The manifestation of graph-theoretic methods in mathematics education research: A metasummary of intercontinental conference proceedings

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In this poster, I present a metasummary of articles employing graph-theoretic methods (i.e., Graphs, Network Analysis, Maps, etc.) published in proceedings from North American (SIGMAA-RUME) and European (CERME) mathematics education conferences from 2015 to 2022. I use the results of this metasummary to describe international trends in the choice of method and prominent research topic themes in mathematics education research amongst conference proceedings articles employing graph-theoretic methods.

Keywords: meta-analysis, graph theory, research methods, mathematics education research

Leveraging the mathematical definition of a graph (Chartrand et al., 2016), I define a *graph-theoretic method* as a research method that makes use of a set of objects and the relationships between them. In this poster presentation, I answer the following research questions: (RQ1) *What are the graph-theoretic methods present in mathematics education research (i.e., Graph Theory, Social Networks, Mapping, etc.)?* and (RQ2) *What topics in mathematics education research are studied using graph-theoretic methods?*

To answer these questions, I conducted a metasummary, a type of qualitative meta-analysis that relies on descriptions of broad research trends rather than a typical interpretive synthesis (Timulak, 2014), of prominent intercontinental mathematics education conference proceedings published in the past eight years. For an article to be included in this analysis, it must (1) be published in a SIGMAA-RUME or CERME Conference proceeding from 2015 to 2022, a collection of 3,940 articles, and (2) employ a graph-theoretic method, narrowing the analysis to 80 articles (26 from RUME proceedings and 54 from CERME proceedings). The articles analyzed represent a diverse, international perspective of 21 countries spanning 5 continents. A full list of articles analyzed is available at https://aub.ie/1lKIDG.

Open coding (Thornberg & Charmaz, 2014) was used to determine graph-theoretic methods, while a combination of open coding, thematic analysis (Thornberg & Charmaz, 2014), and social network analysis (specifically degree centrality) (yEd – graph editor, 3.23.2) was used to extract prominent research themes. Results of the analysis indicate the existence of 6 graph-theoretic methods: Network Analysis (Hannula & Moreno-Esteva, 2017), Graphs (Johns et. al., 2016), Maps (Andrews-Larson & McCrackin, 2018), Grids (Watson & Jones, 2015), Flowcharts (Anwar & Goedhart, 2020), and Data Visualization (Van Steenbrugge, 2022), which are distributed differently between RUME and CERME articles. The results also indicate that graph-theoretic methods are employed in a wide variety of topics across mathematics education research, whose prominent themes include Teachers (Horsman, 2022), Students (Kanwar & Mesa, 2022), Mathematics Education Research (Hannula & Moreno-Esteva, 2017), Learning (Lyublinskaya & Du, 2022), Setting (Funk et. al., 2022), Pedagogy (Andrews-Larson & McCrackin, 2018), Curriculum (Henriksen, 2022), and Hot Topics (Kim & Andrews-Larson, 2022). The articles cited here exemplify each type of method and research theme.

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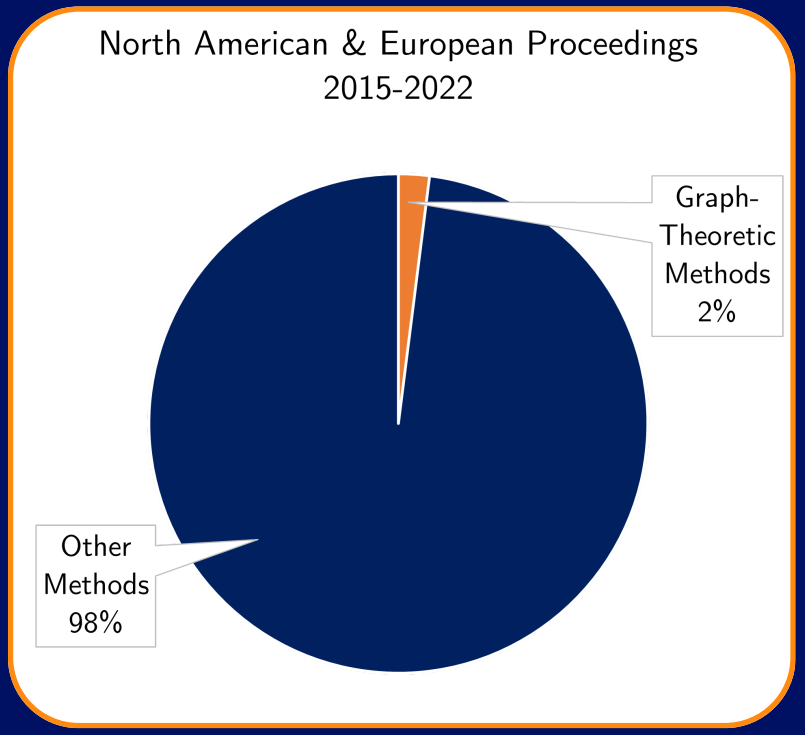
Graph-theoretic methods are uncommon in Mathematics Education research. However, there is an overwhelming notion that our shared knowledge is a graph.



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NETWORK	1,861
CONNECTION	5,553
RELATIONSHIP	8,935