**Engaging with Contemporary Challenges Through Science Education. - Selected papers from the ESERA 2019 Conference**

**Chapter Review Form**

Notes:

This is a single blind review process. The identity of authors is known to reviewers, but reviewers are anonymous to authors. Draft chapters are not blinded for review.

**Due date for submission of your review (to** [**olivia.levrini2@unibo.it**](mailto:olivia.levrini2@unibo.it) **: May 12th 2020)**

**Reviewer #2**

**Chapter title:** Network Analysis Of Changes To An Integrated Science Course Curriculum Over Time

**Chapter authors:** Jesper Bruun, Ida Viola Kalmark Andersen, and Linda Udby

The Editors would appreciate your appraisal of this draft chapter, **responding to the questions below to structure your review**.

1. Does the chapter clearly engage with research on science education?

Yes, the chapter clearly engages with research on science education. This work examines versions of the official science curriculum for Danish secondary students from 2004 to 2010. They use critical discourse analysis (CDA) and thematic discourse network analysis (TDNA) in a mixed methods design to identify and study how the major themes of the curriculum change over time. This analysis, by making explicit how each major theme is related in the curriculum, may provide a basis for professional development training to ensure classroom practices reflect the curriculum authors’ intention. Further, it could be used to study the political and educational intentions within the documents and how those changed over time and interacted with the perception and implementation of the curriculum.

1. Does the chapter make an original contribution to this research field?

Yes, this chapter makes an original contribution to the research field. Using their novel method, the authors discovered thirteen themes in the Danish Basic Science Curriculum (BSC). In this chapter, they restrict themselves to the four most central themes: Structural Demands to the BSC, Importance of Science in a Bildung perspective, Implementation of Teaching, and BSC Identity as a Course.

Their findings are interesting and important. For example, while the Implementing of Teaching and the Structural Demands of the BSC would seem to be closely related, TDNA does not link them together. The authors identify this an a disconnect which can lead to different interpretations of the relationship between the organization of the curriculum and how that connects to the methods of instruction used in the classroom.

The authors also show that the BSC course identity and the Bildung perspective of Science begin in 2004 as separate themes. As the curriculum is revised, the course identity, which connected student work to particular subjects, and the Bildung perspective of Science as a set of methods and ideas necessary for all citizens combine. By 2010, the idea of Science is central and both the students’ work and subjects that are covered are only connected through the larger curricular goal.

1. Are the theoretical and methodological frameworks made explicit, as appropriate?

I think the theoretical framework is sufficiently explicit, but I would like the authors to expand slightly on the TDNA method.

1. Since different clustering algorithms have different strengths, weaknesses, and assumptions, it would be helpful to someone who is familiar with network analysis to know that you used Infomap.
2. Infomap is not deterministic. How stable was the clustering reported here? Is it an average of many runs or just a single application of the algorithm?
3. What is the advantage of using TDNA over Natural Language Processing techniques? At the end of the TDNA section, the explanation of finding new rules, such as removing the all tenses of the verb to be or removing prefixes and suffixes, is standard pre-processing for NLP. What’s the advantage to this method over the more widely used data science techniques of NLP?
4. I understand that the original network is directed to account for word order. It’s less clear what the directed ties in Figure 2 represent. I assume that it is the net flow between the two clusters. How should I interpret the fact that Bildung words come before Competences words in the text? Is it meaningful?
5. In the second paragraph of the Discussion, the theme *inductive* –> *teaching principle* –> *prioritise* –> *autonomous* –> *work processes* is said to connect to teaching. Does this mean that “teaching principle” is equivalent to “teaching” in the network?
6. In the same paragraph, does using directed edges affect the clustering? For instance, consider the phrase “active learning”. A random-walk-based clustering algorithm that considers the direction of edges could go from active to learning, but not learning to active. In this case, the direction is due to the rules of English grammar instead of a meaningful distinction. I don’t know Danish, but do its word order rules get picked up by TDNA? Could that be a reason why that theme doesn’t connect well to the network?
7. Does the chapter take appropriate account of the previous scholarly work on the issues addressed?

To the extent of my knowledge, it seems to. However, the reference to Bohlin, et al. 2014 about the Map Equation does not appear in the text.

1. Is the quality of writing at an appropriate academic standard and is it accessible and interesting to an international and diverse readership?

Yes, the writing is clear and without mistakes. I did notice a small number of typos, listed below:

1. Introduction, page 1: I think “could alleviate teachers’ experiences” should be “could alleviate teachers’ negative experiences” or “could improve teachers’ experiences.”
2. First paragraph, page 3: I’m not sure what the sentence starting “For purposes of this paper…” is trying to say.
3. First paragraph, page 5: “we converted each BSC curriculum document is converted”
4. Please note that the length limit is 5000 words and the paper is expected to be 10 pages in print. If the paper exceeds these limits, please comment on how the length could be shortened, where the use of figures may be reduced, and where it may be possible to eliminate references.

It is under the limit now, but it may not be if my suggestions are incorporated into the text.

I would consider removing lines at the end of the Methodology about adding rules. This is a technical detail and I’m not sure it adds enough to the reader’s understanding of the method or the results to be included. I think you could go straight from “…new interpretations in light of the CDA.” To “Having made new networks…”.

Another suggestion is that the authors consider removing the discussions of interdisciplinarity. This discussion takes up two paragraphs in the section on the BSC, the paragraph in the Evolutions of themes subsection that starts, “As seen in Table 1…”, and a large part of the first paragraph of the Discussion. While this may be an important consideration in the larger research project on the BSC, it doesn’t fit comfortably here. The stated goals of the paper to introduce this new method, to find themes and relationships between themes in the BSC curriculum, and to show how the themes change over time are all accomplished independent of the ideas of how the expectation of interdisciplinarity and pluridisciplinarity change over time. Since the ideas don’t show up the networks pictured in the text, they may be cut. Then, the method could be expanded on to more clearly explain how it works.

1. Any other feedback or suggestions:

The paper describes an interesting method and application. I enjoyed it!