

# INNOVATIVE METHODS TO STUDY SCHOOL SYSTEM DYNAMICS

Gabriela Alonso-Yanez   Barb Brown   Sharon Friesen   Michele Jacobsen

*Werklund School of Education, University of Calgary*

*The transformations currently underway in many school systems point towards teachers becoming actively engaged in research, as well as finding ways to bring new educational research knowledge into school classrooms. In this paper, we discuss two methodological approaches that have strengthened our own research of schools systems: Social Network Analysis and the Social World Arenas framework. We suggest that these analytical approaches are useful tools for studying complex adaptive systems in education and provide the means to improve teachers' scholarship of teaching and learning.*

Keywords: complex adaptive systems, classroom research, social worlds and arenas, social network analysis

## **COMPLEX ADAPTIVE SYSTEMS RESEARCH IN EDUCATION**

Complexity theory attempts to explain how systems, both natural and human, emerge and persist through the self-organizing efforts of localized elements. These systems are referred to as “complex-adaptive” in the literature (Gell-Mann, 1994; Holland, 1995; Marchi, et al. 2014). The central dynamic of a complex adaptive system is the continuous emergence of phenomena that arises from abundant interaction between individuals and elements within the system (Holland,

2016. In M. A. Takeuchi, A. P. Preciado Babb, & J. Lock (Eds.). *Proceedings of the IDEAS: Designing for Innovation*, pp. 12-21. Calgary, Canada: University of Calgary.

1995; Rivkin & Siggelkow, 2007). Researchers within education have borrowed this complexity systems thinking from the natural sciences—some have only used concepts while others sometimes completely adopted a complexity theory paradigm (Davis & Sumara 2006; Jay & Johnson, 2002). Jacobson and Wilensky (2006) argued that within education “complex systems thinking is a dramatic change in perspective that opens up new intellectual horizons, explanatory frameworks, and methodologies that are increasingly important in scientific and professional environments” (p. 12). The use of the complexity metaphor in educational research challenges the reductionist, top-down approach of earlier organizational models and provides a non-linear alternative to describe school systems and school organizational change. When applied in education research, complex adaptive systems reveal flexible and fluid interactions that lack predictable order (Davis & Sumara, 2006; Gell-Mann, 1994). Thus, complexity-influenced research is often shaped by uncertainty and unpredictability. This openness to discovery is what makes this approach so valuable in education. In a teaching context for example, we assume that students’ learning varied in several ways: through the pedagogical approach, by the design of learning activities, and even by the larger school social context. Because complex adaptive systems thinking provides a powerful paradigm for understanding how school systems and school organizations function, researchers in education have found it useful to describe in particular the flexible structures and innovative processes that occur within school at various system levels (Davis, et al. 2012). For instance, the practices of teachers in school classrooms can eventually impact the practices of other teachers and administrators within the larger system of the school or beyond; likewise, the practices of schools leaders can impact teachers and students in the classroom (Timperley & Earl, 2012; Robinson, 2011).

## **TEACHING AS SCHOLARSHIP: TEACHERS AS RESEARCHERS**

Teachers constantly engage in small-scale inquiries within their classrooms. Whereas researchers in education seek to explain or predict phenomena broadly; practitioner teachers often undertake explorations focused on concrete information about situations they have observed, or issues that they encounter in their everyday practice. In this context, teachers are at the center of knowledge production at a school level and thus active agents of change in school systems.

Integrating new ideas about more effective teaching strategies into the daily practice of schools requires that teachers also understand more about how they can think and act differently. Real change requires schools to become places for deliberate and systematic, professional analysis of learning through constant professional learning. Only then, teachers will truly engage in a scholarship of teaching that utilizes evidence-based research and to bring specialist knowledge and skills to bear in doing their work (Brew, 2010 p. 108). To successfully analyze teaching and learning in a school context, teachers then need to become expert methodological practitioners. This will facilitate their work on gathering and rigorously analyzing varied types of classroom-based data.

## **TWO FRAMEWORKS FOR CLASSROOM-BASED RESEARCH**

There is now a considerable body of work reporting on the relevance of scholarship of teaching and learning to teachers and a range of valuable methodological and theoretical frameworks is currently available for teachers to engage in small-scale inquiries and support their practice (Brew, 2010; Dauphinee & Martin, 2000). In this paper, we suggest two methodological frameworks for research: *Social World-Arenas Analysis* (Clarke, 2005) and *Social Network Analysis* (Borgatti, Everett & Johnson, 2013). Both frameworks enact the theoretical tents of

complex systems thinking and can be useful for teachers generating data or working with variables in a classroom context and can contribute to fostering scholarship in teaching.

### **Social World-Arenas Analysis**

The Social World Arenas (SWA) framework defines social worlds as “groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about building their business” (Clarke, 1991, p. 131). For example, social worlds could be groups of educators, students, and administrators who coexist in an educational institution (arena), embracing different ideologies over the approaches to teaching and learning and expressing them through different pedagogical activities, languages, and modes of relation (den Outer, Handley & Price, 2013). An important part of analyzing social worlds and arenas is “boundary delimitation” (Clarke, 2005), which refers to exploring how actors in particular social worlds conduct their work, what activities they prioritize, or what codes they use to create membership or non-membership in the group. SWA explores the negotiations, controversies, and organizational activities of individual and collective actors within school systems. Often these actors are affected by larger social conditions that influence school systems including school cultures, leadership styles, and pedagogical approaches (made up of the values, beliefs, and shared meaning of all stakeholders).

Teachers can apply the social world-arenas research framework using maps or diagrams. The exercise is to lay out the more salient groups/worlds in the research “situation” under inquiry, and to provoke analysis of relations between and among them (Clarke, 2005, par. 19). For example, in a previous study (Friesen, Jacobsen, Brown & Alonso- Yanez; 2016) we used the Social World and Arenas framework to describe connection strengths among diverse stakeholders involved in a provincial level pilot program including: district level leaders (superintendents, district directors);

school administrators (principals and assistant principals) and teachers. Drawing mostly on teacher’s experiences and perspectives at a classroom level system, we represented the types of support that were provided by other stakeholders. In Figure 1, we present an illustration of connection strengths labeled as level one, two or three. A level one connection refers to influences that spark ideas or inspiration for changes among stakeholders. Level two connections refer to influences that provide permission or offer a green-light to move forward through support and encouragement. Level three connections influence through providing structures or processes (including policies) required to implement changes.

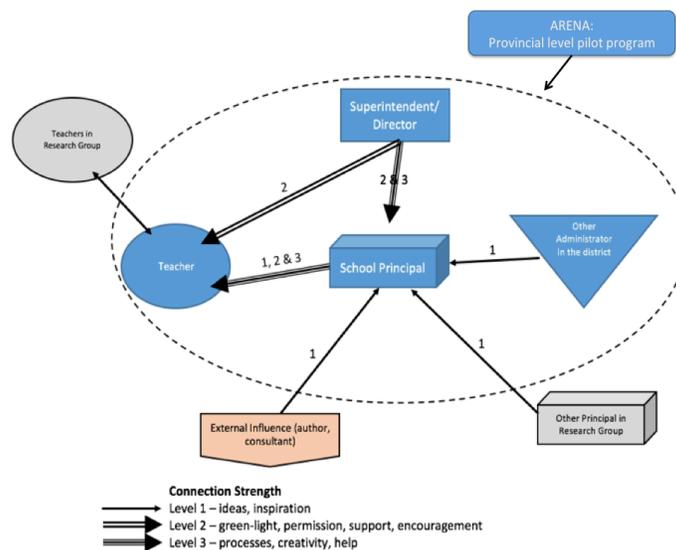


Figure 1. Social Worlds and Arenas diagram

The diagram provides a useful social world and arenas analysis level that makes visible the types of supports offered at school system. It also provides a way to visualize levels of connection strength between school and extra-local system level influences.

An important part of the analysis made evident by a SWA diagram is that it allows us to look at how the social worlds try to maintain their world as separate from others, and how social

legitimation is obtained. Through the social world arenas analysis, teachers can take on school issues or practices and link them to broader socialization processes. This aids understanding of the given issue or process from the perspectives of participants in the different social worlds. The maps or diagrams are then used to analyze a wide range of data sources that have an effect on the classroom environment. They also make it possible to produce a meso-level interpretation of the situation that engages collective action, and its social and organizational dimensions.

### **Social Network Analysis**

Social Network Analysis (SNA) is an increasingly widespread research approach comprising methods from graph theory, statistics, physics, data-mining, and information visualization. While applicable to various disciplines, SNA is useful in education research for both broad and deep analysis of various research data, no matter the area of focus. SNA can be an invaluable tool for assessing and planning interventions in informal networks.

At the most rudimentary level, researchers can represent informal social networks by drawing sociograms or maps for a specific set of people in a particular set of time that show who was connected to whom (Borgatti et al., 2013). Over time, the teacher-analyst can visually grasp patterns of relationships that hold a certain group together.

For example, going back to our provincial level pilot program example, we used SNA to explore the extent of interactions that existed between members of different system levels (internal to the school, external to the school). Figure 2 depicts a network of connections among individuals involved in the pilot provincial program. Here, we see how individuals accessed internal (within the school system) and external (outside the school system) supports. Internal influences refer to supports accessed within the school (other teachers) and school jurisdiction and external influences refer to supports accessed outside of the school and jurisdiction (research literature).

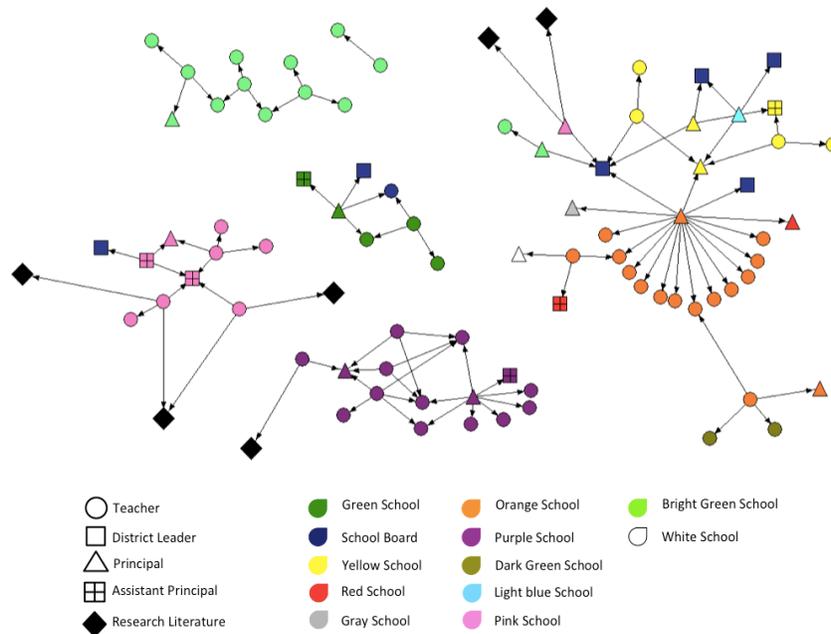


Figure. 2 Social Network Analysis

Social Network Analysis is thus a tool for exploring informal networks that occur in the classroom. SNA provides one of the few methods for making knowledge activities and information flow visible through revealing the relationships between people. In this sense, SNA is a good diagnostic gap-analysis tool to help teachers make planning decisions that can promote greater collaboration within teams, encourage communication among individuals, and enable more effective information flows.

### SIGNIFICANCE

In this paper we have discussed two research methodological approaches: Social Network Analysis and the Social World Arenas framework. Within the context of complex adaptive systems research in education, we hold that these analytical approaches are useful tools for small-scale inquiries within the classroom. We have provided examples to illustrate how these

frameworks have been applied in our research. We suggest that these frameworks provide the means to gather and visualize varied types of data salient to school systems dynamics. These two frameworks allow teachers to generate data, analyze variables in a classroom context and can contribute to fostering scholarship in teaching. The role of scholarship and scholarly work in teaching are important not only to the development of new academic knowledge but also to the development of knowledge about school institutions and school systems in which teachers work.

## References

- Borgatti, S., Martin, E., & Johnson, J. (2013). *Analyzing social networks*. Los Angeles, CA: SAGE Publications, Inc.
- Brew, A. (2010). Transforming academic practice through scholarship. *International Journal for Academic Development*, 15(2), 105-116.
- Dauphinee, D., & Martin, J. (2000). Breaking down the walls: Thoughts on the scholarship of integration. *Academic Medicine*, 75(9), 881-886.
- Clarke, A. E. (1991). Social worlds/arenas theory as organizational theory. In D. R. Maines (Ed.), *Social organization and social process: Essays in honor of Anselm Strauss* (pp. 119-158). New York: Aldine de Gruyter.
- Clarke, A. E. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Thousand Oaks, CA: Sage.
- D'Amour, L., Davis, B. & Sumara, D. (2012). Understanding school districts as learning systems: Some lessons from three cases of complex transformation. *Journal of Educational Change*, 13(3), 373-399. doi: 10.1007/s10833-012-9183-4

Alonso-Yanez, Brown, Friesen, & Jacobsen

Davis, B., & Sumara, D. (2005). Complexity science and educational action research: toward a pragmatics of transformation. *Educational Action Research*, 13(3), 453-465. doi: 10.1080/09650790500200291.

Davis, B., Sumara, D., & D'Amour, L. (2012). Understanding school districts as learning systems” Some lessons from three cases of complex transformation. *Journal of Educational Change*, 13(3), 373-399. doi:10.1007/s10833-012-9183-4.

den Outer, B., Handley, K., & Price, M. (2013). Situational analysis and mapping for use in education research: a reflexive methodology? *Studies in Higher Education*, 38(10), 1504-1521.

Friesen, S., Jacobsen, M., Brown, B., & Alonso Yanez, G. (2016). *Highly adaptive learning systems: Research in seven redesigned high schools in Alberta*. Edmonton: Alberta Education.

Gell-Mann, M. (1994). Complex adaptive systems. In G. Cowan & D. Pines & D. Meltzer (Eds.), *Complexity: Metaphors, models and reality* (pp. 17–45). Reading, MA: Addison-Wesley Publishing Company.

Holland, J. H. (1995). *Hidden order: How adaptation builds complexity*. New York: Basic Books.

Jacobson, M. J., & Wilensky, U. (2006). Complex systems in education: Scientific and educational importance and implications for the learning sciences. *The Journal of the Learning Sciences*, 15(1), 11-34.

Jay, J. K., & Johnson, K. L. (2002). Capturing complexity: A typology of reflective practice for teacher education. *Teaching and Teacher Education*, 18(1), 73-85.

Marchi, J. J., Erdmann, R. H., & Rodriguez, C. M. T. (2014). Understanding supply networks from complex adaptive systems. *BAR-Brazilian Administration Review*, 11(4), 441-454

Alonso-Yanez, Brown, Friesen, & Jacobsen

Meadows, D. H. (2008). *Thinking in systems: A primer*. White River Junction, VT: Chelsea Green Publishing.

Rivkin, J. W., & Siggelkow, N. (2007). Patterned interactions in complex systems: Implications for exploration. *Management Science*, 53(7), 1068-1085.

Timperley, H. & Earl, L. (2012). *Learning and change networks: A background paper on designing networks to make a difference*. Retrieved from [www.vln.school.nz/resources/download/807444](http://www.vln.school.nz/resources/download/807444)

Robinson, V. (2011). *Student-centered leadership*. San Francisco, CA: Jossey-Bass.

Vasconcelos, A. C. (2007). The use of grounded theory and of arenas/social worlds theory in discourse studies: A case study on the discursive adaptation of information systems. *Electronic Journal of Business Research Methods* 5(2), 125-136.