Z Erziehungswiss (2014) (Suppl) 17:1–7
DOI 10.1007/s11618-014-0545-y

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Editorial Note

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Soziale Netzwerkanalyse in Bildungsforschung und Bildungspolitik
[Social Network Analysis in Educational Research and Educational Policy]
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In recent years, scholars from various disciplines have become progressively aware of the fundamental role played by relationships among actors in social settings and the importance of social contexts as such. This development has concurred with the growing reputation of Social Network Analysis (SNA) across the physical and social sciences, as well as the development of statistical and methodological means to model the complexities of interpersonal relations.

There has been a strong emphasis in educational science and policy circles on the efficacy of social networks towards advancing our understanding of individual and collective decision making processes and the diffusion of innovations. The uses towards which an understanding of both the social networks of individuals and the presence of such networks within institutions can be put are potentially manifold. Despite the intuitive appeal and strong consensus regarding the utility of the social network approach, however, there is still a noticeable lack of empirical studies that

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employ its methodology. This is particularly true in the field of educational science in German-speaking countries. This special issue seeks to contribute to closing this gap by featuring qualitative and quantitative empirical contributions that describe social network phenomena at work in a wide spectrum of educational levels ranging from individual classrooms to collaboration between schools and policy makers.

Researchers seeking to apply empirical SNA to educational science are able to draw on a rich tradition of method- and theory-oriented research (cf., *Andreas Herz*, this volume, for an overview), primarily developed and implemented by sociologists studying all facets of human interaction. Applying their findings to educational settings, however, necessarily presents both opportunities and challenges. In SNA, persons, institutions, and all other specified entities are presented as *nodes* and often referred to as *actors*. Social relations (e.g., friends, colleagues, organizations), or relations based on interactions between these entities (e.g., advice giving, playing), are described as the *edges* connecting these *nodes* (Butts 2009). This representation is well suited for educational settings and policy making: The nodes or actors can be students, teachers, or policy makers, as well as teams, task forces, or institutions; with the edges then being defined as any type of relation between these actors, or as the content of their interaction. This simple representation, transformed into matrices, is the basis of statistical models that become increasingly complex when the attributes of nodes as well as the dynamics and changes of different relationships are taken into account.

Since the 1980's, social network researchers have considerably improved upon the existing techniques for the analysis of the dynamics of social networks, particularly those including attributes of the individual actors involved (cf., van Dujin and Huisman 2011; Snijders 2011). A great deal of attention has been devoted to developing methods and identifying constructs well suited to quantifying the ways in which social relations are organized (e.g., whether they are dense or centralized) and the ways in which an individual node is embedded into a net of social relations. Thus, educational researchers wishing to apply SNA have the opportunity to choose from a variety of methods and adopt them according to their specific research questions. At the same time, by applying models developed within the SNA research paradigm to their field of study, educational scientists may discover new perspectives and approaches that inform the understanding of core concepts of educational science.

The challenge arising from the sheer wealth of method- and theory-oriented social network research lies in the process of integrating educational, sociological, and psychological concepts, while at the same time preserving the integrity of the guiding principles, methods, and assumptions of SNA.

Whereas empirical educational science as well as educational psychology have typically studied characteristics of the individual learner and the individual teacher to explain educational outcomes, social network research focuses on the impact of social relations. Applying the principles of social network research to an analysis of the academic performance of an individual learner, therefore, requires an extension of the analysis beyond characteristics such as gender, immigration background, intelligence, or previous performance, to a particular student's position within a relational network—including access, or lack thereof, to social and academic resources (cf., Borgatti et al. 2009). As Borgatti et al. point out, the same principles apply to

the outcomes of group work: "teams with the same composition of member skills can perform very differently depending on the patterns of relationships among the members" (Borgatti et al. 2009, p. 893). Accordingly, the success of an educational reform implemented in a particular school has been seen to be dependent less on the characteristics of that school than on the relationships among its teachers (cf., *Kenneth Frank, Yun-Jia Lo,* and *Min Sun*, this volume). Given how these tendencies and emphases diverge from the attribute- and individual-oriented focus of educational research, there is a pressing need for careful and systematic comparative analysis to develop innovative and sustainable ways for applying the concepts and findings of SNA to core concepts of educational science.

Consider, as an illustration, the concept of group boundaries in SNA (Marin and Wellman 2011). When studying group influences on the academic engagement of students, it is the researcher who decides whether to define the group as a student's classmates or as his or her clique within and/or beyond the boundaries of the school. As it is left to the individual researcher to define the group or relevant social network according to his or her own theoretical or methodological considerations, the findings will depend in large part on the researcher's criteria. This presents difficulties that have been addressed by Laumann, Marsden, and Prensky in "The boundary specification problem in network analysis" (1983), but there has been no comparable discussion about the boundaries of groups specific to the field of educational research.

The typical context level of analysis in recent large-scale studies conducted in educational settings is the classroom. By means of SNA and the various tools used to define relevant subgroups and cliques (cf., van Duijn and Huisman 2011), classrooms as groups can be further specified into clusters of students who are particularly strongly (or weakly) connected. Further, students can belong to several groups simultaneously, which, again, can be expected to be cause and consequence of the complexity of their self-concept. SNA can serve as a valuable tool for comparing the impact of various units of analysis (cliques vs. classroom) on students' self-perceptions of academic competence (cf., *Lysann Zander* and *Bettina Hannover*, this volume) as well as on other learning relevant factors such as students' goal orientations (cf., *Ralf Wölfer* and *Kai Cortina*, this volume). In short, by taking into account students' membership in various social groups memberships, SNA can inform the ongoing debate about relevant reference groups in educational settings and help to identify the mechanisms and selection patterns of students (as *Chris Baerveldt, Gerhard van de Bunt,* and *Marjolijn Vermande* demonstrate for gender in this volume).

As mentioned above, there is a divide between educational psychology and empirical educational science on the one hand, and social network research, on the other. While the former tend to emphasize the personal attributes of individuals, background variables, and subjective perceptions of a learning environment, the latter focuses on social relationships as causative factors (Marin and Wellmann 2011). It is the combination of both, however, that holds out the greatest promise of creating new applications that will lead to a deeper understanding of learning and teaching. And the advantage of SNA is that it is flexible enough to include elements of each. It can take into account the similarities and dissimilarities of those students who prefer to interact with each other and thus enable researchers to model (a) peer influence in learning and teaching situations as well as (b) the principles guiding the choice of

interaction partners. Particularly interesting areas of application open up when the actual performance characteristics of students as well as their reports on relevant reference groups are cross-referenced with the perceptions of teachers. *Christian Steglich* and *Andrea Knecht*'s contribution to this volume, for instance, demonstrates not only that the friendship that teachers perceive between students in a classroom differs from students' actual, self-reported friendship, but also that it can account for teachers' judgement of students' learning efforts, over and against the students' self-reported study effort.

Another advantage of combining the attribute-centered and the relationship-focused approaches lies in the potential to understand the active role of individuals in selecting, accessing, and shaping their social environments. While this has been one of the central tenets of Bandura's (2001) social-cognitive theory, SNA offers new possibilities to empirically test this claim in reference to current themes of educational research, as shown by *Lysann Zander, Madeleine Kreutzmann*, and *Ilka Wolter* in this volume regarding students' constructive handling of mistakes in class.

The contributions to this volume are organized in two parts, the first of which focuses its analysis on inter-organisational networks from a variety of methodological and theoretical angles. These contributions share the assumption that understanding the attributes and structural dynamics of social networks will significantly advance our understanding of the conditions of inter-institutional collaborations as well as the implementation and development of educational reforms and innovations.

In the opening article, *Nina Kolleck* and *Inka Bormann* present the results of a mixed methods study, using quantitative and qualitative techniques of SNA to analyze trust in innovation networks. They show that applying a mixed methods approach of SNA furthers our understanding of what trust relationships exist within such networks and what role these trust relationships play. They argue that successful innovations are based upon two distinct yet intertwined forms of trust: Innovations are implemented by network members that trust in their usefulness, and they are realized and diffused by the trust these same networks inspire.

Robin Junker and *Nils Berkemeyer*, in turn, analyze the social structures of network coordinators in innovative school networks that support highly gifted students. They concentrate on exploring the relational characteristics of network coordinators in the German state North Rhine-Westphalia by implementing a longitudinal approach to collect ego-centered network maps. Relational data is analyzed by combining ego-centered SNA with multilevel analysis. Results show that social support can be predicted by the multiplexity of the social relations. In addition, the authors discuss the lack of trans-regional cooperation—a line of argument that is further elaborated in the subsequent contribution of *Nina Kolleck* on the role that social relations play in educational innovations. In her contribution, the author draws on SNA in order to better understand the role of social networks in the process of implementing educational innovations in five different German municipalities. She analyzes the relational characteristics of these networks and argues that the establishment of educational innovations requires central actors with dense relations and high clustering values as well as a certain amount of brokering leverage and a diversity of peripheral weakly tied actors supporting the diffusion of educational innovations. *Rudolf Tippelt, Stepanka Kadera,* and *Christina Buschle* focus their attention on the conditions

within influential networks themselves and discuss the effects of inter-organizational cooperation. In their analysis they reveal characteristics of cooperation and networks against the background of the social innovation of life-long learning and educational transition, and point to the need for more detailed study of these phenomena in future SNA research.

The study authored by *Kati Trempler, Marco Hasselkuß, Carolin Heckersbruch, Cornelia Gräsel, Carolin Baedeker, and Uwe Schneidewind* aims to identify what strengthens or weakens cooperation as well as to determine if there is a covariation between the quality of cooperation in a network and the implementation of "Education for sustainable development" in schools. Along these lines, they analyze exploratory interviews that are considered as a basis for future SNA studies.

Martina Kenk addresses learning environments, supervision networks, and professional careers with respect to the doctoral phase of former PhD students. Drawing on qualitative techniques of ego-centered SNA, she examines the relation between mentoring and professional career, and concludes that the relevance of the supervisory relationship declines with a rising academic position.

The final contribution of the first part by *Kenneth Frank, Yun-Jia Lo,* and *Min Sun* focuses on the *intra*-organizational social networks of teachers and their role in the successful implementation of educational innovations and reforms. Complementing the previous contributions, the authors give an overview of three alternative social network approaches that can be used to specify the role of teacher networks within schools: (1) a *graphic approach* used to characterize the flow of information and knowledge in teacher networks, (2) *social influence models* that allow quantifying the extent to which teachers' beliefs and behaviors are affected by others in their social network, and (3) *social selection models* that allow quantifying how teachers choose the social networks of those with whom they exchange expertise and information relevant to the implementation of the reform.

The study of Frank et al. thus also serves as a bridge to the contributions of Part II, which focus on the social networks of students and aim to foster an understanding of students' learning-relevant cognitions and behaviors as contingent on their embeddedness in social network structures within the learning environment. *Thomas Kindermann* and *Justin Vollet* make a case for the importance of conceptualizing classrooms as social ecologies—considering a student's relations to peers, teachers, and parents in order to gain more detailed insight into the social processes involved in individual academic development. Using the example of students' classroom engagement, the authors present how socio-cognitive mapping strategies can be applied to identify relevant peer groups, and go on to discuss empirical strategies for modelling the conjoint influences of peers, teachers, and parents. The authors also show that peer influence on student engagement is particularly strong for those students who experience their teachers and parents as less involved.

Christian Steglich and *Andrea Knecht* take on the question of influence from a different angle by examining whether teachers base their perceptions of a student's engagement, i.e., his or her study habits, on the characteristics of the peer group that teachers *think* the student belongs to. *Christian Steglich* and *Andrea Knecht* juxtapose teachers' perceptions of a student's peer networks and study habits with a student's actual self-reported friendships and effort-related behaviors.

Chris Baerveldt, Gerhard van de Bunt, and *Marjolijn Vermande* continue this inquiry into self-reported friendships by examining the criteria by which students select their friends. The authors examine how male and female students' friendship choices vary when it comes to selecting new friends, linking up with friends of friends, and the importance placed on similarity of behavior. They also explore what role the predominant function or aim that students attach to friendship (i.e., intimacy or common social activities) plays in the formation of friendships.

In another empirical contribution *Ralf Wölfer* and *Kai Cortina* investigate how characteristics of existing affective relationships between classmates relate to individual students' academic goal orientation. The authors show that students who are central placed within the classroom's network, i.e., who are liked by many classmates, indicate less ego-related achievement goals than students who are less liked. Interestingly, the opposite applies when cliques that are central vs. peripheral within the classroom's network are compared.

The social networks of students can differ with regards to the sharing and exchange of resources and the predominant content of interaction. In their study, *Lysann Zander, Madeleine Kreutzmann* and *Ilka Wolter* focus on peer networks that are based on collaboration and investigate how the density of collaborative networks in classrooms, as well as the degree of students' embeddedness in these networks, relate to students' constructive handling of mistakes.

In a theoretical contribution, *Lysann Zander* and *Bettina Hannover* lay out a framework within which SNA can be used to stimulate future research on learning relevant self-related cognitions such as the academic self-concept. Building on structural analogies between self-knowledge and social networks, the authors posit a reciprocal influence between an individual's self-related cognitions and their social networks, and specify the psychological mechanisms that can account for it.

This special issue ends with an informative summary by *Andreas Herz* who discusses the key concepts and outlines the breadth of methodological approaches used in social network research as well as the potentials and challenges of applying them in future research. The author provides us with a historical dimension of the importance of SNA in educational science: The deep-rooted historical connection between German educational science and social network research that has only recently been adequately recognized (Heidler et al. 2014). It was *Andreas Herz* and his colleagues who reanalyzed the first documented empirical study that used what today would be called a social network approach: the analysis undertaken by a German school teacher named Johannes Delitsch in 1902 (more than three decades before the seminal work of Jacob Moreno on interpersonal relations gave rise to the popularization of sociometric methods) of the social relations among his students, in order to gain a deeper understanding of educational processes in his class.

The contributors to this volume are researchers from disciplines ranging from educational and political science to psychology, sociology, and statistics, who are united by the conviction that SNA research can deepen our understanding of the issues at the core of educational science today. It is our sincere hope that the studies presented in this special issue of the *Zeitschrift für Erziehungswissenschaft* can contribute to a better understanding of the relevance of SNA to researchers, teachers, students, and policy makers, and that the interdisciplinary orientation of this volume will foster

further such collaborations and stimulate an already increased interest in context-oriented educational research.

Finally, on behalf of all authors of this volume we would like to express our gratitude to the anonymous reviewers for their time and valuable feedback.

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