Application of Concept Maps for Conducting Research in Adult Education

Simone C.O. Conceicao
University of Wisconcin-Milwaukee

Susan M. Yelich-Biniecki
Kansas State University

Anita J. Samuel
University of Wisconsin-Milwaukee

Application of Concept Maps for Conducting Research in Adult Education

Simone C. O. Conceição, University of Wisconsin-Milwaukee
Susan M. Yelich Biniecki, Kansas State University
Anita J. Samuel, University of Wisconsin-Milwaukee

Key words: concept maps, research methods, application tools

Abstract: The purpose of this paper is to identify and analyze existing literature in which concept maps specifically were utilized as a research tool. By theorizing from the literature and making connections among different approaches that use concept maps, adult educators-scholars can broaden their understanding of the application of concept maps in adult education research. This paper shows how concept maps can be used as productivity tools for conducting individual and collaborative research and instructional tools for teaching Research Methods courses.

Concept maps have been used in a variety of ways as a tool for conducting research – from problem formulation and illustration, data collection and organization, to data analysis and presentation. As adult educators, we use concept maps when conducting research or working with doctoral students and we decided to conduct a literature review to identify strategies scholars most frequently use with concept maps for better conducting our own research and instructing students. The purpose of this paper is to identify and analyze existing literature in which concept maps specifically were utilized as a research tool. By theorizing from the literature and making connections among different approaches that use concept maps, we can broaden our understanding of the application of concept maps in research in adult education.

Literature Review Methodology
A broad search on the use of concept maps as a research tool was conducted on various academic databases such as EBSCOHost, ProQuest, ERIC, PsychINFO, and Google Scholar. The search was restricted to the years from 1998 to 2014 and focused on the terms "concept map," "concept mapping," "research," "analysis," "presentation," "collection," and "data." Refereed articles, peer-reviewed publications, dissertations, and paper proceedings were included in the literature review and the initial search resulted in 4000 articles. The search was refined to include only publications related to the use of concept maps in research on adult populations. The narrowed scope resulted in 27 refereed journal articles, two dissertations, two published books, and four conference proceedings. These articles are multi-disciplinary in scope from nursing to education. A panel of three reviewers classified the selected articles into empirically based and conceptual publications.

Findings
We found several empirically based publications that describe concept maps as an approach for conducting the study presented in the publication. We also identified conceptual publications that explain applications of concept maps in research without reference to a specific empirical study. Our findings are presented below based on the type of publication they represent.

Empirically Based Publications

Empirically based publications show that concept maps have been used in quantitative and qualitative studies utilizing a variety of methodologies such as experimental, participatory, and interpretivist research. Qualitative approaches often are used throughout all phases of the research process while quantitative approaches are used mostly for data analysis. The majority of the publications utilizing quantitative approaches involved mixed methods studies.

Meagher-Stewart et al. (2012) used concept maps to deconstruct experiences individually and in groups throughout data collection and analysis in qualitative research. Edmunds and Brown (2012) used concept maps to compare the different cognitive structures of subject matter by traditional and nontraditional dentistry students as well as experts and novices to explore knowledge construction before and after an educational intervention. In Sander et al.s' (2012) study, researcher generated concept maps were applied to visualize the relationships among factors that impacted breast cancer survivors' decisions about exercise.

Baugh, McNallen, and Frazelle (2014) used concept maps to collect, reduce, organize, and interpret data. Data were selected by a consensus between the researchers, common themes and patterns were identified, and then an aggregate map from the individual maps was created. Concept maps were used to identify interconnectedness and development of a gestalt; they also facilitated "conceptualization, analytic clarity, and intellectual rigor" (p. 4).

Some qualitative research studies used concept maps for the presentation of data in order to facilitate the explanation of the results through a visual (Meagher-Stewart et. al., 2012; Henderson & Segal, 2013). Concept maps graphically illustrated the concepts and connections identified by participants in areas such as critical thinking in online learning (Morrison, 2006), patient needs in health care (Püschel et al., 2009), and physical activity (Sander et al., 2012). Kandiko and Kinchin (2012) used concept maps to display and articulate results of longitudinal studies by tracking cognitive changes experienced by doctoral students and faculty over the period of course work. Egusa et al. (2010), using an experimental design, studied users' concept maps of a topic before and after they had conducted a Web search on the topic. They used concept maps in data collection, analysis, and presentation of quantitative results. They also transcribed data points so that the concept maps could be studied quantitatively.

Most mixed methods studies in our literature review utilizing concept maps used a participatory approach with multivariate statistical analyses, an analysis of more than one statistical variable at a time, and multidimensional scaling as well as hierarchical cluster analysis. A high level of participant engagement in the collection and analysis of data is noted as a benefit. These studies utilized specific software for the quantitative analysis, such as Concept Systems Software (Scahill, Harrison, & Carswell, 2010), and encompassed phases such as item generation, sorting, and rating (Bedi & Alexander, 2009; Burke et al, 2009; Nalavany, Carawan, & Rennick, 2011). Bedi and Alexander (2009) asked participants in counseling to generate statements of the counseling experience and then self-categorize these statements, which the authors assert reduces researcher bias in statement categorization. Then, based on participants' sorting, the statements were statistically analyzed through multivariate analysis.

Burke et al. (2009) also used concept maps throughout data collection and analyses. Their study explored the characteristics of mental health that could impact neighborhoods in positive and negative ways. Participants were involved in brainstorming, sorting themes, and rating. Researchers quantitatively analyzed data based on socioeconomic status and gender.

Burke et al. (2005) describe how concept maps were used in participatory qualitative research in public health using a quantitative methodology through concept mapping software. Their work involved quantifying the qualitative research process. Concept maps allowed for the

collection of a wide range of participant-generated ideas. Results from the quantitative analysis were used to produce illustrative cluster maps depicting relationships of ideas in the form of clusters. Using group and individual level data collection, concept maps enabled analyses of how themes related to each other.

Van Manen et al. (2012) studied "patient characteristics pertinent to treatment selection for patients with personality disorders" (p. 481). They describe data collection and analysis phases using concept maps as: generation of the concepts, sorting and rating of the concepts, statistical analysis, and interpretation session. Trochim and Kane's (2005) mixed methods study focused on generating a plan to use funds from a U.S. tobacco settlement. Concept maps generated by diverse stakeholders were used to create a composite thinking of the group, guide action planning, and development. Scahill, Harrison, and Carswell (2010) used concept maps in mixed methods research to develop a model of organization effectiveness for use in community pharmacies. Again, brainstorming and unstructured scoring were used to collect and conduct a preliminary analysis of data. Concept Systems Software was used to generate visual maps, which then could inform a potential model.

In a slightly different approach, Campbell and Salem (1999) used concept maps in a feminist research framework to examine the community response to rape. The mixed methods approach in data collection and analysis provided an evaluation technique to address specifically how the community systems that provide support to rape victims could be more responsive to victims. Participants were brought together in order to generate themes and the process included "the direct expression of participants' voices with minimal interpretation by researchers" (p. 85). The themes were interpreted by concept map software and then advocates or participants further interpreted and organized themes.

Finally, in mixed methods studies, concept maps were used to present findings such as in Bedi and Alexander's (2009) work. Chandrasegaran, Treagust, and Mocerino (2008) looked at students' ability to represent connections and relationships in chemistry education. Concept maps were not used in the educational intervention; however, they were used in the article to visualize the context of the content of chemical reactions.

Conceptual Publications

Several conceptual publications show how scholars are incorporating concept maps into their research for data collection, analysis, and presentation. One publication shows how concept maps are used to conduct large literature reviews while several others show how concept maps are used for formulating and illustrating a problem, documenting and synthesizing ideas, analyzing open-ended survey responses, collecting data through interviews, explaining a theory, analyzing themes relationships, and articulating and presenting findings through a visual.

Carnot (2006) explains how concept maps can be used to organize information for large-scale literature reviews and technical reports. Concept maps can help integrate the topics using the main dissertation themes, identify major research issues and categories, and look for cross-linked topics and issues relevant across domains. Carnot describes how concepts can be used to explore ideas and relevant concepts in individual research, describe key concepts and tasks in the subdomain, and describe relevant theory and key researchers in a study.

Butler-Kisber and Poldma (2010) describe their use of concept maps to document and synthesize ideas to drive the analysis in qualitative inquiry. The visual process allows for new ideas to emerge and research issues can be documented quickly throughout the research process. The challenge is to integrate concept maps systematically.

Jackson and Trochim (2002) write about the use of concept maps as an alternative approach for the analysis of open-ended survey responses. Concept maps provide greater reliability and validity over word-based and code-based methods when analyzing open-ended survey questions. However, the amount of data may overwhelm those sorting the data. Adding researcher judgment within statistical mapping can add important interpretation and contextual analysis rather than a forced computer categorization of open-ended survey results.

Wheeldon and Faubert (2009) write that concept maps for data collection in qualitative research might provide an alternate means of communicating, rather than just the verbal or written narrative. Concept maps give a "snapshot" of perception and allow for the refining and honing of additional data collection processes.

Kinchin, Streatfield, and Hay (2010) describe how they use concept maps as interview prompts to check data saturation, present data, provide creative coding, and analyze data to structure more meaningful interviews. One challenge of using concept maps is if the interview is not exploring concepts or relationships or the interviewee is unable to articulate the relationships. It can also be a challenge if respondent misrepresents relationships or the interviewer does not fully understand the context of the participant. It is even more limiting if the interview has a prescriptive interview process. Brightman (2003) discusses the interviewer as facilitator and data gatherer, suggesting reflexivity between the data collection as the participants' constructed the concept maps and the interpretation and analysis of the data as the researcher continually gathers feedback from participants to verify meaning. Morgan, Fellows, and Guevara (2008) articulate this reflexivity further by discussing the use of concept maps in focus groups. Participant produced concept maps provide collection and analysis processes as participants generate and compare concept maps they created at different points of multiple interviews. This process allows participants and researchers negotiate meaning making.

Maxwell (2013) shows how to use concept maps to explain a conceptual framework or theory by pulling together and making visible what the implicit theory is, viewing the implications of the theory, its limitations, and its relevance for the study. Concept maps can help see unexpected connections, or to identify holes or contradictions in the theory and figure out ways to determine themes. Challenges to the use of concept maps is that they do not automatically create a paper trail of attempts.

Lastly, Daley (2004) and Daley, Cañas, and Stark-Schweitzer (2007) suggest the use of concept maps for framing a research project, reducing qualitative data, analyzing themes and seeing interconnections in a study, analyzing participants' experience and linking them to new experiences, seeing relationships between theory and practice, facilitating cross group comparisons, and drawing study conclusions.

Applications of Concept Maps in Research and Conclusions

Our literature review reveals that concept maps have been used for a variety of purposes utilizing different methodological approaches. Qualitative approaches often use concept maps in all phases of the research process: **problem formulation** (generate and illustrate the problem); **literature review** (explain a conceptual or theoretical framework, describe relevant theory, identify key researchers on a literature review, and identify major issues and categories of studies), **data collection** (provide a snapshot of perception to refine and hone the data collection process, and check data saturation), **data analysis** (reduce, organize, and interpret historical data; document and synthesize ideas to drive analysis; deconstruct experiences; generate individual and group themes; analyze themes and interconnections; and verify meanings), and **data**

presentation (articulate and present findings, show theory-to-practice relationships, and develop a model). Quantitative approaches tend to use concept map software to explain, display, and articulate results; compare before and after behaviors; collect participant-generated ideas; visualize relationships among data; and generate, sort and rate, and interpret findings. Based on our findings mixed methods approaches seem to be prevalent. For the adult-educator-scholar, concept maps can serve as productivity tools for conducting individual and collaborative research. For the adult educator, concept maps can serve as instructional tools for teaching Research Methods courses and helping students during their dissertation process.

References

Baugh, N., McNallen, A., & Frazelle, M. (2014). Concept mapping as a data collection and analysis tool in historical research. *The Qualitative Report*, *19*(13), 1-10.

Bedi, R. P., & Alexander, D. A. (2009). Using multivariate concept-mapping for examining client understandings of counseling. *Canadian Journal of Counselling and Psychotherapy*, *43*(2), 76-91.

Brightman, J. (2003, May). Mapping methods for qualitative data structuring (QDS). In *Strategies in qualitative research: methodological issues and practices using QSR NVivo and NUD* IST Conference,* London, UK.

Burke, J. G., O'Campo, P., Peak, G. L., Gielen, A. C., McDonnell, K. A., & Trochim, W. M. (2005). An introduction to concept mapping as a participatory public health research method. *Qualitative Health Research, 15*(10), 1392-1410.

Burke, J., O'Campo, P., Salmon, C., & Walker, R. (2009). Pathways connecting neighborhood influences and mental well-being: Socioeconomic position and gender differences. *Social Science & Medicine*, *68*(7), 1294-1304.

Butler-Kisber, L., & Poldma, T. (2010). The power of visual approaches in qualitative inquiry: The use of collage making and concept mapping in experiential research. *Journal of Research Practice*, *6*(2), 1-17.

Campbell, R., & Salem, D. A. (1999). Concept Mapping as a feminist research method examining the community response to rape. *Psychology of Women Quarterly, 23*(1), 65-89.

Carnot, M. J. (2006). Using concept maps to organize information for large scale literature reviews and technical reports: Two case studies. In A. J. Cañas, & J.D. (Eds.). Novak. Proceedings of the Second International Conference on Concept Mapping. São José, Costa Rica, 225-228.

Chandrasegaran, A. L., Treagust, D. F., & Mocerino, M. (2008). An evaluation of a teaching intervention to promote students' ability to use multiple levels of representation when describing and explaining chemical reactions. *Research in Science Education*, *38*(2), 237-248.

Daley, B. J. (2004, September). Using concept maps in qualitative research. In *Proceedings of the First International Conference on Concept Mapping*. Universidad Pública de Navarra, Spain, 14-17.

Daley, B. J., Canas, A. J., & Stark-Schweitzer, T. (2007). CmapTools: Integrating teaching, learning, and evaluation in online courses. *New Directions for Adult and Continuing Education, 2007*(113), 37-47.

Edmunds, S., & Brown, G. (2012). Doing qualitative research in dentistry and dental education. *European Journal of Dental Education*, *16*(2), 110-117.

Egusa, Y., Saito, H., Takaku, M., Terai, H., Miwa, M., & Kando, N. (2010, August). Using a concept map to evaluate exploratory search. In *Proceedings of the third symposium on Information interaction in context* (pp. 175-184). ACM.

Henderson, S., & Segal, E. H. (2013). Visualizing qualitative data in evaluation research. In T. Azzam & S. Evergreen (Eds.), *Data visualization, part 1*. New *Directions for Evaluation, 139,* 53-71.

Jackson, K. M., & Trochim, W. M. (2002). Concept mapping as an alternative approach for the analysis of open-ended survey responses. *Organizational Research Methods*, *5*(4), 307-336.

Kandiko, C. B., & Kinchin, I. M. (2012). What is a doctorate? A concept-mapped analysis of process versus product in the supervision of lab-based PhDs. *Educational Research*, *54*(1), 3-16.

Kinchin, I. M., Streatfield, D., & Hay, D. B. (2010). Using concept mapping to enhance the research interview. *International Journal of Qualitative Methods*, *9*(1), 52-68.

Maxwell, J. A. (2013). Qualitative research design: An interactive approach. Los Angeles, CA: SAGE.

Meagher-Stewart, D., Solberg, S. M., Warner, G., MacDonald, J., McPherson, C., & Seaman, P. (2012). Understanding the role of communities of practice in evidence-informed decision making in public health. *Qualitative Health Research, 20*(10)*,*1-17.

Morgan, D., Fellows, C., & Guevara, H. (2008). Emergent approaches to focus group research. *Handbook of Emergent Methods*, 189-205.

Morrison, D. (2006). Critical thinking in a collaborative online learning environment. *Advanced Technology for Learning, 3*(4), 255-262.

Nalavany, B. A., Carawan, L. W., & Rennick, R. A. (2011). Psychosocial experiences associated with confirmed and self-identified dyslexia: A participant-driven concept map of adult perspectives. *Journal of Learning Disabilities*, *44*(1), 63-79.

Püschel, K., Thompson, B., Coronado, G., Gonzalez, K., Rain, C., & Rivera, S. (2009). 'If I feel something wrong, then I will get a mammogram': Understanding barriers and facilitators for mammography screening among Chilean women. *Family Practice*, cmp080, 1-8.

Sander, A. P., Wilson, J., Izzo, N., Mountford, S. A., & Hayes, K. W. (2012). Factors that affect decisions about physical activity and exercise in survivors of breast cancer: A qualitative study. *Physical Therapy*, *92*(4), 525-536.

Scahill, S. L., Harrison, J., & Carswell, P. (2010). What constitutes an effective community pharmacy?—development of a preliminary model of organizational effectiveness through concept mapping with multiple stakeholders. *International Journal for Quality in Health Care*, *22*(4), 324-332.

Trochim, W., & Kane, M. (2005). Concept mapping: an introduction to structured conceptualization in health care. *International Journal for Quality in Health Care*, *17*(3), 187-191.

Van Manen, J. G., Kamphuis, J. H., Goossensen, A., Timman, R., Busschbach, J. J. V., & Verheul, R. (2012). In search of patient characteristics that may guide empirically based treatment selection for personality disorder patients-a concept map approach. *Journal of Personality Disorders*, *26*(4), 481-497.

Wheeldon, J., & Faubert, J. (2009). Framing experience: Concept maps, mind maps, and data collection in qualitative research. *International Journal of Qualitative Methods*, *8*(3), 52-67.