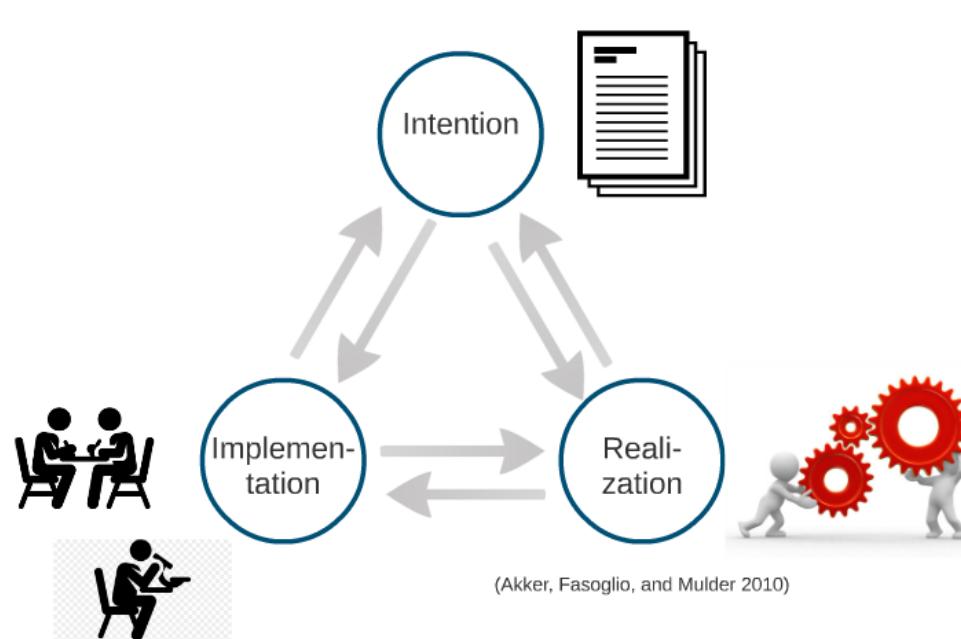


NETWORK ANALYSIS OF CHANGES TO AN INTEGRATED SCIENCE COURSE CURRICULUM OVER TIME

J. Bruun¹, I. V. K. Andersen,^{1, 2} J. H. Overgaard^{1, 2}

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Roles of official curriculum documents

Official educational documents often reflect an agglomeration of political intentions at a given time and often change in light of educational policy changes (Dolin & Evans 2018).

The wording of particular curriculums can influence the perceived possibilities for teachers, teacher educators, and other stakeholders in implementing new curricula (Evans & Dolin 2018).

Analysing themes that emerge in official documents may play an important role in understanding the interplay between intentions, implementation and realisation of lawfulness.

The Basic Science Course in Denmark

In many countries, ideas of inquiry and scientific literacy have been woven into national curriculums (Evans & Odlin 2018).

In Denmark, ideas of inquiry and SL (and also interdisciplinarity and Bildung) were implemented officially in the largest of the four national upper secondary programs (called *six*) in 2004.

This was done through the introduction of the Basic Science Course (BSC, "Afalta af 28. maj" 2003). In Danish: Naturvidenskabeligt Grundlærlæs.

The curriculum first was changed in 2007, 2010, and recently in 2017.

Our analysis restricted to 2004, 2005, and 2006.

References

Discussion: The nature of thematic maps

Like all maps the thematic maps reduces information, and knowledge about the nature of these kinds of maps is needed to interpret them.

Thematic maps give us a birds-eye view of how the text flows - how themes are connected in terms of how words follow each other.

In interpreting themes, a strong link to the original formulations needs to be made via continuous alignment with discourse analysis. Themes should be triangulated with other data and findings. See Andersen (2017) for a thorough triangulation between these maps, implemented, and realized capitals.

Mix of qualitative and quantitative, where the quantitative is in service of the qualitative (Johnson & Onwuegbuzie 2004).
Method is a possible tool for set inquiry study (Lincoln & Guba 1985), in that decisions to remove/reduce words and other 'rules' applied to

Research questions

Educational systems are highly complex - also with regards to policy documents (Evans et al 2018).

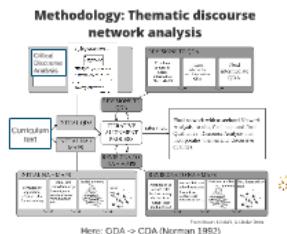
This warrants an integration of quantitative and qualitative perspectives into a mixed methods design (Johnson & Onwuegbuzie 2004).

This study uses a recently developed mixed methods methodology (Bruun et al 2019) to extract and interpret themes in curriculum texts and their interconnections.

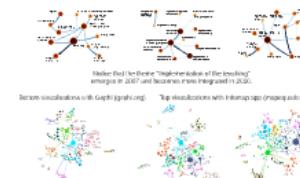
Which interconnected themes emerge as prevalent as in the Danish B2B customer needs for years 2004, 2007, and 2010?

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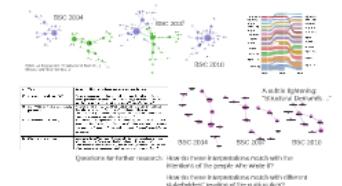
How do selected themes evolve through years 2004, 2007, and 2010?



Interconnected themes



Evolving themes at different scales



1) Dpt. of Science Education, University of Copenhagen. 2) Roskilde Gymnasium

Roles of official curriculum documents

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The curriculum text was changed in 2007, 2010, and recently in 2017.

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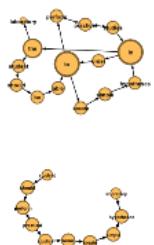
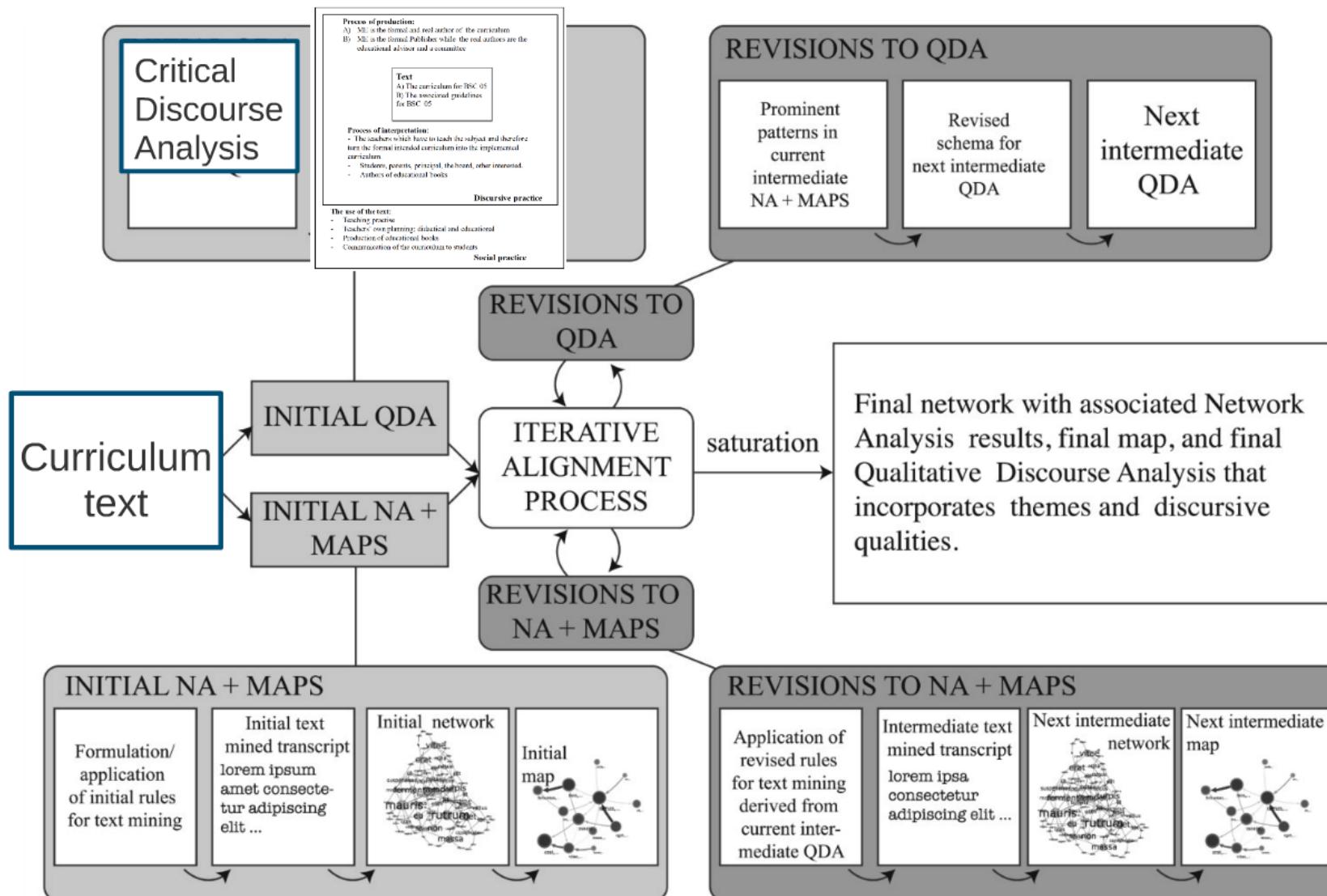
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Which interconnected themes emerge as prevalent as in the Danish BSC curriculum texts for years 2004, 2007, and 2010?

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Methodology: Thematic discourse network analysis



From Bruun, Lindahl, & Linder 2019

Here: QDA -> CDA (Norman 1992)

Process of production:

- A) ME is the formal and real author of the curriculum
- B) ME is the formal Publisher while the real authors are the educational advisor and a committee

Text

- A) The curriculum for BSC 05
- B) The associated guidelines for BSC 05

Process of interpretation:

- The teachers which have to teach the subject and therefore turn the formal intended curriculum into the implemented curriculum.
- Students, parents, principal, the board, other interested.
- Authors of educational books

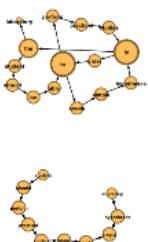
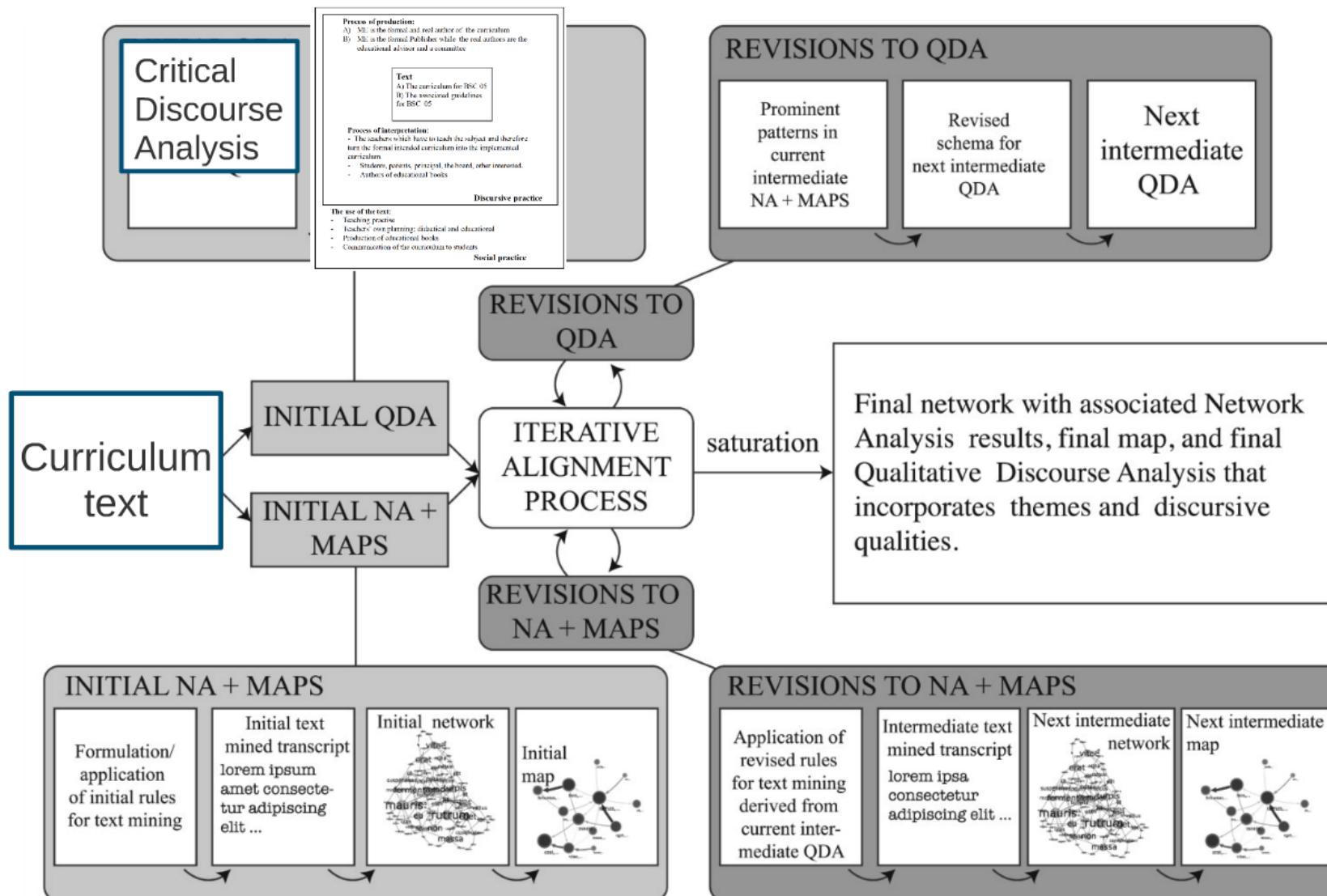
Discursive practice

The use of the text:

- Teaching practise
- Teachers' own planning; didactical and educational
- Production of educational books
- Communication of the curriculum to students

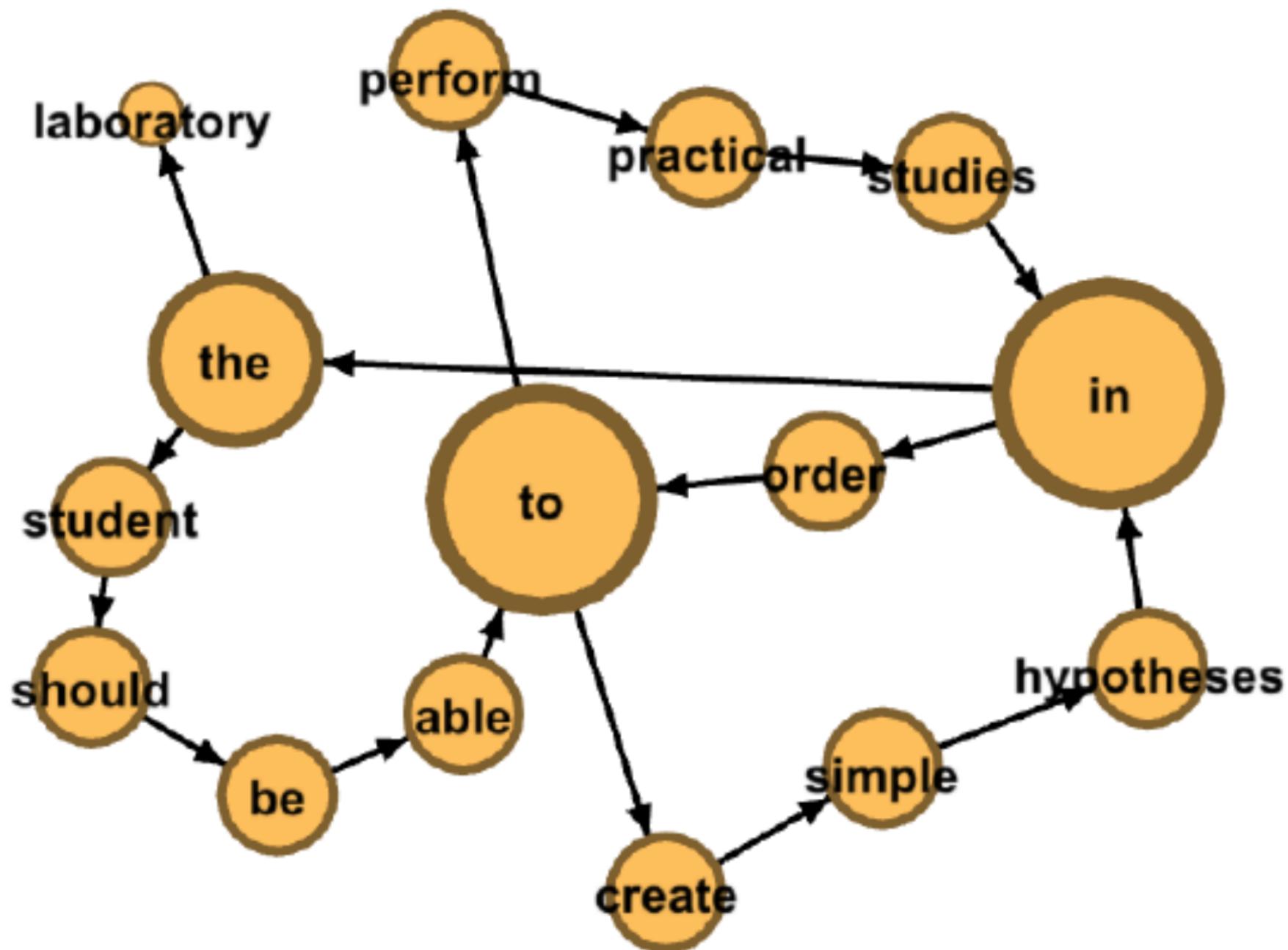
Social practice

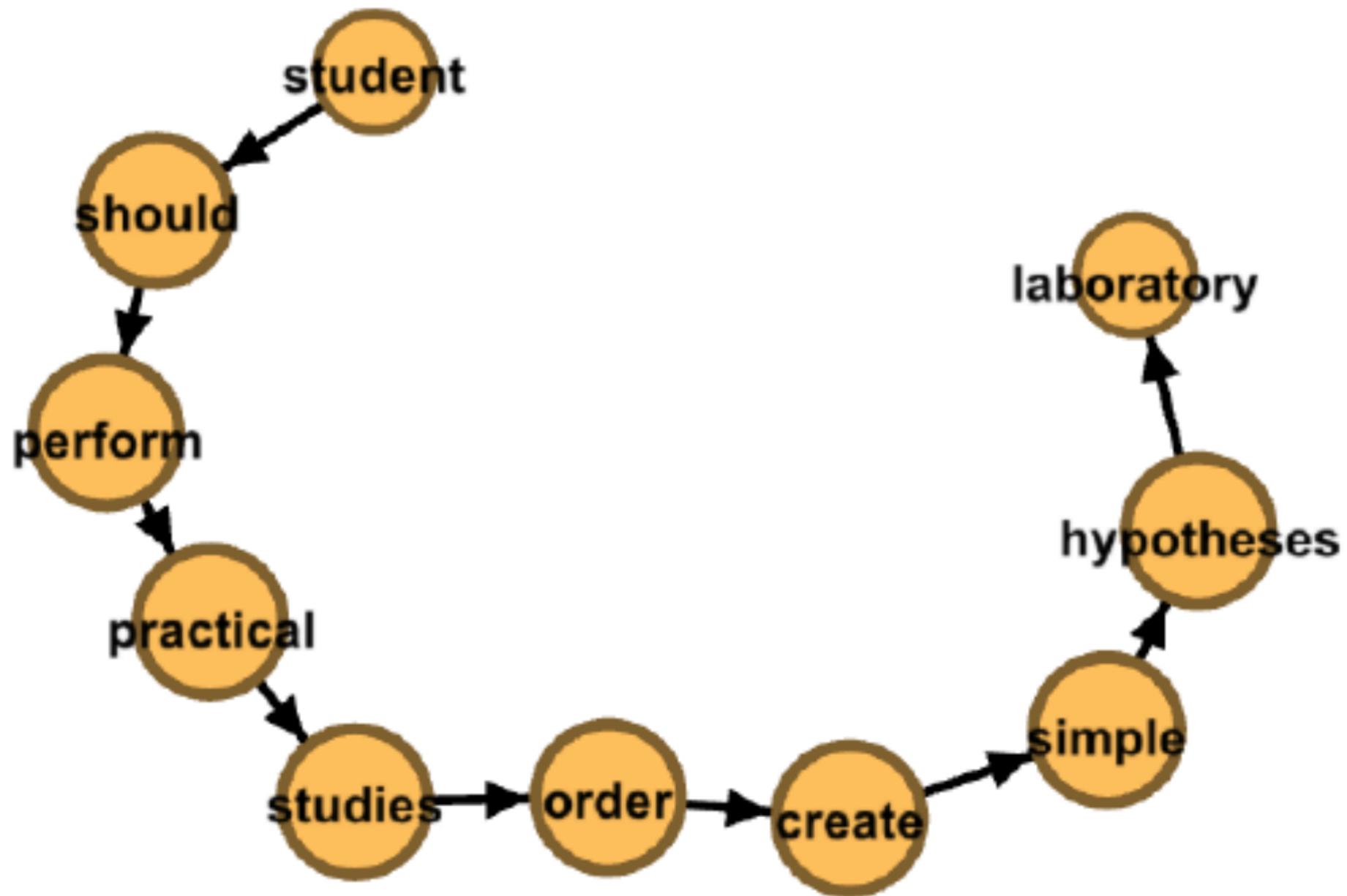
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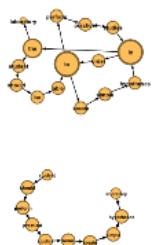
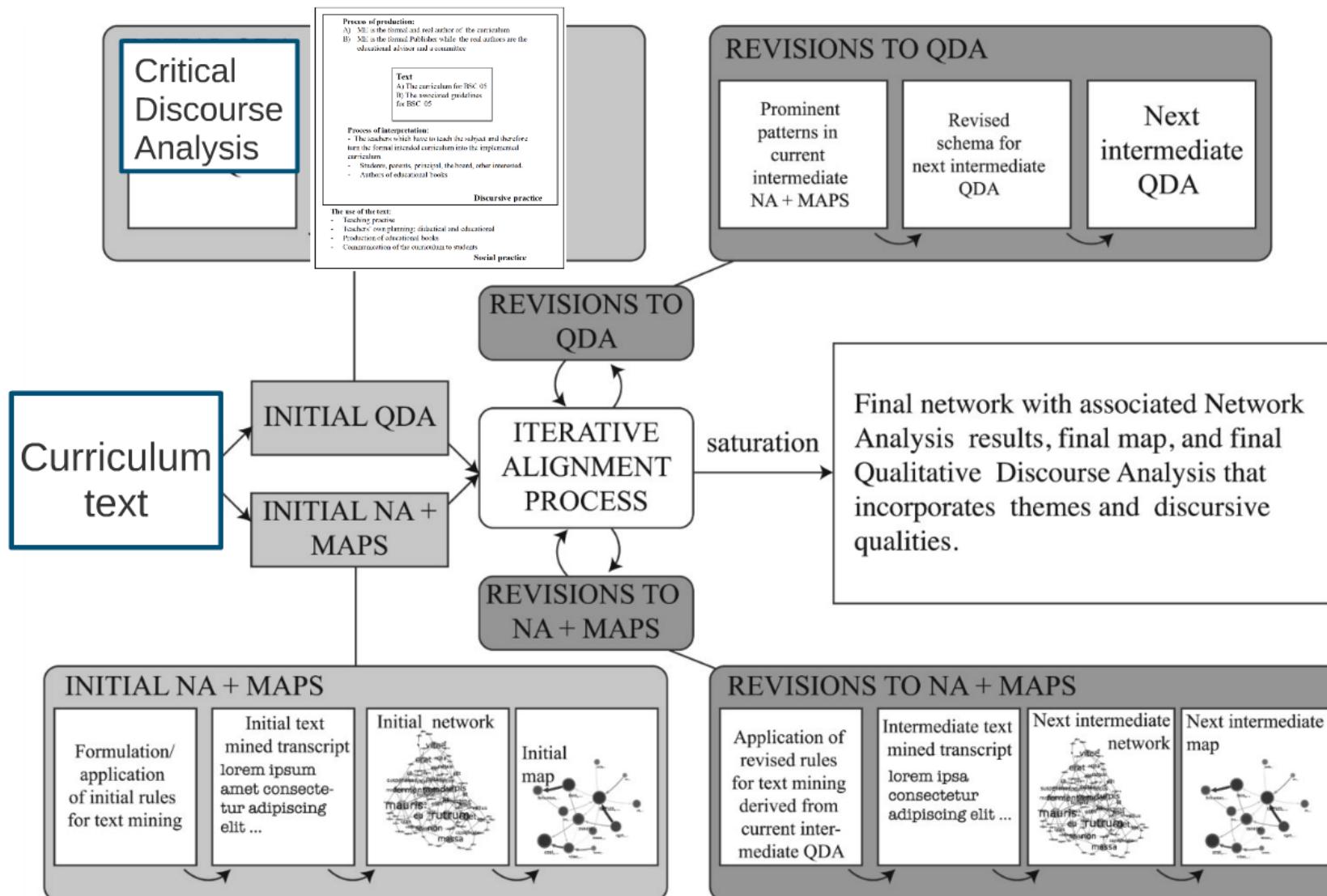
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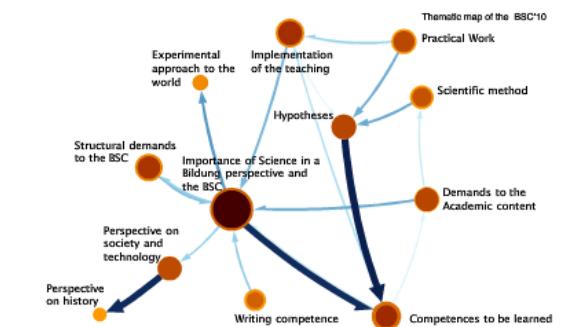
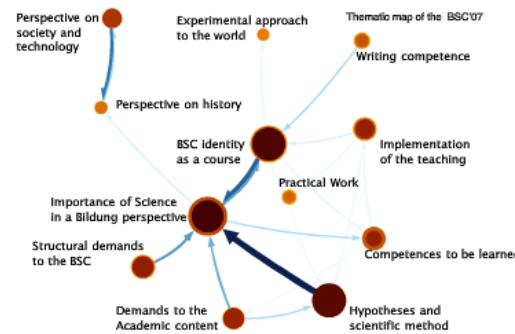
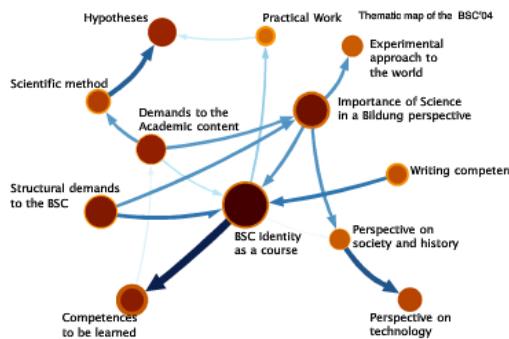
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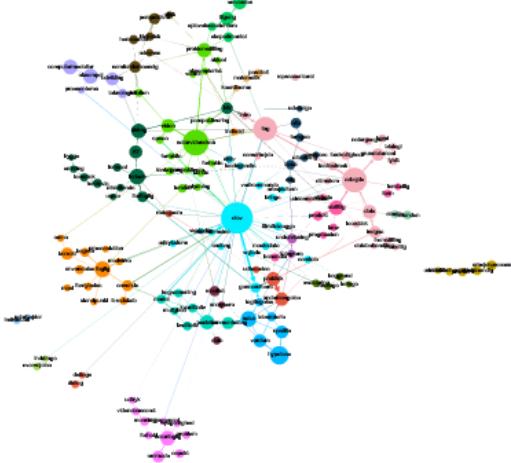
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Interconnected themes

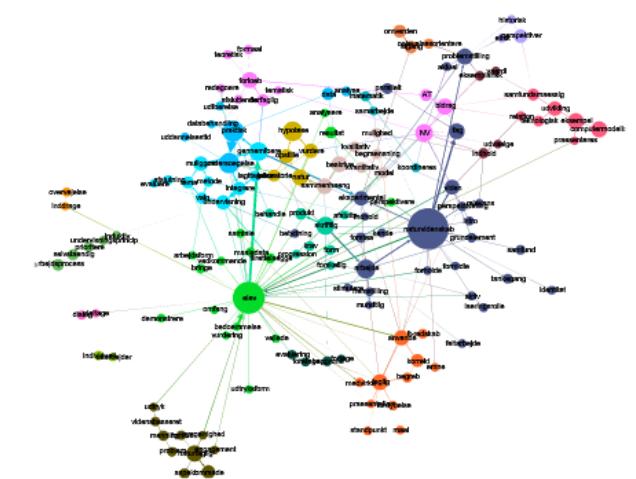
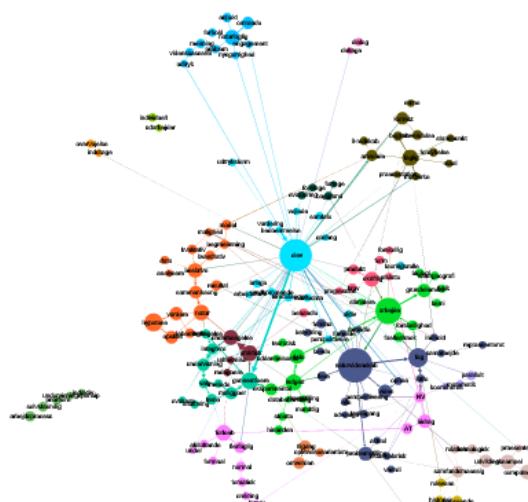


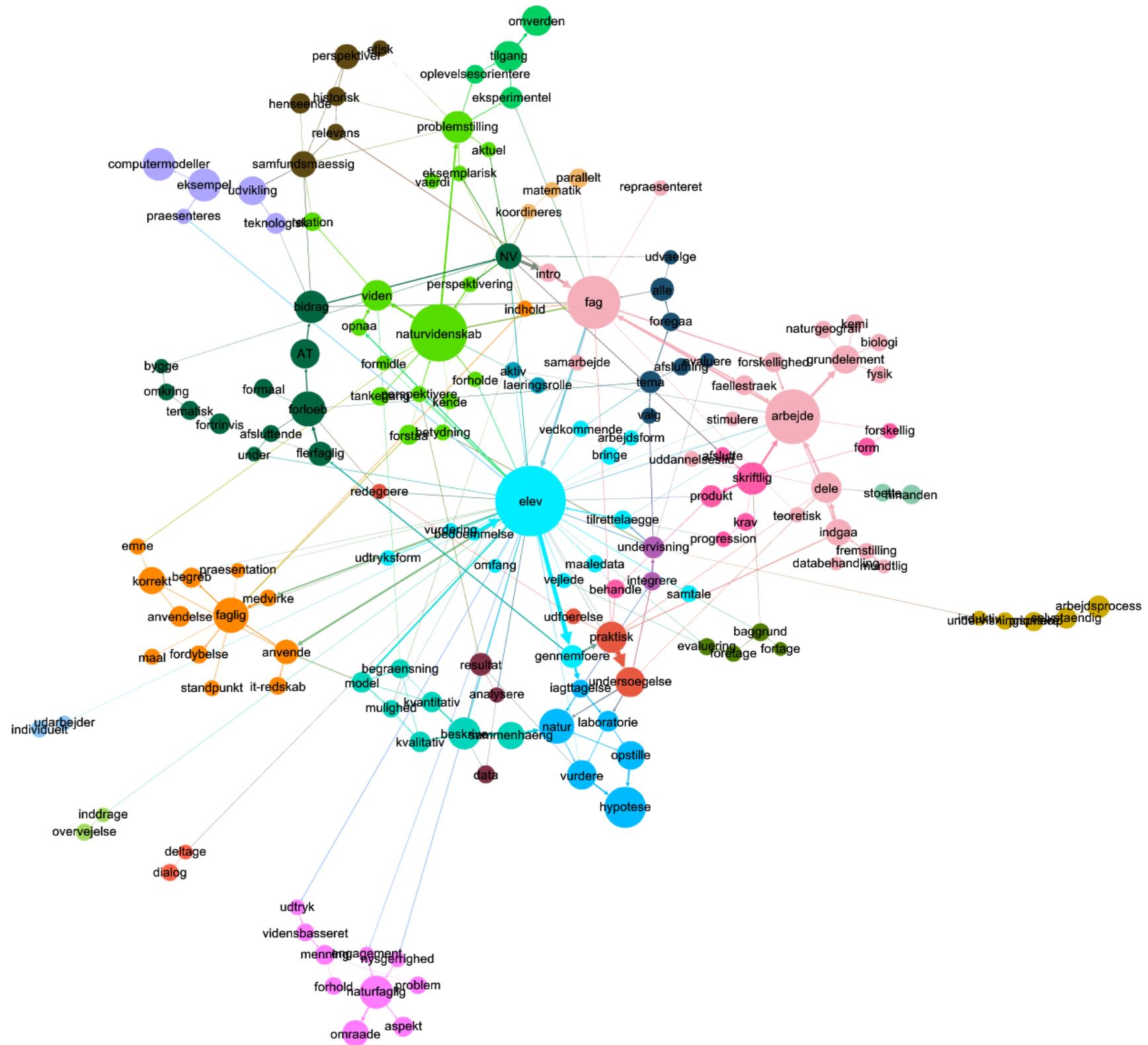
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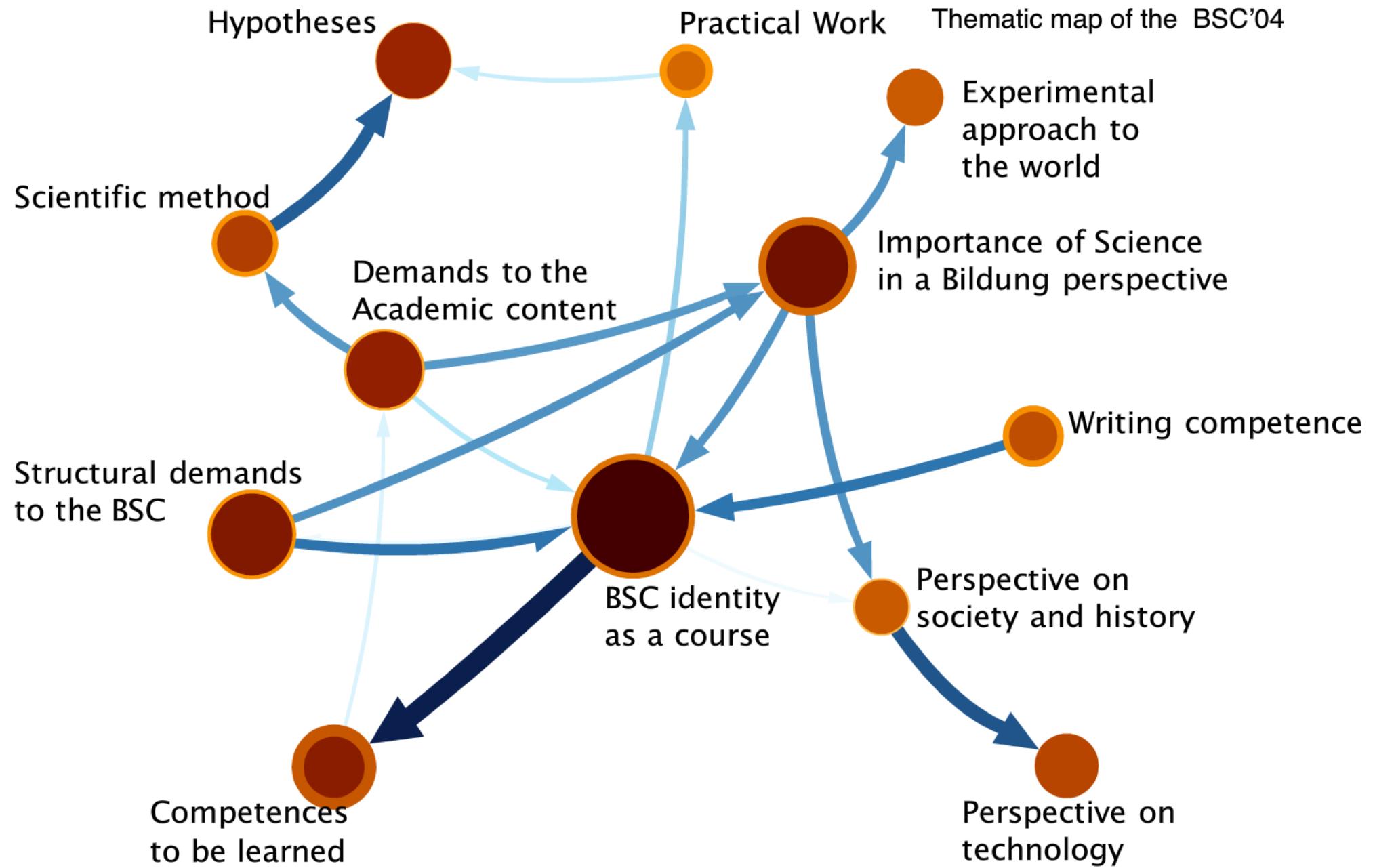
Bottom visualisations with Gephi (gephi.org)



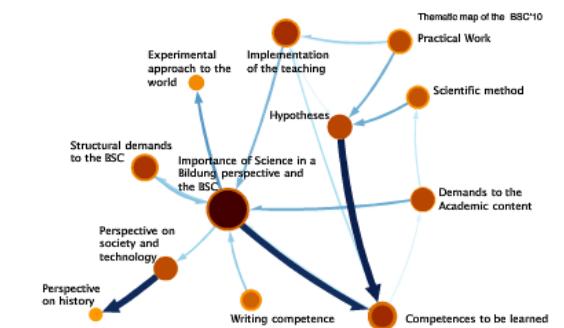
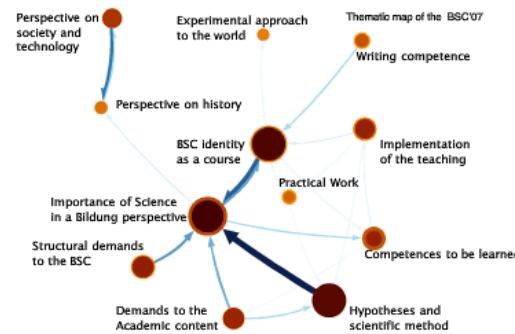
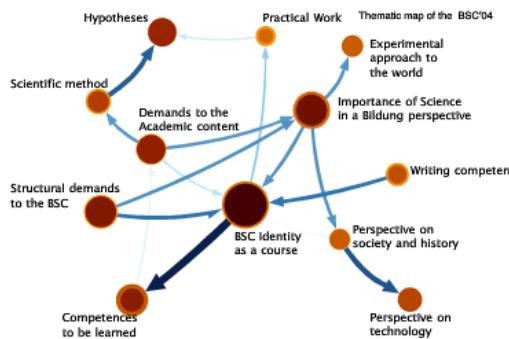
Top visualizations with Infomap app (mapequation.org)





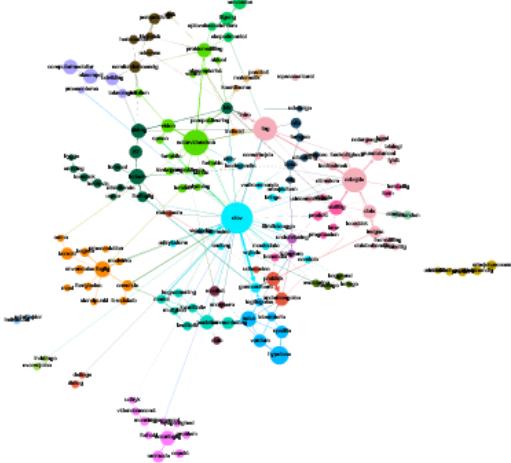


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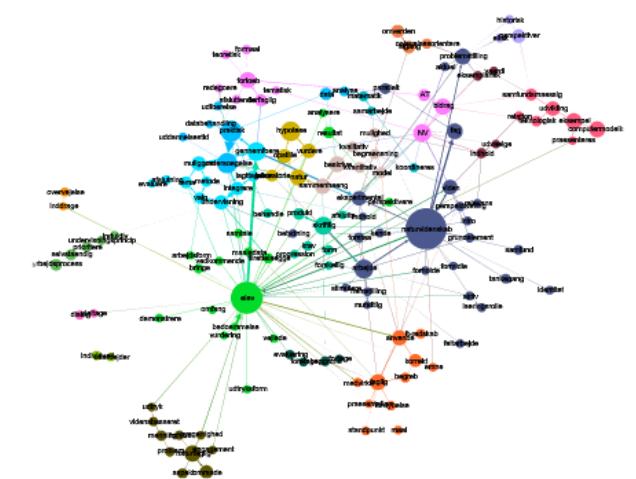
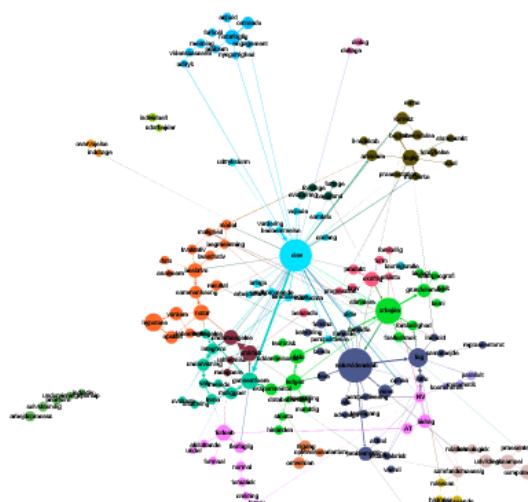


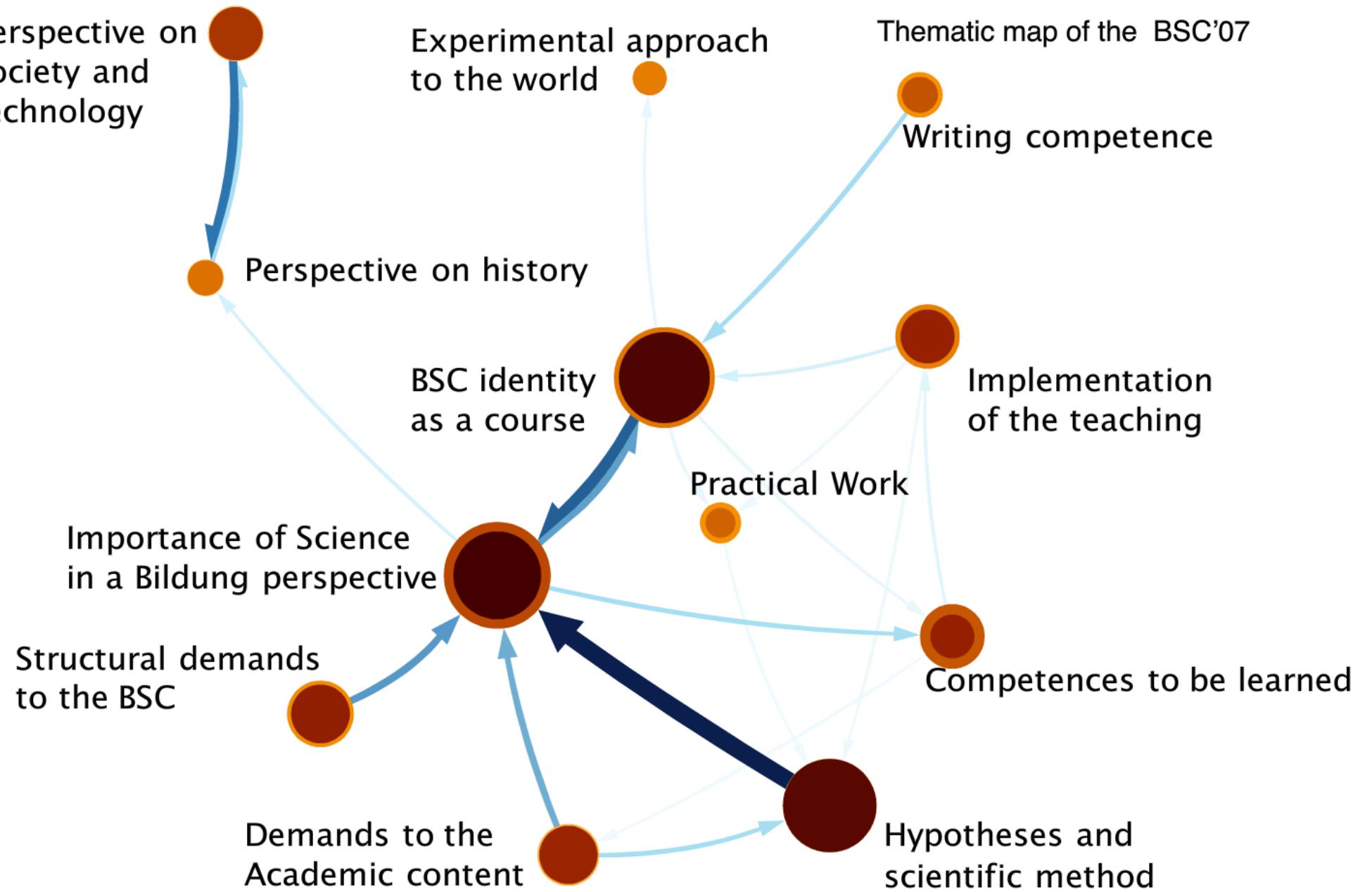
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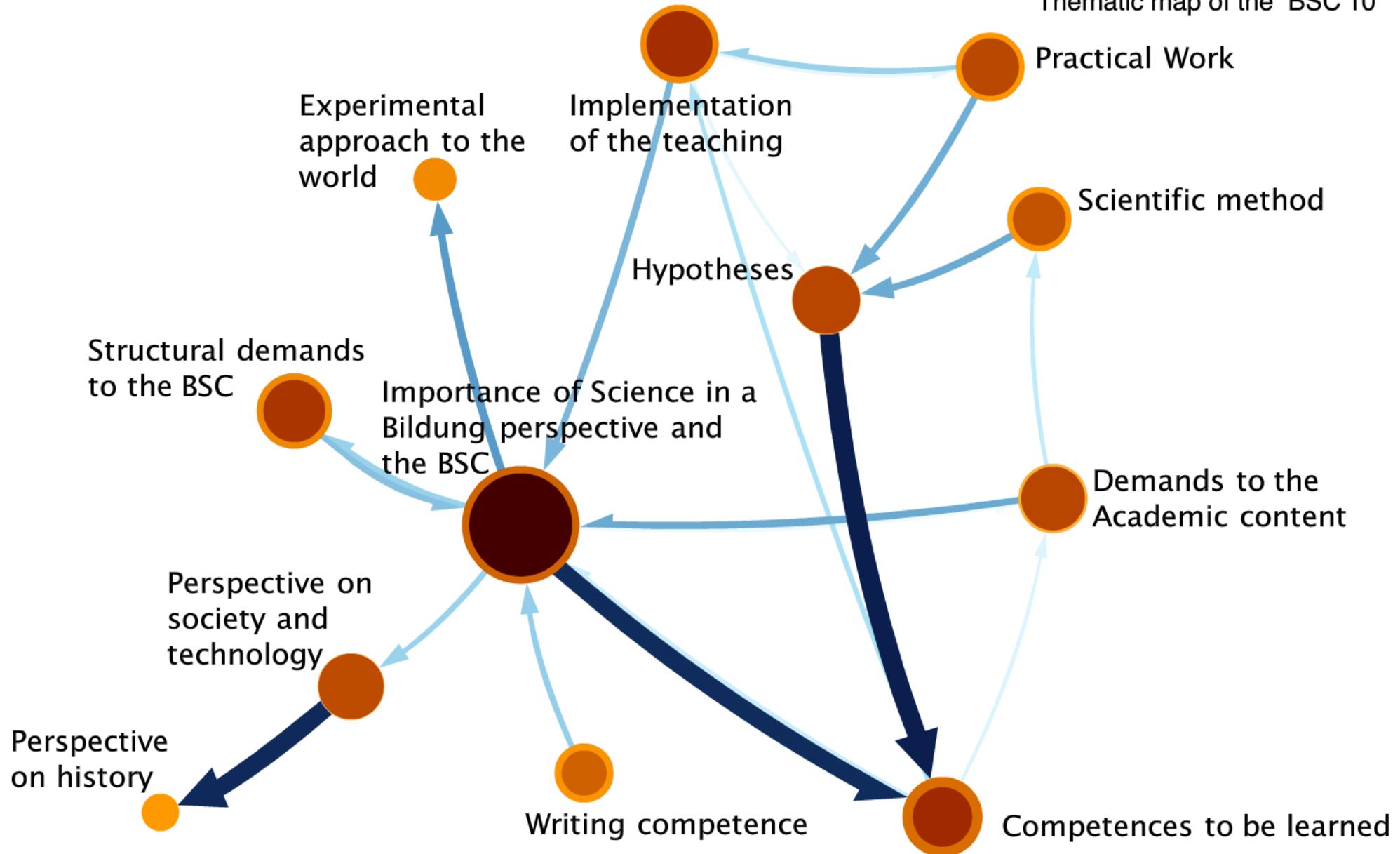


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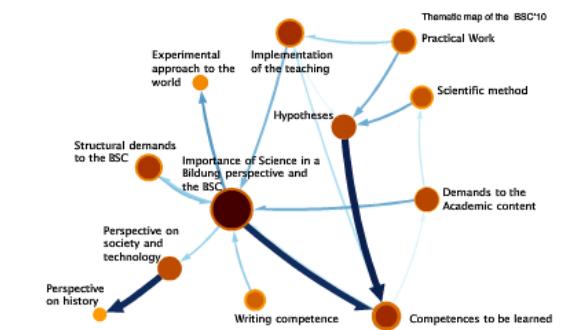
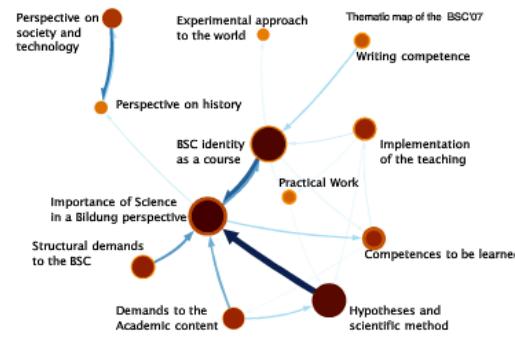
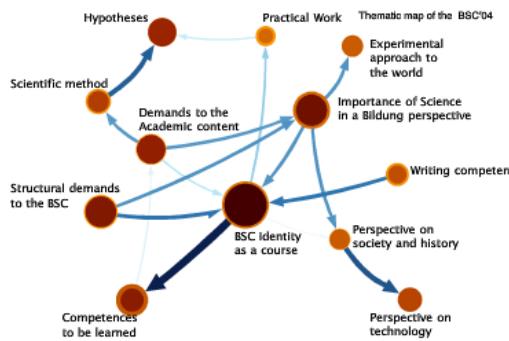




Thematic map of the BSC'10

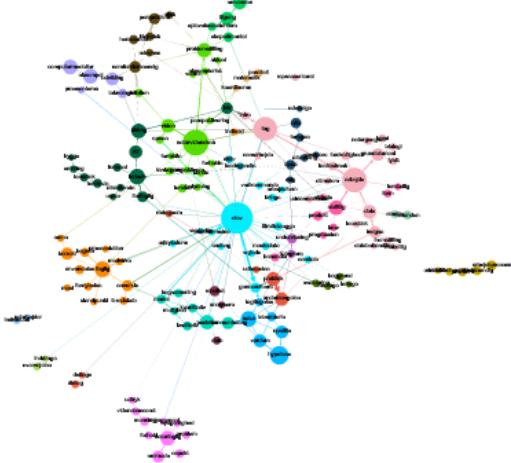


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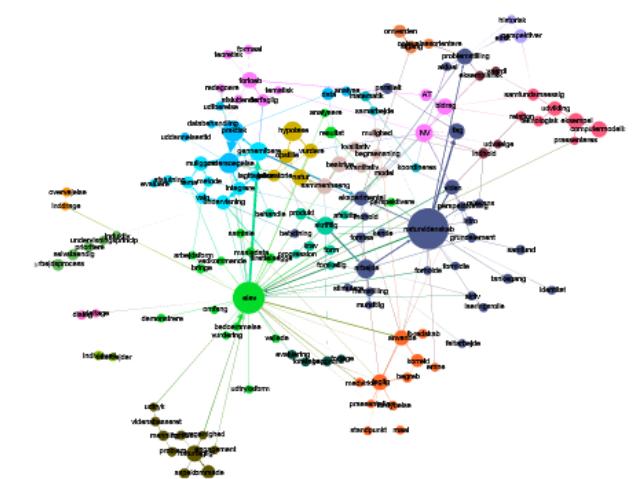
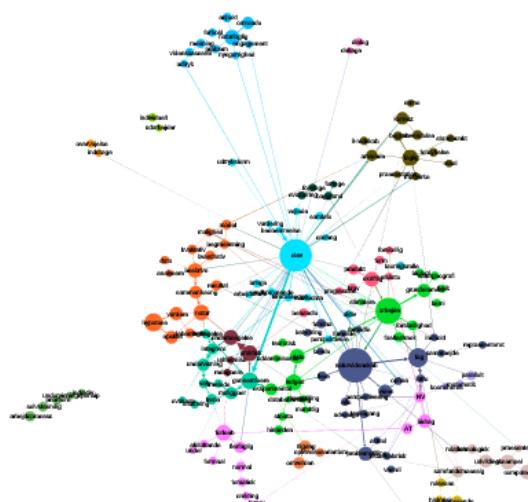


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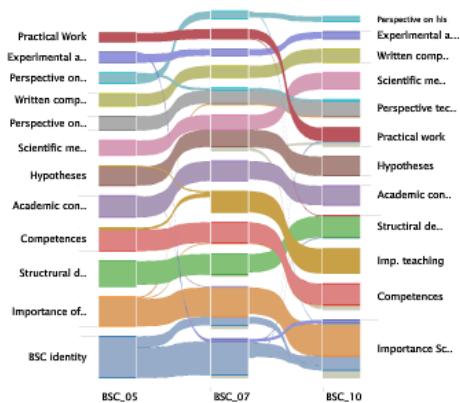
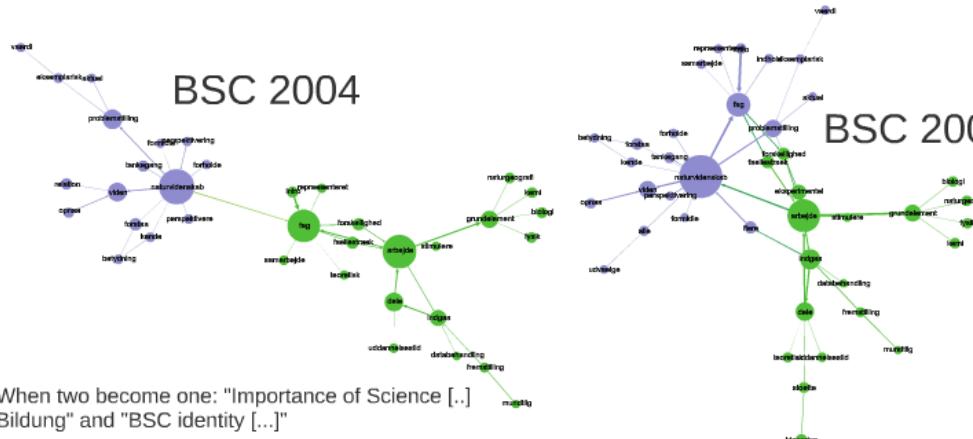
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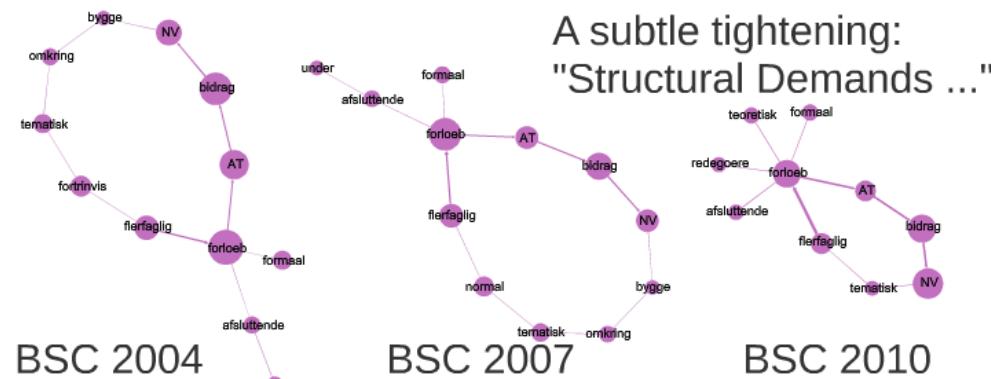
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Evolving themes at different scales



#	Theme	Summary of interpretations (quotes are our translations)
10	Structural demands to the BSC	Focus on student activity, thematic topics and pluridisciplinarity. Sample wording belong to this theme (2004): " <i>the BSC implementation should be based on thematic topics which are preferably pluridisciplinary</i> "
11	Importance of Science in a Bildung perspective	Focus on the developing students as persons who can reflect on science as they take part in society. Sample wording belong to this theme (2004/2007/2010): " <i>students can express a knowledge-based opinion on issues and problems with a natural sciences aspect.</i> "
12	Implementation of teaching	Requirements for implementation. The theme appears in 2007 and 2010. Sample wording (2010): " <i>[...] observations should be integrated into teaching and choice of themes should make possible [student] completion of experiments</i> ".
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A subtle tightening:
"Structural Demands ..."

Questions for further research: How do these interpretations match with the intentions of the people who wrote it?

How do these interpretations match with different stakeholders' reading of the curriculum?

Addressed in a different context by Elmeskov et al (2014)

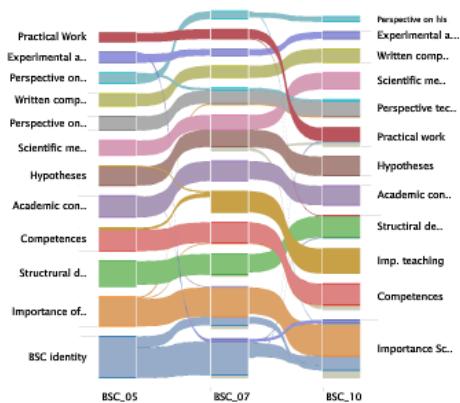
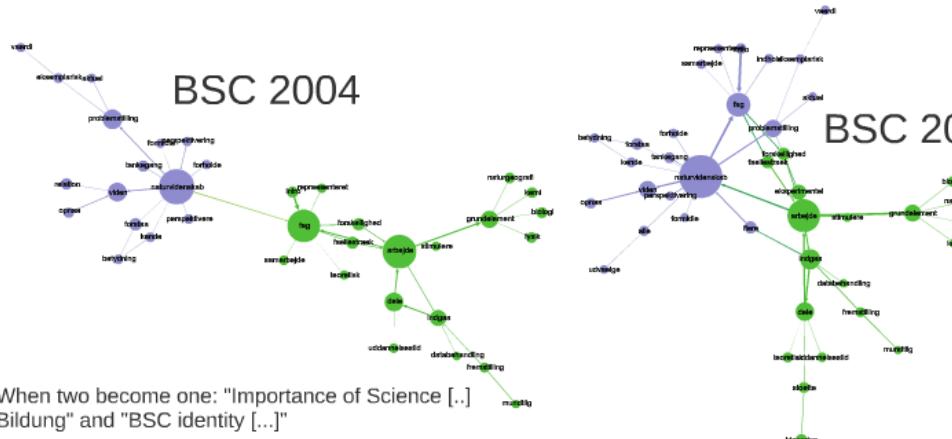
When two become one: "Importance of Science [...] Bildung" and "BSC identity [...]"



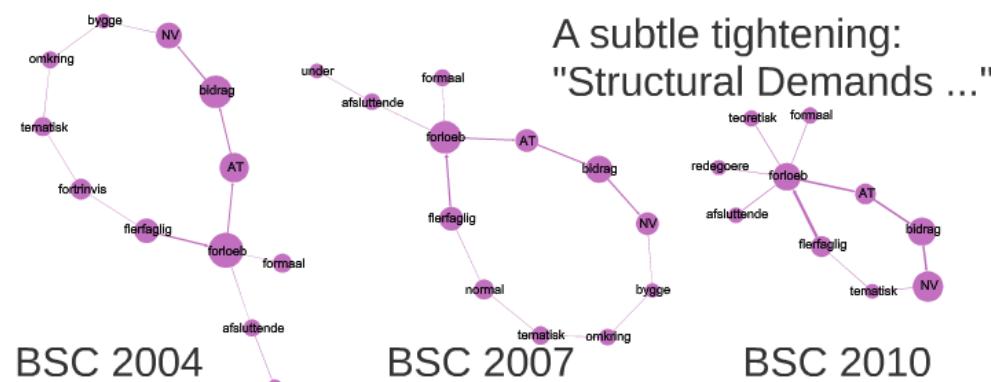
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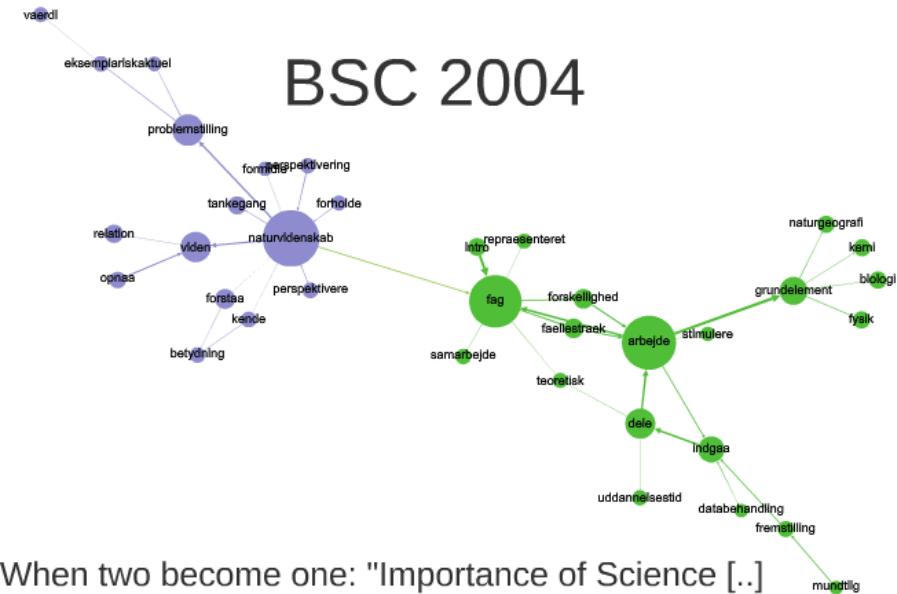
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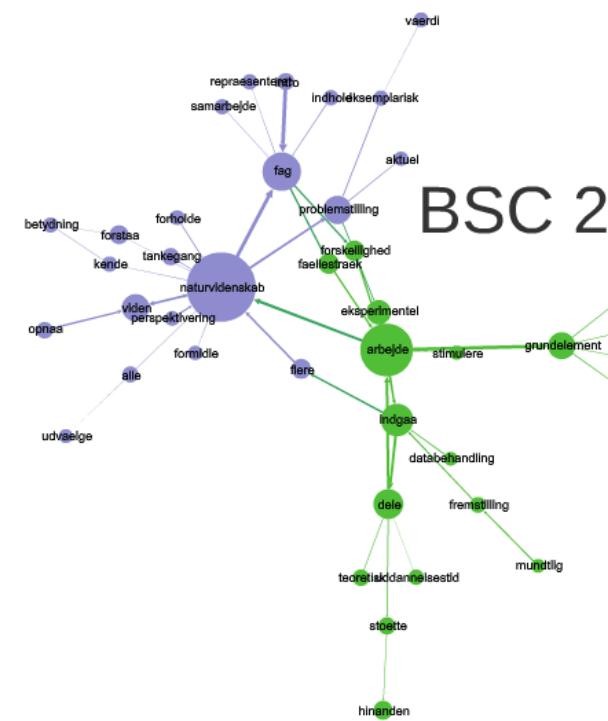
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Evolving themes at different stages

BSC 2004



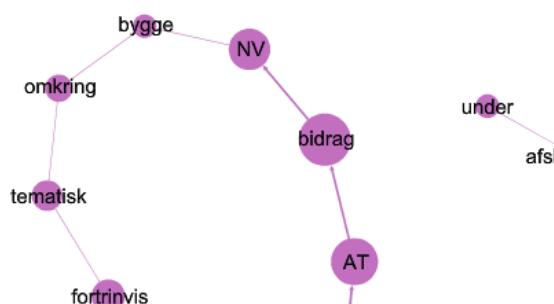
BSC 2007

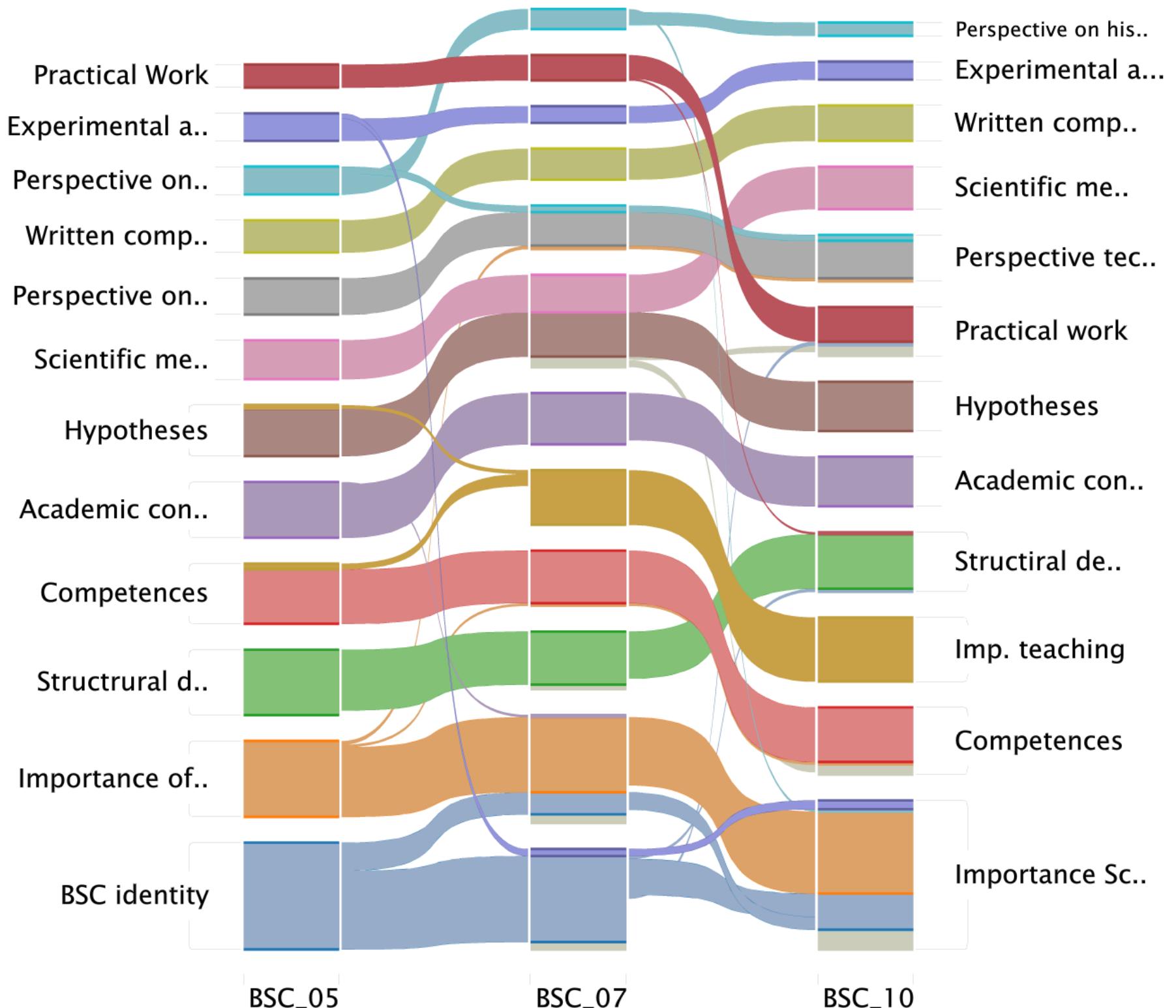


BSC 2010

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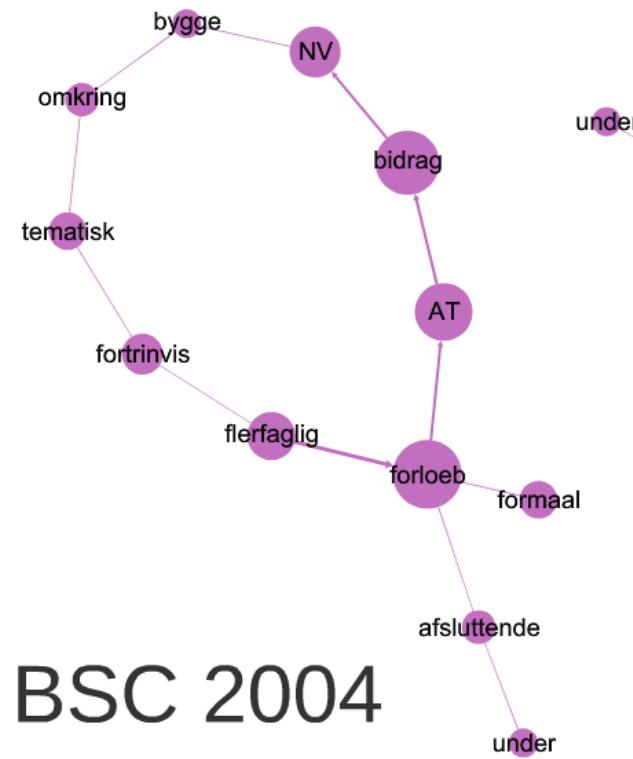
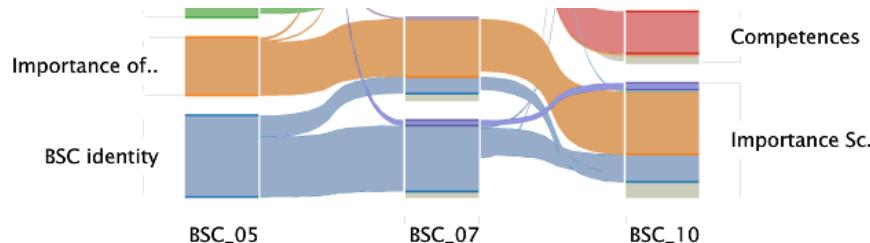
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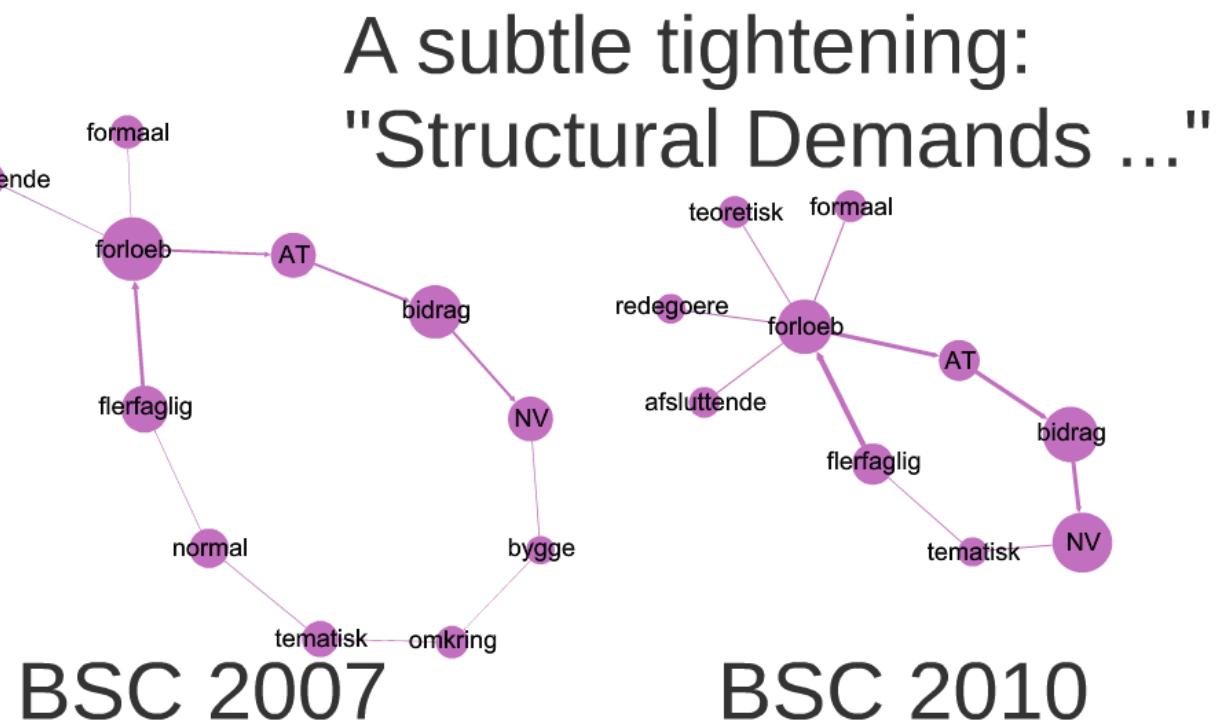


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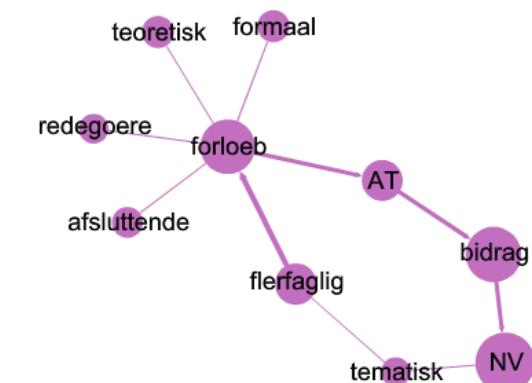
BSC 2010



BSC 2004



BSC 2007

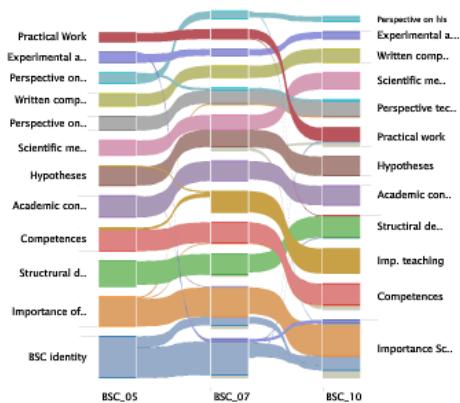
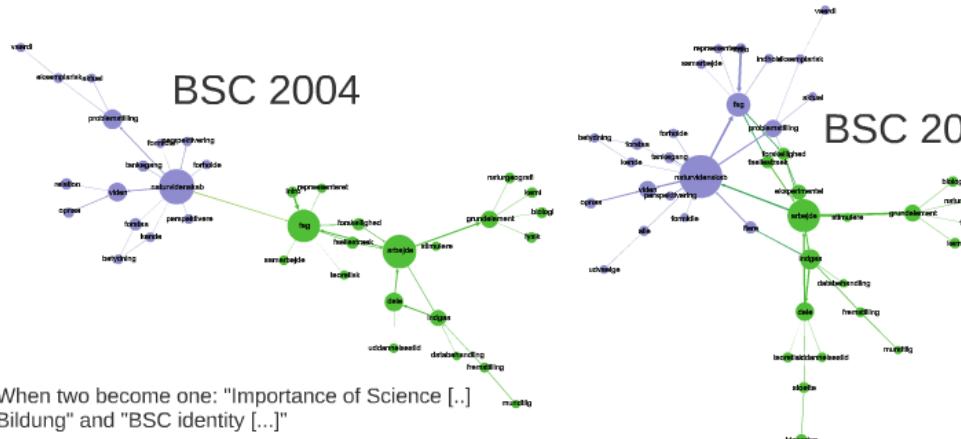


BSC 2010

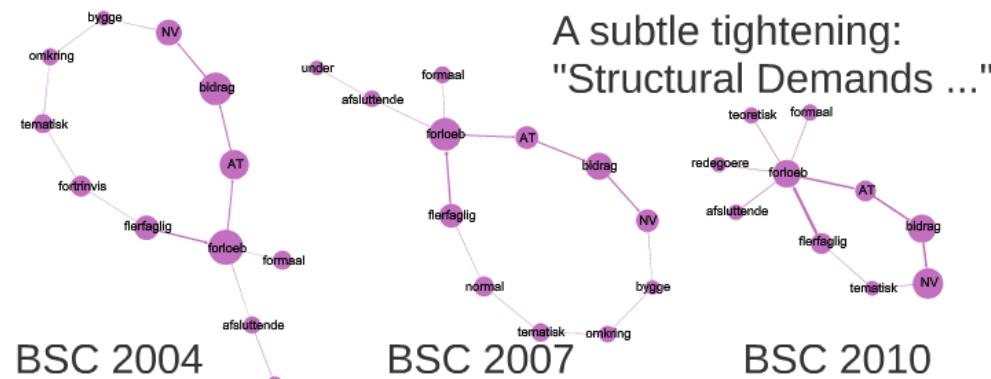
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Like all maps the thematic maps reduces information, and knowledge about the nature of these kinds of maps is needed to interpret them.

Thematic maps give us a birds-eye view of how the text flows - how themes are connected in terms of how words follow each other.

In interpreting themes, a strong link to the original formulations needs to be made via continuous alignment with discourse analysis.

Themes should be triangulated with other data and findings. See Andersen (2017) for a thorough triangulation between these maps, implemented, and realized curricula

Mix of qualitative and quantitative, where the quantitative is in service of the qualitative (Johnson & Ontwuegbuzie 2004)

Method is a possible tool for an inquiry audit (Lincoln & Guba 1985), in that decisions to remove/merge words and other 'rules' applied to creating networks and maps are recorded and thus the procedure can be reproduced.

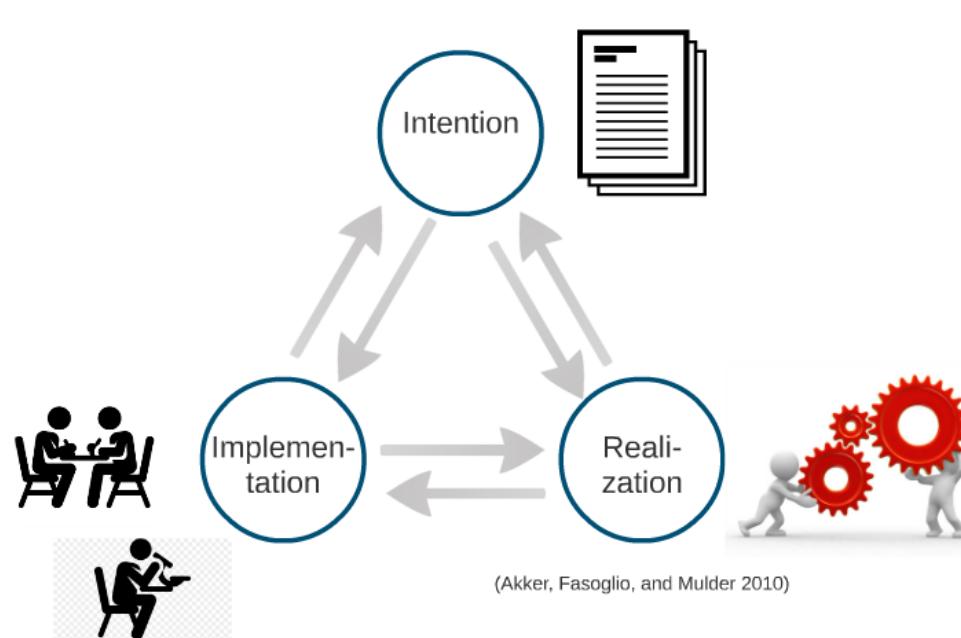
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NETWORK ANALYSIS OF CHANGES TO AN INTEGRATED SCIENCE COURSE CURRICULUM OVER TIME

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Roles of official curriculum documents

Official educational documents often reflect an agglomeration of political intentions at a given time and often change in light of educational policy changes (Dolin & Evans 2018).

The wording of particular curriculums can influence the perceived possibilities for teachers, teacher educators, and other stakeholders in implementing new curricula (Evans & Dolin 2018).

Analysing themes that emerge in official documents may play an important role in understanding the interplay between intentions, implementation and realisation of teaching.

The Basic Science Course in Denmark

In many countries, ideas of inquiry and scientific literacy have been woven into national curriculums (Evans & Oolin 2018).

In Denmark, ideas of inquiry and SL (and also interdisciplinarity and *Bildung*) were implemented officially in the largest of the four national upper secondary programs (called *six*) in 2004.

This was done through the introduction of the Basic Science Course (BSC, "Aftale af 28. maj" 2003). In Danish: Naturvidenskabeligt Grundforlæb.

The curriculum text was changed in 2007, 2010, and recently in 2017.

Our analysis pertains to 2004, 2007, and 2010

Research questions

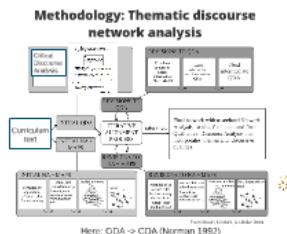
Educational systems are highly complex - also with regards to policy documents (Evans et al 2018).

This warrants an integration of quantitative and qualitative perspectives into a mixed methods design (Johnson & Onwuegbuzie 2004).

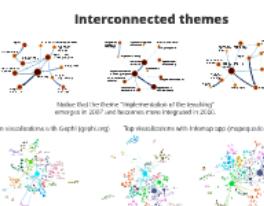
This study uses a recently developed mixed methods methodology (Bruun et al 2019) to extract and interpret themes in curriculum texts and their interconnections.

Which interconnected themes emerge as prevalent as in the Danish ECD curriculum texts for years 2004, 2007, and 2010?

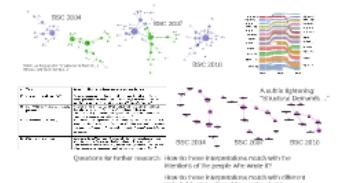
Shows the selected disease trends from years 2004, 2007, and 2010.



Methodology: Thematic discourse network analysis



Evolving themes at different scales



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