

## ESERA 2019 Pre-Conference Workshop

### Workshop: Enriched Skeleton Mindmap for learning about developments in STEM education for future teachers

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Elise Quant is a teacher educator at the Eindhoven School of Education. Her expertise is in the domain of (interdisciplinary) STEM teaching and curriculum development by teachers. As an university teacher she aims to prepare teachers for innovative STEM subjects such as Onderzoek & Ontwerpen (Technasium) and Nature, Life and Technology. She has experience in educational policy and teaching both in secondary as in higher education.

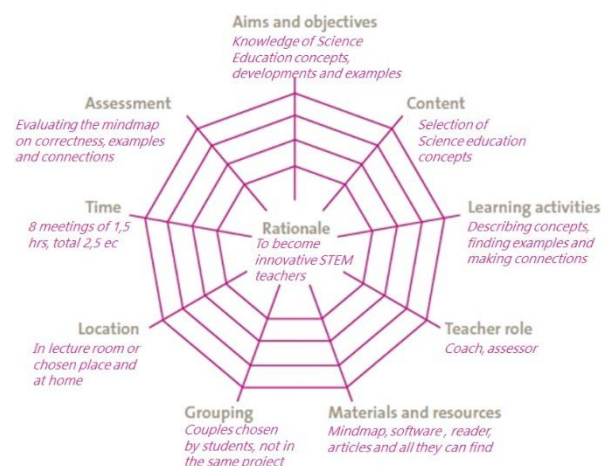
### Developments in STEM education in the Netherlands

In STEM education of upper-level secondary education in the Netherlands a lot of developments are going on. The last decennia there has been a high investment- both in money and time- to make STEM subjects and careers more attractive to young people, mostly motivated by shortage of qualified personnel in this sector (<http://www.stemcoalition.eu/members/pbt>). The exam programs of the STEM subjects have recently been revised towards more context oriented. Two interdisciplinary STEM subjects have been developed and implemented (Michels, Eijkelhof, in print; <https://betavak-nlt.nl/nl/p/english/>). Also in more general terms a lot of secondary schools are implementing personalized learning, formative assessment, flipping the classroom, connecting the outside world to schools etcetera. These last developments also influence the education in STEM subjects. Above that there is a big national curriculum revision in preparation (<https://curriculum.nu/waarom/>).

### Preparing future STEM teachers to contribute to school innovation

Possession of a shared knowledge of the meaning of concepts within the domain of educational developments is an important factor in the success of designing and implementing an educational innovation within a school. The pre service teacher education program offered by the Eindhoven School of Education has included in its mission that it aims to educate teachers that are capable of contributing to school innovation at both meso- and microlevel . In most teacher education programs the time spent on curriculum design is little and mostly aimed at microlevel (Nieveen, Schalk & van Tuinen, 2017)

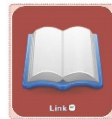
The course ‘Designing STEM Education’ aims at preparing teachers to design education in the STEM context. In multidisciplinary teams students develop lesson series within the STEM domain. They design education for (mostly) schools in the region. A big part of the assessment is based upon the argumentation of the choices the students make while designing the lesson series. In this we think it is highly important that these future teachers are well informed about recent



developments in STEM education and that they know examples of STEM education with a range of approaches and so will become well informed professionals.

### Enriched Skelton mind-map for learning about developments in STEM Education

To get well informed about recent STEM education developments and insights and being able to apply this knowledge deep learning is required (Sawyer, 2006). An activating learning environment with a focus on independent learning has a positive influence on this deep learning (Teurlings, Wolput and Vermeulen, 2006). To obtain this a promising way of learning is the Enriched Skeleton Mindmap (ESCOM) (Marée, 2013). Within the ESCOM students actively search for meaning of the selected concepts and they are asked to describe relations between the concepts.



### Hands-on introduction to the developed course

In this workshop the participants can have hands-on experience with this course organized around an Enriched Skeleton Mindmap. We will share our experiences working with this set-up.

Secondly we would like to discuss with the participants which developments in STEM education are relevant to know for future STEM teachers and to what extent. Do they need to have profound level of all the concepts or can they make choices and how does that influence their motivation and deep learning (Albrecht, Karabenick 2018 ; VanSteenkiste ao, 2018 ) We investigated the students opinions about the relevance of the concepts in the mindmap and will share some of our results.

### Schedule:

9.00 -9-15	welcome, short round of introduction
9.15 -9.45	presentation of the context
9.45-10.30	hands-on introduction to Enriched Skeleton Mindmap in small groups: working on one of the assignments of the students: linking concepts in the mindmap
10.30-11.00	plenary discussion about working with the ESCOM, both experiences of the participants of this workshop as experiences of the students in the pre service teacher education program
11.00-11.15	coffee break
11.15-12.00	indicating relevance of concepts in couples, color coding on mindmap
12.00-12.30	final conclusions/ questions
12.30	end

Maximum number of participants: 40

### Expected roles of participants

Teacher educators are the primary target group, but interested teachers, researchers or others are also welcome. All participants can join this workshop in an active way.

### Equipment

We will need a beamer and a screen. A whiteboard or flip-over would also be useful.

The participants of this workshop can bring their own laptop. If there is wifi connection they can open the ESCOM online with a mindmap app. We will also provide a paper alternative for the workshop.

### References

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- Vansteenkiste, M., Aelterman, N, De Muynck, GJ, Haerens, L., Patall E. and Reeve, J. (2018) *Fostering Personal Meaning and Selfrelevance: A Self-Determination Theory Perspective on Internalization*, The Journal of Experimental Education, 86:1, 30-49.