diakonie Baden in its cooperation with Freiburg's Grünhof or the German Red Cross with its innovation laboratory) and providing information on solutions already developed and financial support opportunities for innovation processes. In the organizations of social work, the following conditions are regarded as particularly conducive conditions: staying power, i.e., not giving up too quickly, client (and thus demand) proximity of staff, the existence of an informal culture of discussion and debate on innovation needs, and a variety of disciplines and professions, as well as a mature innovation milieu and a high willingness to cooperate. For the dissemination of solutions already developed, the size of the organization, its impact in the regional environment, functioning internal communication within the association, interaction between association levels and established contacts to social policy and social administration are identified as conducive (Nock et al., 2013).

Social innovations can thus emerge in social work organizations if—despite sometimes contradictory demands and resistance—relevant actors are willing to take risks in creating conditions and applying methods such as design thinking (Brown and Wyatt, 2010) conducive to the development of new social solutions. This is all the more successful if this willingness to take risks is not only realized on the part of the voluntary welfare organizations, but also by the public providers of welfare state services, e.g., when exercising discretionary powers in connection with the financing of innovative ideas and solutions.

Recent empirical research has shown both conducive and obstructive conditions for the development of social innovations. Empirical research results on social entrepreneurship in Germany in particular provides evidence that larger organizations in the social economy, which are organized by welfare associations, have better founding conditions (access to capital, support from public authorities, established contacts in the social space), but above all, through the associations, also have established dissemination channels for new or improved solutions to social problems. This draws attention to intrapreneurs as opposed to entrepreneurs in the promotion of social innovation (Schröer and Schmitz, 2016; Händel and Schröer, 2017). One of the opportunities and challenges for social work organizations therefore seems to be to identify intrapreneurs and to support them in developing social innovations. Research in organizational education can help to clarify the framework conditions that are conducive to learning processes and the development work of intrapreneurs. Initial findings on this are available from social innovation laboratories (Schröer and Händel, 2019; Schröer and Rosenow-Gerhard, 2019). These results show, how to combine relevant innovation actors (intrapreneurs), the location (at the cross-roads between sectors) and a managed way to provide for informal settings in a third space. This combination seems promising for future efforts to support social innovation in the social and education sector.

CONCLUSION

This paper suggests results of social innovation research, as well as early experiences of social innovation in social service organizations to be considered in the emerging academic discourse on social innovation in education. Social Innovation initiatives mostly start from identifying and analyzing a particular need of a social group (user group), they use creativity and diversity as core competencies, collaboration, and co-creation as key practices and understand the location at sectoral borders and across the borders of public, private, and non-profit sectors not primarily as conflict, but as potential for diversity and therefore creativity in an innovation process. Experiences in fostering social innovation in the field of social services suggest

the importance of special locations (third spaces) that allow for productive usage of differences among actors and perspectives in open processes that have some autonomy from the daily routines of social service delivery. Examples of such locations are social innovations labs, hubs, and accelerators, embedded in regional social innovation networks. Such initiatives are likely to be more successful, if local, regional, or even national governments are part of these networks and help to develop more favorable environmental conditions for innovation processes. Social innovation labs and their respective regional networks help organizations to overcome the classic obstacles to innovation, such as the lack of resources, information, space, and time to develop innovative solutions. Therefore, it is not surprising to see national as well as European policy efforts to create better framework conditions for the social innovation ecosystems in the field of social services, such as paragraphs that allow funding of experimental solutions, public sector involvement in social innovation funds and an increasing amount of public tenders for social innovation projects.

These experiences, challenges, and opportunities provide insights for the conceptualization of social innovation in the field of education. A field that is currently mostly driven by top-down reform programs based on student and school performance measurement programs. Change that arises from such government-driven reform programs can and should not easily be called social innovation.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Mutual Learning in Innovation and Co-Creation Processes: Integrating Technological and Social Innovation

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New digital solutions are often lacking integration and acceptance by potential users. Therefore, only a small amount of innovative software solutions is really in use. The article describes a co-creation process by integrating end-users and relevant stakeholders right in the beginning in a social innovation process. Within this process, technology is seen as an enabler of innovation getting its relevance from new social practices of the people using it (e.g. working practices). Against the background of EU funded projects conducted by the authors (GT-VET, GREEN STAR, COCOP, and ROBOHARSH) the relevance of mutual learning processes of engineers / researchers / trainers on the one side and end-users / beneficiaries / learners on the other side will become evident. Moreover, new (digital and analogue) skills of employees have been identified as key for a successful digital transformation. Thereby, this article shows a twofold perspective on social innovation in education: new skills demands for employees and mutual learning processes of developers and users/stakeholders. To obtain needed skills, traditional innovation practices have to be changed by setting up a social innovation process. Such a process design has to include stakeholder and user involvement beyond pure feedback on a new technology. Co-creation means that experience, knowledge and ideas of users will be considered to ensure high usability and impact of the new technology framed by organisational and people related measures. In this respect, the innovation process and the innovation itself is much more than technological functionality–it is a contribution to new social practices and performances of the people that innovate and use the technology.

Keywords: Social innovation, Technological innovation, Innovation process, Socio-digital transformation, Co-creation, participation, mutual learning

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INTRODUCTION

A New Innovation Paradigm Combining Technological and Social Innovation

Innovation in technological contexts needs a social component, such as social innovation. Especially because digital transformation is leading to high demands on the provision of the right skills for future working practices. There is an increasing need to align the demand side (companies, individuals) and the supply side of skills (vocational education and training (VET), training providers) in shorter time. To solve this problem in a sustainable way a coherent approach is needed, engaging relevant actors and stakeholders from all societal sectors: companies, employers'

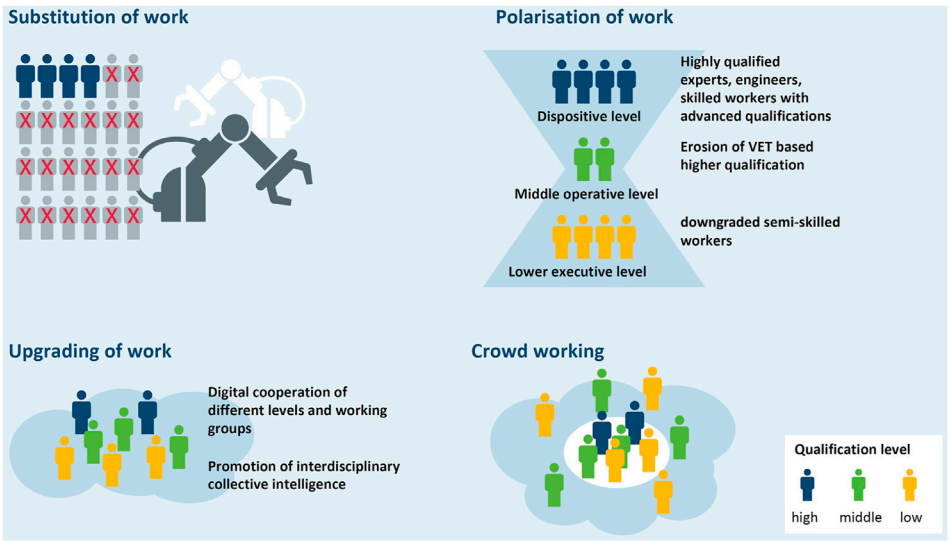

FIGURE 1 | Scenarios of the impact of industry 4.0 on work (Abel et al., 2019, own translation, permission obtained).

associations, trade unions, training providers, vocational education and training, and policy but also the employees and workers themselves. Co-creation and comprehensive processing have to put this challenge further on an overarching level integrating relevant actors from different societal sectors (quadruple helix or social innovation ecosystem of companies, education and training providers, policy, and research and innovation).

The Current Problem of Digital Transformation

The current hype about industry 4.0 is boosting the debate on future skills needed for the digital transformation. There is a consensus of scientists that digitalization will deeply affect the future of work and related skills (The Royal Society and the British Academy, 2018). In particular, Artificial Intelligence (AI) will have significant impact on skills demand: "The utilization of general-purpose technologies based on artificial intelligence in society will change the world of work and the skills needed in it extensively" (Koski and Husso, 2018). The demand of new skills is reflected by the report of the European High-Level Expert Group on the impact of the digital transformation on EU labour markets (European Commission, 2019): "The digital transformation is rapidly changing the demand for workers' skills and task competencies. This way, the digital transformation is contributing to skill mismatch and shortages that require investments in employee training."

Digital transformation requires faster adaptation of skills demands in supplying training to improve work practices. The skills mismatch of the current workforce and the lack of up-to-date digital skills remains a current problem in many economic sectors. Despite the ongoing debate on the need for new skills for digitization (Davies et al., 2011; acatech, 2016; Berger and Frey, 2016; CEEMET, 2016; Gambin et al., 2016; Hirsch-Kreinsen, 2016; World Economic Forum, 2016; Bakhshi et al., 2017; Chuh et al., 2017; Hoberg et al., 2017; Lamb et al., 2017; Cedefop, 2018; Grundke et al., 2018), no distinctive strategies amongst employees to achieve better and more appropriate skills are appearing.

From the labor market perspective, digitalisation today is not only a matter of substitution of work via robots. It could also lead to a polarization and change from the middle operative level to higher and lower qualifications and tasks, new cooperation between different levels and working areas as well as crowd working on virtual or digital connected platforms (see **Figure 1** below). For example, Abel et al. (2019) describe how the introduction of 4.0 technologies in the industry requires different strategies to promote understanding of the new technologies, but also to avoid barriers to acceptance. Some of these strategies are employee training and direct experience of employees with the new technology, so that they can perceive it as a positive experience.

One of the main results of the ongoing skills debate is while there are different estimations on polarization or upgrading of skills due to digitalization, high-skilled employees tend to be winners of the digital transformation. This is called the "skill-biased technology trends" (Berman and Machin, 2000; Green, 2016) and illustrates the demand for providing (more and higher) digital skills. While, due to digital transformation, on the one hand improved competitiveness and "greener" production are creating new jobs and a higher skilled workforce, on the other side disadvantages of digital transformation according to several studies are the impact of digitalization on job losses, job creation and skills demand (Frey and Osborne 2017; Arntz et al., 2016; Berger and Frey, 2016). As a substantial share of jobs seems to be susceptible to automation, related skills (esp. for routine tasks) might be less demanded in the future. At the same time, other jobs will change in terms of tasks and new jobs will be created (The Royal Society and the British Academy, 2018). Other skills will be needed to fulfill requirements of changing or new

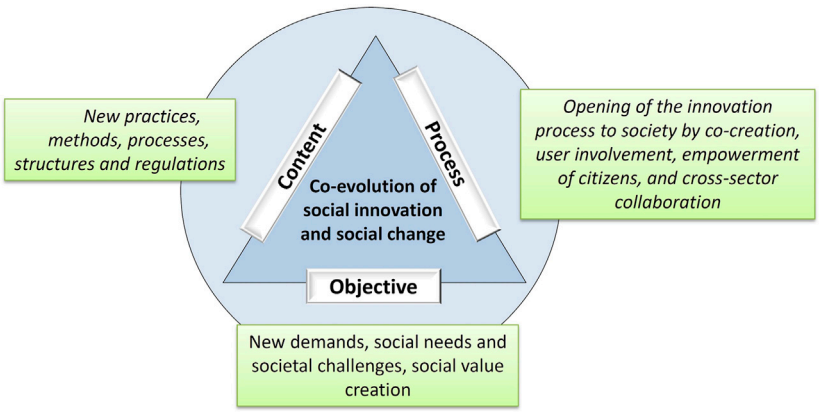

FIGURE 2 | A new innovation paradigm (modified version of Howaldt et al., 2016, p. 40, permission obtained).

jobs. Particularly, current development of artificial intelligence technologies leads to expect extensive changes of needed skills (Koski and Husso, 2018). "This change will reduce certain kinds of jobs and increase the number of others. At the same time, the demand will decrease for certain skills and grow for others. Without corrective actions, this will worsen the labour market mismatch and exacerbate structural unemployment" (Koski and Husso, 2018).

From a company perspective, rejection of digitalisation by the employees seems not to be the problem, but the increasing shortage of skilled labour. A survey in 2020 with about 600 companies in Germany shows that while 55% of users or planners of Industry 4.0 solutions see shortages of skilled labour as a barrier for digitalization, only 20% are facing a lack of acceptance among the staff (Nier, 2016). Another survey by the German Economic Institute showed that costs and shortages of skilled workers is the highest risk for 61% of the companies (Grömling and Matthes, 2019). Skills shortages are raising due to the increasing demand for digital skills in Europe (Berger and Frey, 2016). Particularly for the IT sector, substantial skills shortages are expected due to increasing demand for workers in this sector; a shortage of 756,000 ICT professionals is estimated (European Commission, 2016). It can be argued that skills will become a bottleneck for the diffusion of digital technologies: "With a view to the gap between the skills needed and the skills available internally, access to personnel with specialized digital skills is likely the main bottleneck for future transformation initiatives" (Hoberg et al., 2017).

Digital Transformation and Skill Mismatch Require not Only Technological Innovation but also Social Innovation in Education

The combination of technological and social innovation as part of a new innovation paradigm (Colla et al., 2017; Howaldt et al., 2017; Kohlgrüber et al., 2019) comprises a broader understanding of innovation by considering social needs and societal challenges (see **Figure 2**). By opening the innovation process to society, co-creation as a (social innovation) process has to be started getting all relevant stakeholders involved. Co-creation is a collaborative method (Sanders and Stappers, 2008) and process (Brandsen and Honingh, 2018) involving different stakeholders in the framework of a social innovation (Hochgerner, 2018; Eckhardt et al., 2020).

Research on social innovation in education shows how a more systemic approach is needed in innovation, an approach that includes new forms of cooperation and collaboration as well as new governance structures (Schröder and Krüger, 2019; Maldonado-Mariscal, 2020). Additionally, a literature review on social innovation recognized that social innovation can be identified through new institutions, new social relations, new processes or organisational processes, or new networks of institutions that pursue to provide better solutions (Maldonado-Mariscal, 2017:39).

Against this background, a combined view on technological and social innovation includes two aspects:

(1) Implementing new technologies changes the way of working in many jobs. It creates new social practices which represent social innovation according to the definition of (Howaldt and Schwarz, 2010, p. 21). In line with this our argumentation in this article is based on: "A social innovation is new combination and/or new configuration of social practices in certain areas of action or social contexts prompted by certain actors or constellations of actors in an intentional targeted manner with the goal of better satisfying or answering needs and problems than is possible on the basis of established practices." In the context of technological innovation, new social practices include new working and organizational practices, such as using a new software and new ways of (cross-process) collaboration, new ways of combining data, better process understanding and practical knowledge to make better decisions based on digitalisation. Skills are an integrated part of social practices (Shove et al., 2012) and thereby a part of social innovation.

(2) Another aspect of integrating technological and social innovation is the innovation process. This article is based on the understanding that technological innovation is embedded in a social innovation process which means a

co-creation process. In distinction to other approaches of user involvement, co-creation includes not only gaining feedback from users on mock-ups or prototypes, but playing a role as co-developers of the new solutions. This includes proposals for new or different features, integrating new solutions into existing IT infrastructure (such as a Manufacturing Execution Systems) and embedding the technological solution into a fitting work organization.

A social innovation process is needed to unfold the potential of (digital) innovations and solutions by combining technology with personnel expertise and skills development and optimising organisation (at the workplace). Thereby, the social innovation process encompasses the dimensions of technology, organisation and people (Hirsch-Kreinsen, 2016; Ittermann et al., 2016). However, this approach of integrating technological and social innovations requires mutual learning processes of the involved actors. A joint optimization of sociotechnical systems that aligns technology, people (***skills***) and organization requires harmonization of cultures and languages of technical developers and human factors experts. Without these mutual learning processes, technical requirement specifications and human factor requirements exist in parallel and will not affect each other.

So, using social innovation in education for technological innovation processes is based on two arguments: If social innovations are successful they deliver new social practices solving societal challenges and social demands in a better way than this was done before. This is one argument for applying the social innovation approach to education. The second argument is that a social innovation process (including all relevant stakeholders) is needed to avoid in a concerted action skills shortages and mismatches.

To summarize, the general concept of social innovation in education has to be customized for different applications. Depending on specific fields of application, social innovation in education takes different forms[1] that include common elements (such as stakeholder integration) and different elements (such as the specific workflows for defining human factors requirements). This article presents practical evidence due to the described approaches and research-leading theses above by four different pilot projects embedding technological/educational innovation within a social innovation, co-creation and mutual learning process, conceptually described above.

IMPLEMENTATION OF THE SOCIAL INNOVATION AND MUTUAL LEARNING PROCESS

The following projects present different examples of co-creation processes in diverse projects but also in different social innovation processes. The empirical results in this article are based on European research and innovation projects where innovation in technological processes, innovation in Vocational Education and Training (VET) or both took place. Some of the co-creation processes identified are innovative learning arrangements and development of new digital solutions. In this section, we analyze the conceptual implementation of the described social innovation approach on a micro level, like within companies. We present an overview of the projects in the following **Table 1**.

Methodological Approach

In this paper, we analyzed four different projects and its co-creation practices in a framework of social innovation and technological innovation. First, through empirical results of GT-VET and Green Star, we identify co-creation practices of developing innovative learning arrangements for greening technical VET. Second, through empirical results of COCOP and ROBOHARSH, we identify co-creation practices of identifying and adjusting digital skills because of the digitalization of production and maintenance processes. The analysis in all four projects mainly consists on a qualitative analysis, which is accompanied by interviews, surveys, and measurement of different indicators.

The method used in GT-VET is the common development of the training module by a research institution in close cooperation with a steel company (in four different countries representing different VET systems). During the social innovation process of developing the training module with workshops, interviews, surveys of the stakeholders from the companies, VET systems, and social partners the topics, content, and didactical approach were developed and tested. Performing it in this way, a planned eLearning module was replaced by a more action-oriented learning by doing and stepwise approach fostering the self-responsibility for learning.

In the Green Skills project innovation transfer based on the GT-VET training blueprint took place from a big company approach of the steel industry to a Small and Medium Enterprises (SME) cluster-oriented framework. Within two Focus Groups stakeholders from the involved regional automotive clusters (SME, VET system and training providers, public policy, research institutions) discussed the adjustment possibilities and necessities in an iterative way leading to accepted and concrete action plans.

Methods used in both ROBOHARSH and COCOP projects were the measurement of technical Key Performance Indicators (KPIs) completed by social Key Performance Indicators (social KPIs). Besides the usual technical KPIs the additional social KPIs monitor the user involvement and co-creation on the workplace and company level, introducing in this way a social dimension in the measurement of the development process. These indicators measure progress and target achievement levels of the co-creation process (see **Figure 3**). They are built on three perspectives: 1) Perspective of developers; 2) Company

[1]An overview of different manifestations of social innovation cases in education and lifelong learning worldwide could be found in Schröder et al. (2017); Schröder and Kuschmiertz (2017).

TABLE 1 | Summary of analyzed projects and co-creation practices. Source: self-elaborated based on the projects GT-VET, Green Star, COCOP and ROBOHARSH.

Project Name	Project Description	Methods used	Co-creation examples
GT-VET Greening Technical Vocational Education and Training–EU Lifelong Learning Program-Leonardo da Vinci (2011–2012) https://www.estep.eu/estep-at-a-glance/involvement/gt-vet/	GT-VET developed a sustainable industry driven and coordinated European VET module for an ongoing and short termed implementation process of new skills for greening technical VET. This module can be integrated into national VET system or used in addition by matching the demands of industry with different VET systems (Germany, Italy, Poland, and United Kingdom).	Cooperation of research institutions and steel companies, accompanied by the European social partners and the involvement of VET system relevant associated partners, combining research with practical company knowledge. Surveys with HR managers, workers, and apprentices to clarify demands and didactical approaches. Developing and testing of the training modules in companies in an iterative way.	New training modules and scenarios for increasing environmental responsible skills on the shop floor were developed. This was done by a collaborative human resources development integrating relevant stakeholders in a social innovation co-creation process.
Green Star: GREEN Skills for Enterprises-Sustainable Training for Automotive suppliers cluster, EU Lifelong Learning Program-Leonardo da Vinci (2013–2015) http://www.greenskills-project.eu/	GREEN STAR supported the systemic change toward eco-innovation within clusters of automotive suppliers, mainly SMEs, by transferring the GT-VET projects results to automotive supplier clusters in Italy, Spain and Romania	Cluster driven analysis of green skills requirements in automotive suppliers Small and Medium Enterprises (SMEs) via two focus groups (including enterprises and policy makers) FOCUS GROUP 1 - Reskilling and upskilling identification of (transversal) green skills for SMEs, apprenticeship in enterprises FOCUS GROUP 2 - Integration of green skills in identified qualification levels, development of (local) Stakeholders Action Plans for green skills in Continuous Training and Apprenticeship systems	New training modules and scenarios for increasing environmental responsible skills on the shop floor were developed. This was done by a collaborative human resources development integrating relevant stakeholders in a social innovation co-creation process.
ROBOHARSH: Robotic workstation in harsh environmental conditions to improve safety in the steel industry (funded by the EU RFCS program 2016–2019)	ROBOHARSH is combining technological innovation with a social innovation process by installing a robotic cell in the steel shop supporting technical personnel in the control of a tap hole, replacing the sliding gate and related refractory material at the bottom of the ladle.	Measuring target achievement levels by Social key performance indicators	An interface between the robot and the operator was co-designed by defining new human-robot-interactions in a co-creative development process.
COCOP: Coordinating Optimisation of Complex Industrial Processes (funded by the EU HORIZON 2020–SPIRE program 2016–2020) https://www.cocop-spire.eu/	The vision of the COCOP project is that complex process industry plants are optimally run by the operators with the guidance of a coordinating, real-time optimisation system. COCOP is combining the technological development with a social innovation process of co-creation and co-development.	Surveys: in the beginning and at the end of the project to the following stakeholders Potential users • questionnaires (14 potential users) • semi-structured interviews (9 potential users) Engineers • semi-structured interviews of four engineers having knowledge/experiences related to plant-wide optimization External experts • online questionnaire of 60 project external experts Measuring target achievement levels by Social key Performance Indicators	A comprehensive catalog of human factors requirements (in the dimensions technology, organization and people/skills) was developed by KPI- and human factors experts and software developers. It includes the requirements of stakeholders on the new solution. An action plan was derived covering activities, addressed requirements, time tables and status according to the milestones of the development process.

perspective; and 3) Users' perspective. Some of the questions including these indicators are:

1. Perspective of developers: Do operators and managers really use the system and do they accept advice of the system?
2. Company perspective: Do users understand and contribute to plant-wide optimisation?
3. Users' perspective: Do users have/develop the right skills and does the solution improve job satisfaction?

From a quantitative and statistical point of view, the number of companies, stakeholders, involved workers, apprentices, and interviewees (counting nevertheless more than about 300 concerned actors across all for projects) are low and therefore

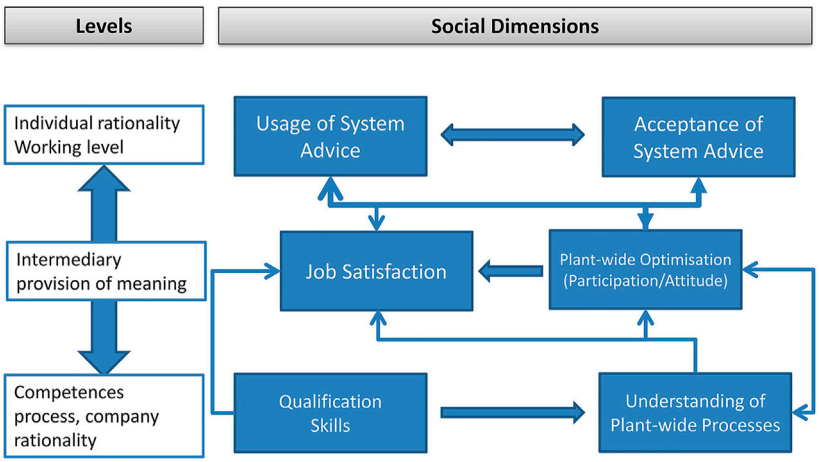

FIGURE 3 | Social Key Performance Indicators (OPT et al., 2017, p. 11, permission obtained).

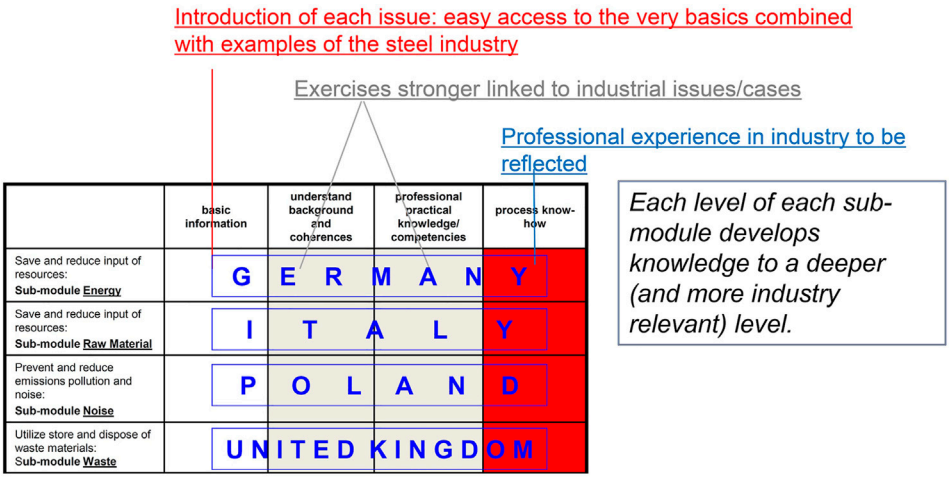

FIGURE 4 | GT-VET training module (Schröder et al., 2013, permission obtained).

individual opinions have a high weight but no statistical representativeness and significance could be claimed. However, the qualitative analysis integrating different stakeholders and target groups perspectives led to fruitful discussions and iterative alignment processes – in the end to accepted effective common and better solutions than planned.

New Digital Skills: Mutual Learning Creates Integrated Socio-Technical Solutions

Co-creation as Innovative Learning Arrangements (GT-VET, Green Star)

In both projects Greening Technical Vocational Education and Training (GT VET) and GREEN STAR training modules and scenarios for increasing environmental responsible skills on the shop floor of different companies were developed. This was done by a collaborative human resources development integrating relevant stakeholders in a co-creation process. In the GT-VET project, research and training institutions worked closely together with steel companies, accompanied by the European social partners and the involvement of VET system relevant associated partners. Such collaboration took place especially by involving company representatives for human resources development and apprentices in interviews and workshops. Very important result of this empirical work was to substitute the planned eLearning tool (where no one was really interested in) by an action and workplace based training handbook[2].

The GT VET training module is of high relevance to reduce waste, energy, noise and emissions (Schröder, 2014, 2015;

[2]https://www.estep.eu/assets/GT-VET/GT-VET-European-Framework-Module-Green-skills-for-mechanical-industrial-and-electrical-technicians-Training-Handbook.pdf.

Kohlgrüber and Schröder, 2019) and to sensitize workers and apprentices for "greener" working practices. An effective, efficient and accepted way of learning and training became an evident part of the development of the training module. Within this project, we observed that social innovation consists on integrating relevant stakeholders and future learners. Integration of trainees and experts of the companies right from the beginning of the innovation process was the guarantee to identifying the concrete needs of the company and the workers and apprentices, the relevant topics and learning outcomes, and the accepted didactics. In the end, a common training module was developed, reflecting the main content requirements of the companies in four submodules: energy, waste, noise, and raw material reduction. Additionally, the didactical requirements of the learners were: starting with basic information, understanding background and coherences and later focusing on practical exercises and projects, linked to the concrete workplaces (see sub-modules and levels of training as axes in the Figure below).

The co-creation process took mainly place through the introduction and development of a new training module. This training module was tested and improved by putting a strong focus on the workplace experience and implications, fostering own responsibility, project planning and involving workers and apprentices. Such interaction and collaboration generate a bottom-up workplace innovation (Dhondt et al., 2017; Howaldt et al., 2017), leading to a "learn-learn-learn" situation for all stakeholders, such as trainees, trainers or teachers, and workers or management. An improvement of context knowledge by a comprehensive approach for learning and training, a generic understanding of green skills and the identification of parameters for changing behavior in the maintenance area was achieved. The module improves through its activity the awareness and skills for self-reliant work, reduction of resources, and saving of money, proved by the results of training inherent projects of workers and apprentices (energy savings through LED lights and new production procedures). The developed GT VET training module is seen as a link for short-termed reaction to technological changes. One of the main results was an improvement of the existing cooperation between companies and vocational schools.

Knowledge and awareness of the target group about environmental issues of the steel industry before the training was not given, there was no interest and motivation for such activities. Engagement and motivation had to be risen by the trainers and the concept of the training module looking for interesting tasks and own activities of the trainees.

The co-creation process of developing the training module led in the end not only to an increasing but also to a high engagement and enthusiasm of the trainees (see video of GET-VET https://www.estep.eu/estep-at-a-glance/involvement/gt-vet/), especially because they found more efficient solutions on the workplace (saving money, work place innovation) within their training related tasks and projects. It led to a new view on the production process and a change of conscience and behavior (including correction of behavior of other colleagues).

GT-VET was awarded by the European Commission as one of the best projects of the funding period, due to its success. Such recognition and success led to the reproduction of this innovation practice. Therefore, the framework module was transferred from the steel to the automotive supplier sector within the GREEN STAR project. GREEN STAR adapted and modified the industry-driven process of the iron and steel sector, mainly consisting of large enterprises, to the Small and Medium Enterprises (SME), and to regional clusters of automotive suppliers related to several sectors, e.g. metal works, microelectronics, and plastic materials through the implementation of a cluster-driven approach. This solution has enabled the development of suitable competences for sustainable innovation in the training paths addressed to workers ("reskilling") and apprentices ("upskilling"), in order to reduce the environmental impact in the production chain as well as service activities, better managing available resources.

Integrating some SMEs which had a leading role in the relevant clusters led to specific action plans implemented in participating regional clusters in Italy, Romania, and Spain. Transfer activities were supported by a partnership made up of enterprises and VET representatives associated in a consortium. Both in its structure and in its working methodology, this coordination was based on the triple helix model, which includes public authorities, the industry sector, and universities. Such structure aimed at strengthening cooperation for sustainable innovation between public bodies, service organisations and enterprises, universities and VET centres-creating favourable conditions for cooperation across the stakeholders (companies and their cluster associations, regional policy, and training providers), combining knowledge, policies and innovation.

To sum up, the development of training programmes and modules require a high level of commitment of stakeholders, especially in a co-creative social innovation process. However, taking this approach leads to better fitting companies and learners needs, choosing the right didactics and learning arrangements and leading to better learning outcomes through tailor-made solutions.

Co-Creation for Human-Robot-Interaction: From Operator to Supervisor (ROBOHARSH)

In the project ROBOHARSH, the interface between a new robotic station and the operator was co-designed by defining new human-robot-interaction. Manual maintenance operations at a steel converter were deeply analyzed and decomposed into elementary operations (tasks). New subdivision of tasks the robot could perform and the ones left in the hand of operators was defined in a co-creation process of operators and robot developers. The development of the new interface led to a drastic reduction of manual tasks still to be conducted by the operator (from 39 before to 8 remaining manual tasks). The main tasks are done now by the robot, especially the most hazardous and heavy ones. The results show that the robot handles all the heavy weights procedures and the exposure to high temperatures has decreased drastically: from 63% to 15% in the view of the developers and from 71% to 37% in the opinion of the operators. Additionally, new skills demands were considered to enable the operator to make best use of the new solution. Furthermore, affecting work organization, the new robotic cell is generating a new allocation of tasks between robot

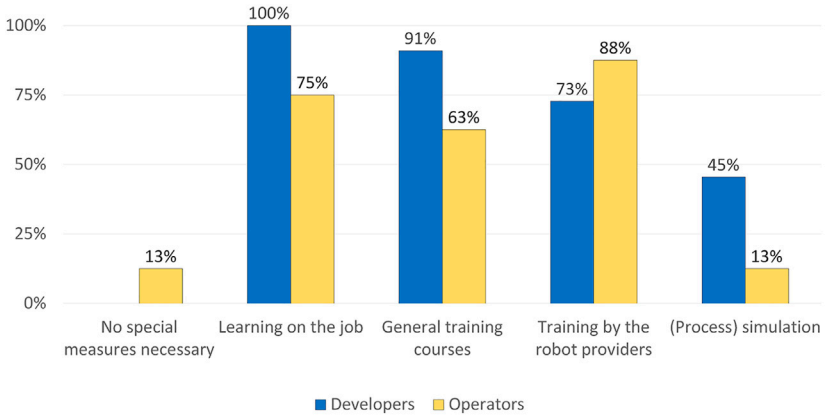

FIGURE 5 | Mix of training measures are required (ROBOHARSH, own graphic).

and human and a totally new way of working for the operators (doing major parts of their job from a pulpit).

The co-creation process in this project took place through a high involvement of both developers and operators within the introduction of a new technology. This means that operators were sufficiently involved in the development process, their opinions were heard, the developers took up their suggestions, and the management of the company was supporting the operator involvement. According to the developers, there was a high integration of users or operators, and stakeholders in the co-creation process, depending on the stage and subject of development.

This high involvement led to an important mutual learning effect: The number of improvement suggestions from users or operators and stakeholders are ranging from 5 to 50 suggestions (depending on the different developer person), with an average of 21 suggestions made. Respectively the number of changes based on these suggestions is ranging from 4 to 30 up-taken advices with an average of 12 proposals that were considered improving the technological solution. Overall, two of three suggestions were executed. This underlines that the developers and the future users are mutually learning from each other; for example, the developers by integrating the user suggestions and the users by learning the robotic software step-by-step and on the job. Developers learned by integrating the experiences and knowledge of the operators to come to better solutions, e.g. what works and what not or how to design the robot support practical effectively. Operators learned how to use, monitor and control the robot.

In spite of this mutual and cross-fertilizing learning and development process, questionnaires with the operators and developers underlined that new skills are required. This was especially stressed by the operators. Training for robot assistance could be integrated in existing trainings schemes (but has to be clearly exposed). The operators claim that the recent training measures could be extended and new skills and a mix of methods should meet training demands: Mainly by learning on the job, training by the robot providers and general training courses (see **Figure 5**). Beside the general importance, the developers prefer more learning on the job while the operators prioritize training by the robot providers.

To summarize, a common technological development within a social innovation process is a clear win-win-situation for all the people concerned: developers/technicians, operators/end users, management, and project participants. It is a mutual learning on the job process across the borders of hierarchical, technological and workplace related levels, leading to an optimized and accepted solution and an effective and efficient implementation (with no or minimized follow-up costs). The disruptive change from a manual operation to a robot assisted and digital controlled and operated job is changing the skills demands of the concerned operators drastically. For example, one of the involved operators mentioned it is a "change from an operator to a supervisor" (see **Figure 6**).

To minimize the problems of such a drastic transformation (from manual work to robot supervising) the integration and learning by doing of the operators in a co-creation process of two years was important. Besides the own learning process the involved operators informed their colleagues at similar work places and they function as experts in a peer-to-peer skills adjustment and learning process.

Co-Creation for Plant-Wide Optimisation Process (COCOP)

In the project COCOP the social innovation process includes the skills dimension explicitly. COCOP as a technological oriented project aims at developing a system for a plant-wide optimization in process industries, piloted in a steel and a copper company. The challenge was to integrate a new system for plant-wide optimization within a collaborative and integrated social innovation process. Within this process, skill needs for plant-wide optimization were estimated (which comprises more than using a new tool).

The skill needs estimation (as part of human factors requirements) consists of four stages:

1. Measurement of the involvement of future users/stakeholders by surveys: At the first stage, a team was established including human factors (HF) experts, KPI experts and software developers. The HF experts analyzed the key staff of the factory that would be affected by the new plant-wide optimization system. They comprise the main

FIGURE 6 | Job profile change: from operator to supervisor (Colla, 2019, permission obtained).

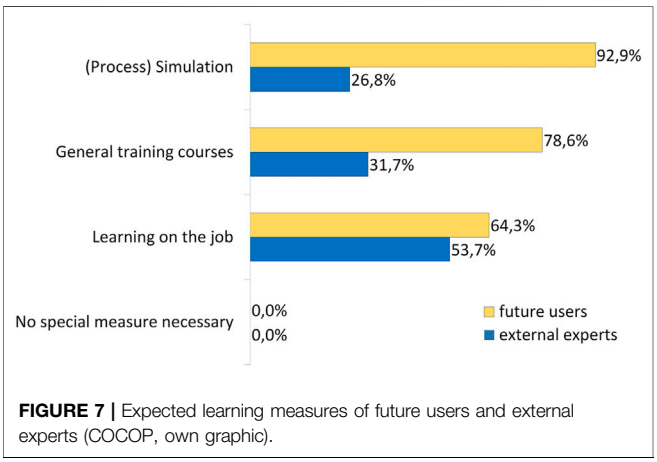

FIGURE 7 | Expected learning measures of future users and external experts (COCOP, own graphic).

tasks of the future users of the COCOP systems, their position in the organization chart, the involved production processes and relevant stakeholders. Together with KPI experts, a new set of indicators were defined. These indicators measure the improvements of the new system in social terms, such as job satisfaction, acceptance/usage of the new system, participation, needed skills and understanding of plant-wide processes (see defined social KPIs above and **Figure 3**). In the course of the project and the software development and implementation, different surveys and interviews took place with future users, other relevant stakeholders and technical experts measuring the social KPIs.

2. Transforming indicators into human factors requirements: In order to harness the results of the survey for software developers, they were transformed into a format that is compatible to the logic of technological development processes. The requirements had to be clear, measurable and subject of validation whether a requirement is fulfilled or not. Actions are linked to validate human factors requirements and their connection to the milestones of the project.
3. Drawing up an action plan: To make the list of requirements manageable for the HF team and the involved company, an action plan was drawn. This plan summarized all HF related activities at every milestone of the project. The action plan included the needs of participants, time and benefits of any human factor requirement.
4. Validating human factors requirements: The current status of validating a human factor requirement was shown by graphical symbols. It provides an overview of to what extent HF requirements are fulfilled and the full impact of a new solution on human factors issues is visible through the social KPIs.

Results from the human factors workflow (Kohlgrüber et al., 2019) should be carefully interpreted by the fact that only 14 future users of the system were interviewed. However, surveys with external experts (n = 60) compared with the user's opinion show that nearly two of three persons of both groups stress that integrating a plant-wide perspective in their work requires new skills. Approximately only one of four users or experts claimed that there is enough training for plant-wide processes. While both groups underline the need of special training measures, the majority of the future users prefer (process) simulation (93%), followed by general training courses (79%), and finally, learning on the job (64%). External experts, on the contrary, prioritize learning on the job (54%) (see **Figure 7**).

Results from face-to-face interviews with future users and company internal stakeholders show that based on experiences with existing software tools and cross-process optimization, most of the interviewed persons expected that education and training will be a relevant condition for a successful implementation of the planned COCOP system. According to our results, it is important that handling of a new system is learned mainly at the workplace. However, some interviewees preferred training courses; others favored additional education that is integrated in working

processes. It was stated that theoretical knowledge should be imparted before practical knowledge.

To sum up, the COCOP project aimed at building explicit links between the digitalization strategy of the pilot company and related skills improvement. Choosing the co-creation approach human factor requirements are understood, integrated and validated in a mutual (learning) process of the technicians (software developers) and the end users (operators, foremen, managers).

CONCLUSION

As introduced in this article, social innovation can be identified through new institutions, new social relations, new processes or organisational processes, or new networks of institutions that pursue to provide better solutions than the ones before (Maldonado-Mariscal, 2017:39). In this sense, social innovation in education refers to new forms of cooperation or even new governance structures (Schröder and Krüger, 2019; Maldonado-Mariscal, 2020).

Current research on social innovation in education have some limitations since it is usually based on case studies in very specific contexts. Despite these restrictions, this article contributes to a broader understanding of social innovation in general, especially in the specific context of education and training combined with co-creation in technological developments. The presented projects are limited to examples of involved project partners (companies, research institutions, etc.) and its transferability of the concept to sectoral, national or EU level. However, these examples show the advantages of social innovation processes in companies and training institutions for innovative training and technology development by serving a blueprint of involving stakeholders, developers and end users through co-creation and mutual learning.

At the project and company level, related results of the analyzed projects show the heterogeneity of social innovation processes by different co-creation practices, for example:

1. The GT-VET and GREEN STAR projects show very similar co-creation practices, such as the introduction of a new training module (know-how process and scenarios for increasing environmental responsible skills) involving relevant stakeholders and future learners. This integration process took place from the beginning of the training module development and changed the outcome during the course of the process in a learner and company demanded way. The process strengthened also cooperation between companies and vocational schools. Within the GREEN STAR project, especially new partnerships were achieved, such as a partnership of enterprises and VET representatives, and between companies and their cluster associations, regional policy, and training providers. Beside co-creation GT-VET and GREEN STAR made evident that also new digital and didactical learning arrangements are needed, including new didactical concepts, such as action and workplace-oriented learning, self-responsible learning, trainer as learning coach, learning communities.
2. ROBOHARSH showed co-design practices to define new applications of human-robot interaction. A development process dividing together with the operators in a first step the former manual work in different tasks, and then allocating step by step as much tasks as possible to the robotic assistance in a co-creation process with the developing engineers – leading to mutual learning processes for both engineers and operators.
3. In the COCOP project the integration of a new system was developed through a collaborative process, including the needs for human factor and integrating them with the learning needs of technicians. This led also to the necessity to change the view and responsibility of the operators/managers from the own area to a plant-wide production.

The presented co-creation practices based on social innovation processes show how new alliances and ecosystems are created (regional and local authorities, economic clusters and sector stakeholders, training providers and departments, companies and social partners) but also how new internal processes are implemented within companies and their employees in a collaborative way.

Based on the empirical results of this article, some recommendations to improve the process matching of skills to needs are:

- Define concrete co-creation processes in new technology projects to facilitate acceptance of new technology and faster learning among technicians, operators, end-users and managers.
- Provide examples of successful practices to operators and managers to open their vision for co-creation and mutual learning.
- Use social KPI and relate it to the technical KPI to make progress by co-creation processes transparent.
- Include mutual learning processes for technicians and engineers in the project by introducing new digital skills and new didactic concepts.
- Define clear actions of the co-creation process addressing all relevant project members to make changes in the development process happen.
- Document the implemented co-creation practices and their elements of success and failure for future use.
- Create learning communities with new technologies and mutual learning in the workplace.

DISCUSSION: HOLISTIC STAKEHOLDER APPROACH COMBINING TECHNOLOGICAL AND SOCIAL INNOVATION

The holistic social innovation approach is looking at "innovation as an enabler" (FORA, 2009) and is going further than traditional

design thinking (Brown and Katz, 2009) and socio-technical system approaches (Hirsch-Kreinsen, 2016). While technological design and socio-technological system approaches are "indirectly" integrating end-users as research objects, the social innovation co-creation process is integrating end users and stakeholders of concerned organisations directly as subjects in the development and implementation process from the idea over invention and implementation to institutionalisation (Schröder, 2011). Additionally, the social innovation process comprises a more comprehensive and holistic concerted action by integrating stakeholders from relevant societal sectors: industry/economy, policy, education and research, as well as (if relevant) civil society (e.g. NGO's)–establishing a social innovation ecosystem with a triple or quadruple helix.

What can We Learn From the Empirical Cases Presented Here?

First, the four presented projects show the evidence of skill demands due to digital transformation and the effectivity of the integration of innovations within a social innovation process. They show as well that integrating the end users and other relevant stakeholders, such as management and human resources department, in the development process clarifies the demand of skills and the supply of how skills have to be delivered and implemented. Second, these projects indicate the importance of a holistic social innovation approach integrating all stakeholders, such as developers and researchers as well as the end users. Third, they show that perceptions and expectations between engineers and workers, technological and human requirements have to be bridged. Mutual learning of the engineers, developers and the end users, e.g. operators and learners, leads to better or new outcomes (as in the case of GT-VET), more effective and more accepted technological solutions and learning arrangements. Finally, mutual learning processes integrating the competences of the end users and other relevant stakeholders into the development process has led to clear win-win situations. For example, more effective solutions for the users, companies, and developers; reduced follow-up costs because of the higher acceptance of the common solution; more effective learning results based on learning by doing and learning on the workplace; development of tailor-made training programs; managerial and organisational supporting measures detected and implemented during the development process; new solutions found by the trainees and operators, and improved job satisfaction. And, not at least, this co-creation and mutual learning social innovation processes help to unfold the full potential of digital solutions in and for the workplace.

However, we also recognised that, beside the directly in the co-creation process involved people, transfer to other stakeholders and users (workers, management, trainers) is still a challenge because it requires acceptance, understanding and taking over this new perspective and approach. Concerning the social innovation process the main gap is between introducing a prototype and the actual implementation and institutionalisation in the company (esp. COCOP) and in formal VET training programs (e.g. in GT-VET the training module was implemented in the companies but only informally combined with vocational school curricula, due to given leeway). To bridge this gap (transfer to other users and areas and further implementation and development on the workplace), leadership becomes not only more important but has to change its role, esp. concerning the application of new digital solutions. Leaders are required to get technological solutions and organisational framework conditions aligned. In the case of COCOP, the technologically facilitated plant-wide optimization would be in contradiction with sub-process-oriented targets and incentives for workers when it comes to a sustainable implementation. Therefore, leaders are challenged to take care for a fit of technological, organisational and people-related solutions.

OUTLOOK: PROACTIVE ADJUSTMENT OF SKILLS WITHIN MUTUAL DEVELOPMENT AND LEARNING PROCESSES

This article has so far focused on co-creation processes and the role of mutual learning and competence needs in individual projects defined by pilot developments for specific companies and applications. What is not yet explicitly addressed here are scalable solutions that meet the challenges of the digital transformation for entire industries, if not the entire EU economy. For future research, it should be considered that the approach of social innovation processes is rolled out to identify future skill demands and solutions on how to meet these needs - at different levels (sectoral, regional, national and EU). As an outlook, we present some recently started projects taking up these requirements.

Providing Future Skills Through a Social Innovation Process

To achieve a successful matching of skills demands and supply, providing skills should be organized as a social innovation process as described by the example above: development of training modules (GT-VET/GREEN STAR), the robot-human interface (ROBOHARSH), and the optimization system (COCOP). Co-creation in these projects combined technology with training modules, where developers, research institutions, social partners, users/operators/apprentices, and stakeholders of companies and VET institutions were involved with their different perspectives, knowledge and responsibilities–leading to practical tailor-made training blueprints and implementations as well as to company and regional action plans (GREEN STAR).

Which Skills Are Needed for Future work?

Regarding the *future skills demands*, it can be stated that skills needs are not only limited to digital, technological or high-tech skills. Certainly, digital or high-tech skills are needed to meet the challenges of a digital future. This includes basic digital skills, advanced digital skills but also skills for e-leadership (Berger and Frey, 2016). But there is a broad consensus in literature that also

non-technical skills are needed in a digitalized world. Many researchers consider a mix of technical and non-technical skills as a requirement for a digitalized future (Berger and Frey, 2016; CEEMET, 2016; Pfeiffer et al., 2016; Lamb et al., 2017; Kirchherr et al., 2019; Servoz, 2019). For example, Rampelt et al. (2019) recognize a need for "hybrid skills" as a mix of specific and general skills. This combination of specific and general skills is also called "T-Shaped Skills." The T-Shape approach combines skills of a specialist and of a generalist resp. professional skills and transversal skills (PWC, 2018). PWC (2018) conceptualize high-tech T-shaped skills as a mix of high-tech skills (e.g. basic/advanced digital skills) and complementary skills, such as collaboration, innovation, emotional intelligence. Pot et al. (2019) argue that organizations have to become T-shaped in order to enable T-shaped personalities. First results of the ESSA project (described below) underline the high importance of transversal soft skills within the T-shape approach.

What can Be Said About the supply side of Skills?

Whereas demand is formulated in terms of tasks and needed skills, indicators for skills supply are defined by qualifications or test data (Green, 2016). Matching skills requirements and Vocational Education and Training (VET) support we have to rethink the "process of matching labour market demand and supply" (Servoz, 2019). While the supply side trains and educates people for occupations and qualification it does often not meet employers' requirements in terms of needed skills. Therefore, both sides (stakeholders from the demand and supply side) have to be integrated into the development process to ensure matching of provided and needed skills. "The education and skill system has a vital role to play in equipping individuals with the skills, competences and attributes necessary to cope and manage with labor market and other shifts over their life course" (Barnes et al., 2016). As employees are often lacking basic skills (literacy, numeracy, basic digital skills), VET systems should have a "repair component" to compensate such education deficits (Servoz, 2019). This is also valid for secondary education: "It is not acceptable that there are currently 61 million Europeans [. . .] who do not have these basic skills: without them, people become unemployable" (Servoz, 2019). Higher education "should focus more on soft and interdisciplinary skills" (Servoz, 2019). This should include a combination of different skills, of technical and general skills, of training in the university and on the job in a company (ibid). Preliminary insights from the ESSA project with steel companies (see below) confirm that graduates are lacking interdisciplinary skills, project management skills and communication skills.

Further Research

While there is a lot of literature dealing with the impact of digital technologies on occupations and labour market (e.g. Brynjolfsson and McAfee, 2014) and researchers predict strong negative impact of digital technologies on employment (Frey and Osborne, 2017), skills are not systematically addressed in such studies. Particularly on EU level, scientific research on the impact of digital transformation on skills is still lacking. At the same time, skills are playing a vital role for the digital transformation: to avoid structural unemployment due to skills mismatches, to include low skilled people in labour, to be an enabler for job creation (filling job vacancies with skilled people) and to make full use of new technologies by well skilled users, developers and leaders. Therefore, the skills debate is an essential part within innovative research, for instance the (Erasmus + funded) European Sectoral Blueprint Program but also Horizon2020 and the new SPIRE Program "Processes for Planet."

Sectoral Skills Alliances and Strategies for Identifying Future Skills demands and Training

Within the "New Skills Agenda" of the European Commission the authors developed the social innovation process approach illustrated above (focusing on the micro level of specific innovations and companies) further and extended it to an overarching (meso level) approach of two European sectoral skills alliances combining technological innovation with skills requirements and adjustments in a co-creation process (of up to 40 partners each from industry, policy, education and training, research and innovation) across Europe and energy intensive industry sectors:

- ESSA: Blueprint "New Skills Agenda Steel"-Industry-driven sustainable European Steel Skills Agenda and Strategy (funded by the EU ERASMUS + program 2019-2022) https://www.estep.eu/essa/ ESSA is realizing an industry driven, sustainable and coordinated blueprint for a European Steel Skills Agenda. A strategy for human capital development through a Sector Skills Alliance is delivered within a social innovation process involving a broad range of key stakeholders of the steel industry: companies, education and training providers, research institutions, social partners (European and national steel associations and trade unions as well as sector experts).
- SPIRE SAIS: Skills Alliance for Industrial Symbiosis–A Cross-sectoral Blueprint for a Sustainable Process Industry funded by the EU ERASMUS + program 2020-2023 https://www.spire2030.eu/ SPIRE-SAIS realizes a Blueprint strategy for human capital development through a Cross-Sector Skills Alliance on Energy Intensive Industries. It involves a broad range of key stakeholders (sector associations or technology platforms, training providers, and research partners) from the eight sectors of the public-private partnership "Sustainable Process Industry through Resource and Energy Efficiency" (SPIRE): Steel, Chemicals, Minerals, Non-ferrous Metals, Water, Engineering, Ceramics, and Cement. New skill demands and adjustments for energy efficiency, industrial symbiosis and related Vocational Education and Training are in focus.

Additionally, within the Beyond 4.0 project (Inclusive Futures for Europe– BEYOND the Impacts of Industry 4.0 and Digital Disruption, funded by the EU HORIZON 2020 program,

2019-2022, http://beyond4-0.eu) we examine further on the macro level the societal impact of the new technologies on the future of jobs, business models and welfare via a multidisciplinary research approach.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

MK contributed to every chapter, the depiction and analysis of the skills debate, the discussion section and insights from the projects COCOP and BEYOND 4.0. KM-M contributed to every chapter, to the scientific discussion on social innovation in education and co-creation methods, to the discussion section and the systematization of the presented projects. AS contributed to every chapter, the depiction and analysis of the skills debate, the discussion section and insights from the projects ESSA, SPIRE-SAIS, GT-VET, Green Star and ROBOHARSH.

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A Person-Centered Approach for Analyzing Multidimensional Integration in Collaboration Between Educational Researchers and Practitioners

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This study was conducted in the context of a development project for teacher education, establishing a collaborative format called Transdisciplinary Development Teams (TDTs). The aim of this study was to investigate (a) how participating TDT members assess focal dimensions of integration characteristics (DICs) with regard to success factors and challenging aspects. DICs are operationalized as (1a) mutual learning and (1b) knowledge integration, (2a) perceived trustworthiness, and (2b) appreciation within the team, and (3a) collective ownership of goals. In addition, they seek to (b) differentiate the types of actors characterized by particular assessment patterns. The study employs a person-centered approach (cluster analysis) and uses a data corpus with 62 response sets. Subsequently, this study offers a genuine conceptual approach to frame interorganizational collaboration in teacher education. On this basis, empirical insights that provide further practical implications to support future collaboration at the boundary of educational research and practice have been generated.

Keywords: cluster analysis, collaboration integration, research-practice partnerships, teacher education, transdisciplinarity

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INTRODUCTION

The discourse on interorganizational collaboration in teacher education has received increasing attention over the last two decades. Scholars frame such cooperative formats as powerful mechanisms for the development and transfer of didactical innovations (Einsiedler, 2010; Gräsel, 2011), while educational policy-makers and practitioners consider them as integrating factors to bridge the persistently criticized gap between educational research and practice (Hericks, 2004; Wissenschaftsrat, 2001, 14, 55). A growing body of literature offers theoretical frameworks, conceptual propositions, and empirical studies for the design as well as the analysis of such collaborative formats (Pilypaitytė and Siller, 2018; Kleemann et al., 2019). With regard to works of Loogma et al. (2013), Gräsel (2011), and others, interorganizational collaboration in teacher education may be conceptualized as socio-organizational innovation that in turn fosters the development, implementation, and transfer of didactical innovations. However, few studies have analyzed the integration of involved stakeholder groups as a key success factor for interorganizational collaboration at the boundary of educational research and practice (Straub et al., 2021).

The present article aimed to contribute to this research in two ways. First, an analytical framework that combines conceptual propositions of the Research–Practice Partnership (RPP) approach with insights into the discourse of transdisciplinarity will be offered. The RPPs approach provides a comprehensive understanding of long-term co-constructive collaboration between educational researchers and and practitioners (Penuel et al., 2015; Coburn and Penuel, 2016). Transdisciplinarity represents an integrative research and development mode that fosters the co-constructive engagement of actor groups across heterogeneous professional, organizational, and institutional backgrounds (Klein, 2014; Scholz and Steiner, 2015). Moreover, it advocates for a multidimensional understanding of integration that highlights the importance of 1) epistemic, 2) social, and 3) organizational dimensions (Jahn et al., 2012). In alignment with that, focal dimensions of integration characteristics (DICs) have been operationalized in terms of (1a) *mutual learning* and (1b) *knowledge integration*, (2a) *perceived trustworthiness*, and (2b) *appreciation within the team*, and (3a) *collective ownership of goals* (Straub et al., 2021). Second, concerning the research method, we use a person-centered approach to identify different patterns of integration characteristics within the actor groups. This allows the use of a complementary methodological perspective for the analysis of interorganizational collaboration in teacher education in general and for the investigation of multidimensional integration characteristics in particular (Straub et al., 2021).

THE CALL FOR INTERORGANIZATIONAL COLLABORATION IN TEACHER EDUCATION

The starting point for this study is a widely acknowledged critique that teacher education in Germany is understood not only as highly specialized, but also as institutionally and disciplinarily fragmented by international comparison (Blömeke, 2014). This is particularly due to the consecutive three-phased teacher education system, which comprises 1) university-based studies, 2) preservice teacher training, and 3) advanced on-the-job teacher training (European Commission/EACEA/Eurydice, 2015, p. 34; Kotthoff, 2011; Terhart, 2004). University-based teacher education aims to develop academic knowledge and competencies rooted in a wide range of disciplines. It comprises, *inter alia*, subject matter didactics, pedagogies, educational science, and psychology. Even though mandatory practical studies have largely expanded within the study curriculum during the past two decades (Weyland, 2012; Rothland and Biederbeck, 2018), the formal responsibility for the development of practical teaching competencies is situated within the second phase involving schools and teacher education colleges (German: "Studienseminare"; Lenhard, 2004). With respect to the third phase, that is, advanced teacher training, there are no uniform standards across Germany's federal state system. Therefore, advanced training might be conducted at training institutes affiliated with universities, as is the case for Lower Saxony, or else at educational administration institutes.

Institutional fragmentation may also be understood as a reinforcing element of what is commonly referred to as "theory–practice divide" in teacher education (Korthagen, 2007; Villiger, 2015). Ongoing controversies seek to provide refined conceptualizations and alternative perspectives on the interrelation, *inter alia*, "knowledge and action", "research and experience", "reflection and acting", and "distancing and engagement" (for a comprehensive overview, see Rothland, 2020). Nonetheless, various interest groups have continuously criticized the German teacher education system for its insufficient integration and coherence between academic expertise and practical skills (Arnold, 2010; Vanderlinde and van Braak, 2010). Even worse, mutual accusations and delimitation tendencies have become common knowledge within the teaching profession (Messner, 2012, p. 77). In extreme cases, the work of scholars created "in their ivory towers" is considered of limited practical relevance (Broekkamp and van Hout-Wolters, 2007), while practitioners are accused of neglecting theoretical, conceptual, and empirical knowledge (Patry, 2005).

However, in contrast to these conflicting tendencies, there are also increasing calls for interorganizational collaboration in teacher education (Gorodetsky and Barak, 2008; Straub and Vilsmaier, 2020). Those making these calls are committed to overcoming the aforementioned institutional fragmentation by pooling various bodies of knowledge and expertise across the teacher education system in order to co-construct integrative advancements within the teaching profession. Such collaborative formats are applicable, for instance, to university-based teacher education and teacher education colleges, schools, and youth welfare representatives, and among universities, schools, and extracurricular institutions (Boer et al., 2018; Kleemann et al., 2019).

The potential benefits of interorganizational collaborations are threefold: First, on an interpersonal level, interorganizational collaboration is understood as a genuine opportunity for professional development due to processes of mutual learning and knowledge integration (Korthagen, 2016; Boer et al., 2018). Second, at the organizational and institutional levels, such collaboration is understood to allow for collective capacity building and to be a driving force for organizational change (Fullan, 2016; Hartmann and Decristan, 2018). Third, the pooling of academic expertise and practical experience fosters the co-creation of didactical innovations, such as, teaching and learning arrangements, and teaching practices (Gräsel, 2011; Sewell et al., 2018). Overall, interorganizational collaborations in teacher education are discussed as powerful mechanisms to mitigate the gap between academic research and school practice.

THEORETICAL FRAMING OF INTERORGANIZATIONAL COLLABORATION IN TEACHER EDUCATION

In the context of this study, interorganizational collaboration in teacher education is conceptualized as 1) long-term interrelations among various stakeholder groups from educational research and

practice that 2) engage in mutual exchange and co-constructive processes in order to 2) jointly design, develop, establish, and reflect on didactical innovations in school-based teaching and university-based teacher education. This conceptualization draws significantly on theoretical contributions offered by the RPP approach and the discourse of transdisciplinarity.

Originating from the U.S. teacher education discourse, the RPP framework comprises a family of research and development approaches that is defined as "long-term collaborations between practitioners and researchers that are organized to investigate problems of practice and solutions for improving schools and school districts" (Coburn and Penuel, 2016, p. 48). RPP subtypes range from research alliances, over design research or design-based implementation research, to networked improvement communities (NICs) (Penuel et al., 2015; Coburn and Penuel, 2016). While each of these types focuses on joint research and development activities at the level of school practice, they differ in degree of shared goals, responsibilities, and interdependencies as well as concerning the joint decision-making competencies and ownership of the cooperation or collaboration process, respectively (Penuel and Gallagher, 2017; Straub et al., 2020). Research alliances, for instance, are characterized by mutually negotiated goals, whereas research activities fall within the responsibility of representatives of the university; while, practitioners focus on the implementation of didactical advancements (Coburn and Penuel, 2016). In contrast to this traditional role pattern, design research and design-based implementation research also highlight mutual interactions throughout the iterative research and development processes (Fishman et al., 2013; Bakker, 2018). Subsequently, networked improvement communities also resonate with design-based approaches, but seek to identify success factors and challenges for the implementation of school development activities or didactical innovations through the comparison of and exchange between different networked improvement communities (Bryk et al., 2011; Russell et al., 2017).

In contrast, the discourse of transdisciplinarity thrives on contributions from a broad variety of disciplinary backgrounds that link theoretical, conceptual, and empirical insights engaging with 1) challenges of problem-solving and transformation under the condition of 2) heterogeneous disciplinary, and institutional and organizational requirements through 3) the integration of relevant stakeholder groups in processes of mutual learning and co-construction (Straub, 2021, p. 15). Against this background, transdisciplinarity refers to an integrative research and development mode that advocates the interrelation of different bodies of knowledge and ways of knowing beyond professional, organizational, and institutional boundaries (Klein, 2014; Straub and Vilsmaier, 2020). In contrast to the RPP approach, transdisciplinary processes are committed to fostering a systemic and thus symmetrically integrative perspective toward the co-development of research and practical fields (Straub and Vilsmaier, 2020). In the context of this present study, this understanding highlights that collaboration and its outcomes should comprise both university-based teacher education and school-based teaching. Eventually, according to Nowotny et al. (2001), the integration of different sources of expertize and dedication to addressing both scientific and practical challenges, allow for the development of "socially robust knowledge". The notion of "socially robust knowledge", in turn, is linked to increased "legitimacy, ownership, and accountability" concerning the sustainable establishment of change processes and the lasting usage of didactical innovations (Lang et al., 2012, p. 26).

Despite some differences in focus, both conceptual frameworks overlap significantly. In the following, four intertwined principles will be discussed that subsume key characteristics of long-term interorganizational collaborations at the boundary of university-based teacher education and school-based teaching (Straub et al., 2020; Straub and Vilsmaier, 2020): 1) long-term collaboration perspective, 2) focus on practical problem-solving, 3) multi-perspectivity and participation, and 4) joint research and development orientation.

1) Long-term collaboration perspective: Lasting in-depth change processes and the sustainable implementation of didactical innovations require a long-term perspective (Coburn and Penuel, 2016, p. 48). First, a long-term research and development perspective allows stakeholders to comprehensively engage in co-constructive research and development activities that range from conceptual development, by way of application, and implementation to testing, evaluation, and revision, respectively (Straub and Vilsmaier, 2020). This ensures that different stakeholders contribute not only their expertise but also their respective interests and needs throughout the research and development process. Second, a continuous temporal perspective is also considered a necessary condition to build stable and trust-based social relations (Coburn et al., 2013). The recurrent experience of joint problem-solving across professional, institutional, and organizational boundaries strengthens the willingness and commitment for further collaboration. Third, a continuous partnership perspective resonates well with iterative research and development processes. In this way, research and development cycles may be interlinked, while objectives and the results can be refined stepwise or adapted to changing conditions and requirements (Straub et al., 2020).
2) Focus on practical problem-solving: The RPP approach highlights in particular the need for collaborations among researchers and practitioners to focus on issues, problems, and challenges that are considered to have immediate practical relevance (Coburn and Penuel, 2016, p. 49). Consequently, collaborative engagements ought to address tangible outcomes such as concrete teaching concepts and materials or professional development activities addressing issues of daily classroom interaction. Inspired by the discourse of transdisciplinarity, the present article encompasses a systemic perspective that comprises university-based teacher education as well as school-based teaching practice as interlinked professional practices (Straub and Vilsmaier, 2020). Thus, a broad understanding of practice is brought to fruition that extends along practical training elements and professional learning opportunities during the three phases of university-based study, preparatory service, and school

practice. This perspective also advocates a co-constructive interaction of relevant (influencing as well as affected) persons and institutions. In this way, a systemic understanding of multiple practices is also considered highly compatible with approaches seeking to overcome the static duality of the so-called theory–practice problem in teaching and teacher education (Straub, 2021).

3) Multiperspectivity and participation: A constitutive element of co-constructive collaboration refers to the comprehensive involvement of relevant stakeholder groups (Coburn and Penuel, 2016). The active participation of heterogeneous groups of actors is seen as a central prerequisite for ensuring that the outcomes reflect not only different expertise but also the needs and interests specific to the involved actor groups. From a transdisciplinary perspective, the framing of a problem and the involvement of relevant stakeholder groups in the problem-solving process have to be understood as two intertwined yet distinct requirements (Straub and Vilsmaier, 2020). As already indicated, the committed participation of the target groups' representatives is considered to increase the acceptance and thus the chance for implementation and transfer into the practical field.
4) Research and development orientation: Both RPP and transdisciplinary processes highlight the need for integrative research and development processes that balance the need for scientific credibility and practical relevance. In other words, despite a focus on issues of practical relevance, the iterative development process should be accompanied by a suitable set of formative and summative reflection, evaluation, and research activities (Straub et al., 2020; Straub and Vilsmaier, 2020). Accompanying reflection, evaluation, and research activities support the mutual adaptation of goals and development activities. They offer further insights into the implementation, transfer, and adaptation of didactical innovations and change processes to other contexts. In addition, especially the design-based implementation research approach highlights the need for integrated research and development activities that offer further theoretical, conceptual, and empirical insights about success factors of and obstacles to implementation and transfer processes (Fishman et al., 2013). Eventually, RPPs and transdisciplinary research and development approaches advocate for a broad usage of qualitative, quantitative, and mixed-methods approaches in order to use complementary perspectives and methodologies (Straub et al., 2020; Straub and Vilsmaier, 2020).

TRANSDISCIPLINARY DIMENSIONS OF INTEGRATION

Based on the theoretical outline of long-term collaborations at the boundary of educational research and practice, the integration of different stakeholders, such as practitioners, researchers, and students, within a co-constructive and participatory process is of paramount importance. Moreover, due to the professional, institutional, and organizational heterogeneity of such collaborative settings, a multidimensional understanding of integration is required (Felt, 2009; Felt and Fochler, 2012; Jahn et al., 2012; Lang et al., 2012). The present study focuses on (1) epistemic, (2) social, and (3) organizational dimensions of integration, which in turn include certain dimensions of integration characteristics. The following outline is based on the framework provided by Straub et al. (2021).

1) Epistemic integration: mutual learning and knowledge integration. Transdisciplinarity highlights the integration of different bodies of knowledge and ways of knowing through mutual learning (Scholz and Steiner, 2015; Vilsmaier et al., 2015). Mutual learning comprises behavioral capacities regarding the exchange of knowledge and expertise, co-constructive behavior, and critical reflection (van den Bossche et al., 2011). In this study, mutual learning is also understood as a focal requirement for knowledge integration. Knowledge integration, again, comprises the ability to establish a mutual understanding and common knowledge base among heterogeneous stakeholder groups (Steinheider et al., 2009).
2) Social integration: trust and appreciation. According to the multidimensional understanding of integration, mutual learning and knowledge integration are highly dependent on social integration. In particular, in-depth and long-term collaborations among different stakeholders, such as researchers, practitioners, and students, rely heavily on trust-based and appreciative relations. Trusting relationships are characterized by a reciprocal commitment to honor agreements and to engage in open and transparent communication (Costa and Anderson, 2011). In addition to trust-based relations, mutual appreciation among different stakeholder groups is understood as an important facilitating factor that helps to mitigate potential status hierarchies and to engage on an equal footing (Carmeli and Gittell, 2009). Mutual appreciation is also a necessary condition for engaging in critical debates and constructive conflicts (van den Bossche et al., 2011).
3) Organizational integration: collective ownership of goals. Trust-based and appreciative relations that promote mutual learning and co-construction of shared knowledge benefit from organizational integration. Thus, it is essential that the collaboration is characterized by participative decision-making and shared ownership of goals (Bronstein, 2002). Participation and shared responsibilities for the achievement of shared goals are powerful mechanisms to mitigate power asymmetries and allow stakeholders to express their particular perspectives and needs (Elzinga, 2008). This is also understood as a crucial prerequisite for establishing the legitimacy and acceptance necessary for the implementation of innovations (Lang et al., 2012).

RESEARCH INTERESTS

Against this theoretical backdrop, the present study seeks to provide further empirical insights into the characteristics of

interorganizational collaborations in teacher education by applying a socio-organizational innovation perspective. To do so, the study was conducted in the context of a research development project that established a collaborative format termed Transdisciplinary Development Teams (TDTs). By applying a person-centered approach, we want to identify different patterns that are crucial for transdisciplinary cooperation in teacher education. Furthermore, we wanted to determine whether the differences between the clusters (types of TDT members). Against this backdrop, the study addresses two main research questions:

1) How do the involved actors assess TDT work with respect to the successful and challenging aspects of transdisciplinary DICs?
2) Are there different types (clusters) of TDT members who differ in their perceptions of successful and challenging aspects of transdisciplinary DICs?

METHODS

Research Context

The study is based on data provided in the context of a research and development project in Lower Saxony, Germany. According to the project's mission statement, the overall vision is twofold (Ehmke et al., 2018, p. 10). First, it aims to establish a space for joint discourse and thought for various actor groups across the teacher education system, such as researchers, teachers, and student teachers, to engage on an equal footing. Second, this is supposed to foster interorganizational collaboration regarding the development, revision, and implementation of advancements in teacher education at a regional level (Straub and Vilsmaier, 2020). In this context, the eight so-called TDTs have been established to foster collaboration at the boundary of initial teacher education and school practice. Each team addresses a particular action field that represents an overarching challenge in the teaching profession, which is considered relevant to the academic and the practical fields. These so-called "action fields" refer to competence-oriented instruction, including schooling, mentoring student teachers during practical studies, and maintaining teachers' health (Straub and Dollereder, 2019).

Within the boundaries of the overall action fields, particular development teams are characterized by considerable degrees of freedom. In alignment with focal principles for transdisciplinary processes, the arrangement of 1) problem-framing and team building, 2) mutual learning, and knowledge integration, and 3) reintegration and application of TDT outcomes are subject to shared decision-making and negotiation processes among the involved actor groups (for a detailed discussion, see Straub and Vilsmaier, 2020). In addition, participation in the TDTs was based on voluntary commitment, while teachers, teacher-training educators (German: "Studienseminarleitung"), and extracurricular partners received basic expense allowance. For these reasons, the particular development teams show variations with regard to team size and team composition as well as work organization and concrete development objectives (Straub et al., 2021; for a compact overview, see Straub and Dollereder, 2019). Despite these differences, the TDTs met on a regular basis, about every three to six weeks, in order to co-constructively develop, establish, and revise didactical innovations at the boundary of university-based teacher education and school-based teaching practice (see, inter alia, Scharnberg, 2019; Waschewski, 2018; ZZL-Netzwerk, 2018).

The following two examples provide some illustrative features. At the time of the survey, the TDT on "Mentoring during Practical Studies", for instance, consisted of six team members, comprising researchers, teachers, teacher-training educators, and student teachers. Together, the team members aimed to jointly develop, establish, and revise the so-called, ProMent, advanced teacher training program. The program offers various modules that prepare teachers to mentor student teachers during their long-term school placements (Beckmann et al., 2021). In contrast, the TDT on "Competence-Oriented Instructional Design in Basic Social and Science Studies" consisted of twelve team members, including partners from extracurricular institutions (Bürgener and Barth, 2018). Moreover, the TDT was closely linked to a university-based course for student teachers and addressed two main objectives (Bürgener and Barth, 2020). The interrelation between the TDT and the university course offered 1) mutual learning opportunities for the participating actor groups and 2) teaching materials applicable for school-based teaching and extracurricular programs that have been practically tested and revised.

Sample Description

At the time of the survey, a total of $N = 77$ active team members collaborated, divided among eight development teams. To focus the study on factual teamwork settings, a cutoff criterion was applied, according to which only those persons were considered in the survey who took part in at least five development team meetings. The overall response rate of 80.5% was considered satisfactory, resulting in a factual sample size of $n = 62$.

The gender composition of the team members (male = 23.3% and female = 76.6%) largely corresponds with those of teachers in Lower Saxony in 2016 (male = 27.9% and female = 72.1%) (MK Niedersachsen, 2018). The *age-groups* represented in the development teams cover the full range, from under 30 to 59 and above years. Despite the group beeing older than 49 years (11.7%), the age-groups are approximately uniformly distributed, which again corresponds roughly with the teacher composition in Lower Saxony (MK Niedersachsen, 2018). In addition, the *professional experience* is approximately uniformly distributed and reflects various levels of expertise from novice to experienced practitioners.

The *stakeholder groups* consist of three major players: practitioners (51.6%), researchers (25.8%), students (16.1%), and "others" counting for (6.5%). Needless to say, educational backgrounds, organizational affiliations, and vocational status, are in, fact much more diverse. In particular, subgroup *practitioners* comprise teachers, principals and teacher training

TABLE 1 | Coding manual including working definition, example quotes, and inter-rater reliability measure Cohen's kappa (*K*) for dimensions of integration (DI) characteristics.

DI	Characteristic	Definition	Examples	*K*
Epistemic	*Mutual learning*	*Mutual learning* refers to behaviors including exchange, co-construction, and/or critical reflection of, for example, knowledge, experience, and concepts and materials among different actors.	"Exchange among experts"; "mutual confirmation/ complementing of ideas"	0.85
	Knowledge integration	*Knowledge integration* indicates team members' perception that the TDT is characterized by heterogeneous knowledge bases and perception, mutual perception taking, and creation of a common ground.	"Differing state of knowledge"; "creation of a shared project understanding"	0.86
Social	*Perceived trustworthiness*	*Perceived trustworthiness* applies when team members state that they rely on agreements, individual interests are transparent, and there are no hidden agendas.	"With regard to equitable cooperation, it would be conducive if there were transparency and assurance about how originators for (shared) developed ideas are documented"	0.85
	Appreciation within the team	*Appreciation within the team* stands for the acceptance and acknowledgment among the TDT members, even if their perspectives may differ from another.	"Respectful and appreciating interaction," "to take each other seriously"	0.88
Organizational	*Collective ownership of goals*	*Collective ownership of goals* indicates that TDT members participate and take on responsibility for defining and achieving joint goals.	"Everybody works toward the same goals," "shared decision-making"	0.80

Definitions are positively formulated but also apply to statements that indicate a lack, a violation, or a problematization regarding a given characteristic in order to cover challenging aspects of TDT work as well.

educators. The latter works usually part-time at teacher-training seminars and schools. *The category researchers* refers to professors and research assistants at the universities. *Students* are considered a major target group for TDT outcomes. However, student teachers are involved in only two out of eight teams and represent only a comparatively small number within the sample size. There are two possible reasons for this. First, participation at the TDTs is based on voluntary commitment, while being quite time consuming. In contrast to teachers, for instance, student teachers are not entitled to receive expense allowances according to the regulations of the funding agency. Second, since most TDTs are closely linked to university-based teaching arrangements, student teachers participate in the outcomes of the TDT work without necessarily being part of the teams. The category *others* refers to partners from extramural organizations such as foundations and public authorities. Despite the fact that they provide profound insights for the joint work in the development teams, their small number made it impossible to consider them as an independent subgroup.

Survey Instruments and Methods of Analysis

The study used data gathered through a written survey of all active TDT members. The questionnaire comprises standardized attitude scales with regard to DICs, open question formats, and a survey instrument for ego centric network analysis. The present study focuses exclusively on the analysis of data generated through the open question formats. The corresponding questions are as follows: 1) "In your own opinion, please state the three most successful aspects with regard to development teamwork?" and 2) "In your own opinion, what are the three most challenging aspects with regard to development teamwork?" The survey was conducted in German language. Therefore, these questions and items within the coding manual (see **Table 1**) were translated by the authors.

The responses were mostly expressed as key words or short half sentences, which is probably due to the considerable length of the overall survey, with an average processing time of 45 min. A mixed-methods approach was applied for data analysis, which was deemed most suitable given of the following research conditions: 1) the explorative aim of the study, 2) the lack of a prior case or subsample selection criteria, 3) the small-scale setting with a sample size of $n = 62$ response sets, and 4) the fact that the response sets comprised mostly keywords and short sentences. In particular, a complementary transfer design was used to combine qualitative and quantitative approaches for data analysis (Kuckartz, 2014, pp. 87–90; Vogl, 2017). Initially, the data corpus was coded following the procedure for a structuring qualitative content analysis (Kuckartz, 2016). The coding process was conducted by a research tandem comprising a PhD student and a student research assistant. The analytic category system was derived deductively based on the conceptual framework outlined in **Section 3**. A comprehensive coding manual was developed to establish sufficient coding reliability, including code definitions, anchor examples, and descriptive indicators such as inclusion and exclusion criteria. **Table 1** displays an overview of the category system including working definitions, reference examples, and inter-coder reliability measures. The latter were displayed by Cohen's kappa values. They range between 0.80 and 0.88, indicating excellent inter-rater agreement. Subsequent to the qualitative coding process, the data corpus has been quantified to allow for further statistical analysis.

To answer research question 1, descriptive statistics, especially proportional values, were calculated to complement qualitative data inspection. This allows for the assessment of the prevalence and distribution of statements with respect to the successful and challenging aspects of DICs.

TABLE 2 | Prevalence of dimensions of integration (DI) characteristics with respect to successful and challenging aspects.

		Successful aspects		Challenging aspects		Total
DI	**Characteristic**	***n*** **(%$_{col}$)**	**%$_{row}$**	***n*** **(%$_{col}$)**	**%$_{row}$**	***n*** **(%$_{col}$)**
Epistemic	Mutual learning	29 (41.43)	63.04	17 (24.64)	36.96	46 (33.09)
	Knowledge integration	12 (30.00)	26.67	33 (47.83)	73.33	45 (32.37)
Social	Perceived trustworthiness	2 (2.86)	40.00	3 (4.35)	60.00	5 (3.6)
	Appreciation within the team	19 (27,14)	76.00	6 (8.70)	24.00	25 (17.99)
Organizational	Collective ownership of goals	8 (11.43)	44.44	10 (14.49)	55.56	18 (12.95)
	Total	70	50.36	69	49.64	139

Research question 2 was approached by applying a hierarchical cluster analysis and a nonparametric ANOVA using van der Waerden's test statistics to distinguish different response patterns from the TDT members. Cluster analysis represents a person-centered approach, which is why the dataset used to answer research question 1 was dichotomized previously. Subsequently, the value "1" indicates that a respondent made at least one statement about a certain DIC. In contrast, "0" indicates that no statement was made. Moreover, differentiation between successful and challenging aspects was maintained. To calculate the cluster analysis, the simple matching similarity measure was used in combination with the complete linkage clustering algorithm. This configuration is considered preferable in the case of qualitative data as the source of origin (Kuckartz, 2016, p. 238).

Moreover, a nonparametric ANOVA using van der Waerden's test statistic was applied, which is considered to be fairly reliable under test conditions such as dichotomous data, homogenous variances, unbalanced and comparable small subsample sizes (Luepsen, 2018). The tests were performed in R using the RStudio (ver. 1.2.1335) and Package PMCMRplus (Pohlert, 2018). All other calculations were performed using the IBM SPSS Statistics (ver. 26.0).

FINDINGS

Assessment of Dimension of Integration Characteristics

To investigate research question 1, how TDT members assess teamwork with regard to DICs, descriptive statistics have been combined with a qualitative inspection. The total number of codings with respect to successful or challenging aspects regarding DICs was 139. This number also contains potential multiple mentions of a person regarding a particular DIC. **Table 2** provides an overview of the prevalence of statements concerning the successful and challenging aspects of transdisciplinary DICs.

The overall number of mentions was equally distributed among successful (50.36%) and challenging aspects (49.64%). Both epistemic dimensions of integration characteristics show the highest percentages of *mutual learning* (successful: 41.43%; challenging 30.00%) and *knowledge integration* (successful: 24.43%; challenging 47.83%), while perceived trustworthiness was the least mentioned characteristic (successful: 2.86%; challenging: 4.35%). When the proportions for each characteristic was inspected, it becomes apparent that *mutual learning* and *appreciation with the team* feature particularly successful aspects of the development teamwork, with 63.04% and 76.00%, respectively. In contrast, *knowledge integration* and *perceived trustworthiness* mainly contain challenging statements (with 73.33% and 60.00%, respectively). However, *collective ownership of goals* shows a relatively moderate proportion with regard to the overall number of statements (12.95%) and is also almost equally distributed according to successful and challenging mentions.

In addition to the analysis of the proportional distributions of the team members' statements, a qualitative inspection of the DICs shows some differences with respect to the variety of facets and the depth of elaboration. Although *mutual learning* was coded quite frequently, most answers referred literally to the aspect of exchange. For the most part, there were no further specifications, but if so they indicated mainly intellectual exchange, for instance, exchange of opinions or experiences, in contrast to the exchange of materials or products. In addition, only a few statements indicated co-constructive discussions and interactions. "Challenging aspects" referred to, in addition to exchange, aspects of reflection.

As indicated above, statements regarding *knowledge integration* were mostly stated as challenging. These can be differentiated into three groups. The first indicates, in general, considerable heterogeneity in understanding and perspectives, which have to be addressed during the development teamwork. Second, the need for mutual perspective taking has been addressed, while the development of common ground with regard to problem understanding and solution approaches comprises the third challange. Mentions of *knowledge integration* as successful resemble similar sub-facets but occur less often.

The characteristic *perceived trustworthiness* has seldom been mentioned. However, it becomes apparent that while positive mentions consist only of single keywords such as "trust" and "reliability," problematizing statements were considerably more elaborated. For instance, one criticism was that an initial arrangement regarding the compensation of teacher's engagement could not be fulfilled as initially agreed in terms of compensatory hours (German: "Anrechnungs-bzw. Entlastungsstunden") but had to be replaced with monetary compensation. Another statement problematized the lack of transparency about the authorship of co-constructed ideas and concepts and the potential risk that single persons might earn gratitude for collective efforts.

In contrast to *perceived trustworthiness*, the characteristics *appreciation within the team* was predominantly considered a successful attribute of development teamwork. For the most part, these statements referred plainly to keywords such as "appreciation", "respect", or "equal footing", but offered little explanation of which aspects in particular reflect appreciation. Also counted were aspects,

which occurred less often. However, these referred, for instance, to the mitigation of hierarchies and the involvement of students.

Finally, *the collective ownership of goals* comprises equally successful and challenging aspects. With regard to successful aspects statement pointed mostly at "shared goals", challenging statements were a bit more diffuse, ranging from the lack of shared commitment among different actor groups or joint engagement with research and development activities.

Types of Development Team Members

Following dichotomization, the dataset comprised 106 occasions in which a development team member made at least one statement with respect to one of the DICs. This allows to perform a cluster analysis in order to identify types of development team members who can be distinguished by characterizing patterns of DIC expressions.

A visual inspection of the dendrogram for the hierarchical cluster analysis indicated that the potential cluster solutions were quite similar to each other. Nonetheless, differentiating the dataset into a set of four clusters represents the greatest differences among them. Accordingly, the resulting subsample sizes for each cluster were as follows: cluster A, $n = 18$ (29.0%), cluster B, $n = 12$ (19.4%), cluster C, $n = 13$ (21%), and cluster D, $n = 19$ (30.6%). **Table 3** displays the frequencies, nonparametric test statistics based on van der Waerden's test, and respective effect sizes measured with *Cramer's V* for differences among clusters A, B, C, and D regarding successful and challenging aspects of DICs.

The results indicate group differences with regard to *mutual learning* (s), *mutual learning* (c), *knowledge integration* (c), *perceived trustworthiness* (s), *appreciation within the team* (s), *collective ownership of goals* (s), and *collective ownership of goals* (c), with p values ranging between < 0.01 and 0.03. The corresponding effect sizes range between 0.38 and 0.78, indicating medium to large differences among the clusters on a general level. In contrast, no statistical differences were found for *knowledge integration* (s) ($p = 0.088$), *perceived trustworthiness* (c) ($p = 0.135$), and *appreciation within the team* (c) ($p = 0.056$).

In addition, *post hoc* tests were calculated to identify which clusters differed from each other in particular (see column to the far right). On this basis, it is also possible to further characterize the four clusters based on genuine DIC expressions.

Cluster A: Indifferent Members

According to *post hoc* tests, team members in cluster A only show occasional statements with regard to DIC. Therefore, this group is referred to as "Indifferent Members". At this point, however, it should be noted that the framework of analysis focused exclusively the deductive category system. Thus, members of this group may have made statements to the contrary, which were not included in the present study.

Cluster B: Integration Critics

Cluster B is referred to as "Integration Critics" since the corresponding team members' statements problematize in particular that heterogeneous levels of expertise and knowledge within the development teams were an obstacle with which they had to cope. This does not necessarily imply that the importance of heterogeneity in terms of different professional backgrounds, organizational affiliations, and work experience itself was denied as an influencing factor. This interpretation is supported by the fact that respondents were significantly more likely to state that the collaboration was characterized by mutual appreciation than members of clusters A and D.

Cluster C: Learning Critics

Cluster C is likewise characterized by the perception of mutual appreciation but, more importantly, it features significantly higher proportions with regard to critical aspects of *mutual learning*. Therefore, this group is referred to as "Learning Critics". Accordingly, members of this cluster are more likely to articulate challenging or problematic aspects with respect to the exchange of experiences, reflections, or co-construction of new ideas, concepts, or materials. However, on a descriptive level, they also are slightly inclined to mention positive aspects with regard to *mutual learning*. Therefore, *mutual learning* seems to be in general of importance to this cluster, even though it is regarded as critical. Finally, there is also a significant tendency for *Learning Critics* to state successful aspects with regard to *collective ownership of goals*, which indicates the perception of equivocal cooperation among the different team members.

Cluster D: Committed Learners

The final cluster D, was labeled "Committed Learners". On the one hand, respondents within this cluster are characterized by a significantly higher probability of assessing *mutual learning* as a successful aspect of the teamwork. On the other hand, they are more likely to articulate perceptions with regard to any DICs in general. For instance, they also share rather critical views on aspects of *mutual learning* such as the learning critics do. However, they also make approving statements toward successful exchange, joint reflection, and co-constructive processes. Nonetheless, members within this cluster are significantly more likely to express concerns about aspects of the *collective ownership of goals*. Since they did not mention any aspects related to *appreciation within the team*, this might indicate that they have experienced somewhat unbalanced situations with regard to an uneven division of responsibility rather than unequal participation. **Figure 1** illustrates the cluster profiles with regard to the proportion of statements made to the successful or challenging aspects of the respective DICs.

DISCUSSION

The present article outlines the importance of integrating focal stakeholder groups as a paramount success factor for the effective and sustainable establishment of interorganizational collaborations in teacher education. To substantiate this proposition, an analytical framework inspired by the discourse on transdisciplinarity was applied (Straub et al., 2021). The framework highlights a multidimensional understanding of integration comprising 1) epistemic, 2) social, and 3) organizational factors such as (1a) *mutual learning* and (1b) *knowledge integration*, (2a) *perceived trustworthiness*, (2b) *appreciation within the team*, and (3a) *collective ownership of goals*.

TABLE 3 | Frequencies and nonparametric ANOVA for clusters A, B, C, and D.

Characteristics	Cluster a (n = 18)		Cluster B (n = 12)		Cluster C (n = 13)		Cluster D (n = 19)					
	$n_{(0)}$	$n_{(1)}$	$n_{(0)}$	$n_{(1)}$	$n_{(0)}$	$n_{(1)}$	$n_{(0)}$	$n_{(1)}$	*vdW*	*P*	*V*	Post hoc
Mutual learning (s)	15	3	10	2	9	4	2	17	25.77	<0.01	0.64	D > A,B,C
Mutual learning (c)	18	0	12	0	4	9	15	4	26.04	<0.01	0.65	C > A,B,D
Knowledge integration (s)	14	4	12	0	12	1	13	6	6.54	0.09	0.32	A,B,C,D
Knowledge integration (c)	17	1	0	12	13	0	8	11	37.91	<0.01	0.78	B > D > A,C
Perceived trustworthiness (s)	18	0	10	2	13	0	19	0	8.74	0.03	0.38	A,B,C,D
Perceived trustworthiness (c)	17	1	10	2	13	0	19	0	5.56	0.14	0.30	A,B,C,D
Appreciation within the team (s)	15	3	6	6	6	7	18	1	13.37	<0.01	0.46	B,C > A,D
Appreciation within the team (c)	14	4	12	0	13	0	18	1	7.57	0.06	0.35	A,B,C,D
Collective ownership of goals (s)	18	0	9	3	9	4	19	0	12.11	<0.01	0.44	C > A,B,D
Collective ownership of goals (c)	17	1	11	1	13	0	11	8	14.15	<0.01	0.48	D > A,B,C

n(0) indicates that no statement was made to a given characteristic, and n(1) indicates that a statement was made. (s) refers to statements indicating successful aspects and (c) refers to statements indicating challenging aspects. vdW = van der Waerden's test statistic. V = Cramer's V. The column labeled post hoc *indicates significant differences for multiple pairwise comparisons at a* $p < 0.05$ *level.*

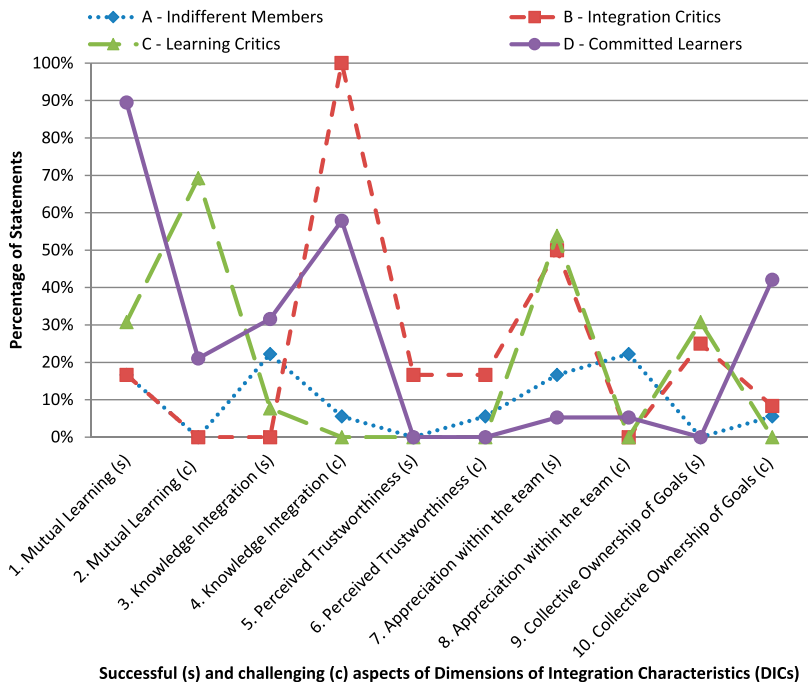

FIGURE 1 | Percentage of statements according to successful (s) and challenging (c) aspects of dimensions of integration characteristics (DICs).

Against this theoretical backdrop, descriptive findings regarding research question 1 reveal that the TDT members are ambivalent in their assessment of epistemic characteristics. Generally speaking, *mutual learning* is considered mostly a successful aspect of cooperation, whereas *knowledge integration* is referred to as rather challenging. In addition, qualitative inspection revealed that *mutual learning* mostly referred to processes of exchange of expertise and experiences, while reflection and co-constructive interactions were rarely mentioned. However, it would be overly simplistic to assume that these collaborative forms did not occur or would otherwise be considered problematic. On the contrary, this emphasizes the particular challenges inherent in interorganizational collaboration. In addition, these findings resonate to some extent with the results of a representative study on teacher collaboration, which indicates that elaborated practices such as joint reflection and co-construction are less likely than less demanding forms of cooperation, such as an exchange of experiences and materials (Richter and Pant, 2016, p. 20).

Regarding to social DICs, it becomes apparent that *appreciation within the team* is an important factor for actors working together across their original professional backgrounds. In contrast, the statements regarding *perceived trustworthiness* were marginally comparable in numbers. However, qualitative inspection showed that the respective statements were noticeably elaborated, which again indicates their significance for the respondents. This also implies some conceptual considerations. So far, the literature on

collaboration in teacher education has focused especially on the role of trust (Bartmann et al., 2012; Kappauf and Kolleck, 2018). Consequently, it is argued that further research would benefit from increasing attention toward appreciation and its interrelation with trust as significant social factors (see, e.g., Kulin, 2019).

In comparison to epistemic and organizational DICs, the assessment of *collective ownership of goals* representing organizational principles of cooperation was again rather ambiguous. This is again understood as an indicator that the negotiation of participation opportunities, distribution of responsibilities, and decision-making processes have to be understood as inherent challenges of interorganizational cooperation.

With regard to research question 2, we used a person-centered approach to identify different response patterns concerning the challenges and success factors for transdisciplinary cooperation in teacher education. Four different response patterns from TDT members have been identified to be characterized by a particular set of assessments toward successful and challenging aspects of DICs. In comparison, cluster A, the Indifferent Members, showed the lowest response rates toward the integration characteristics. This does not mean that they are indifferent toward interorganizational collaboration as such. However, due to the present study's focus on DICs, statements not applicable to the deductive category system remain untouched. Future investigation of these statements might offer some additional insights toward Indifferent Members' attitudes about TDT work and may eventually lead to an alternating characterization.

Clusters B and C refer to actors who are characterized by problematizing challenges regarding epistemic aspects, *knowledge integration* and *mutual learning*. Throughout the qualitative analysis, it became apparent that the respective actors did not question the significance of *knowledge integration* or *mutual learning* as a crucial factor for successful interorganizational collaboration. Instead, at a conceptual level, their statements underscore the demanding nature of both epistemic processes with regard to temporal resources and personal commitment. In addition, these statements offer some practical implications for the potential support of TDT work organizations. The establishment of collective feedback and reflection opportunities could, for example, allow TDT members to articulate potential demands that might help to identify effective support mechanisms.

Finally, cluster D refers to *Committed Learners*. They are characterized by their engagement with regard to epistemic dimensions of integration characteristics. In particular, the perceived *mutual learning* and especially the exchange of knowledge and experience are a successful aspect of TDT work. In contrast, they assess *knowledge integration* in terms of the development of shared understanding and joint common ground as beeing rather challenging. Again, this finding is not understood as the denial of *knowledge integration* as an important success factor for the TDT work but as an indicator of its complexity and difficulty. As already suggested, deliberate reflection on this issue might help to develop productive insights for future teamwork. In addition, *Committed Learners* tend to problematize *collective ownership of goals*. Qualitative data inspection suggests that they embrace equal participation, but in contrast, they also demand more equal distribution of responsibilities. However, further research is needed to substantiate this assumption.

The Limitations of this study can be seen in how we collected the perceptions of TDT members. This was done using a questionnaire as part of the evaluation of the development project. It is possible that not all members expressed negative feelings about challenges in collaborative work. Furthermore, it is possible that the TDT members who did not participate in the study had experiences as part of collaboration that they did not want to share with others. Against this background, a suggestion for further research is to analyze the qualitative processes of the knowledge construction of TDT members using other methods such as interviews or group discussions. A second recommendation is to analyze the different motivations of status groups. It can be anticipated that there are specific intrinsic and extrinsic motivations between the status groups that influence the level of engagement of the TDT members and their perceptions of collaborative work.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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