Taotlus doktorantuurikoha eraldamiseks LOTE-s

1. Projekti pealkiri:

Cross cultural research on student`s understanding of the nature of science and technology in the context of natural hazards and disasters and its implication to society

2. Doktorandikandidaat:

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<th>Eesnimi</th>
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<tbody>
<tr>
<td>David</td>
<td>Cerulli</td>
<td>Bronx Community College, Bronx, NY, USA Geoloogia instruktor</td>
<td><a href="mailto:dc10739@gmail.com">dc10739@gmail.com</a></td>
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3. Õppekava: 5270 Pedagoogika ja didaktika

4. Juhendajad:

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<tr>
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<td>Jack</td>
<td>Holbrook</td>
<td>Geograafia osakond</td>
<td>professor</td>
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5. Uurimisgrupp, kus doktoritööd tehakse: TÜ loodusteadusliku hariduse uurimisrühm koostöös TÜ maastikukõrge- ja üldteaduse hariduse uurimisrühma

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Yet European reports indicate decreasing student interest in science and technology (S&T) related studies and careers (EC, 2007; Kier et al., 2013; Güvercin, 2010; OECD, 2007). An understanding of the nature of technology (NOT) has clear implications for productive citizens and highlights the importance of students’ understanding of both NOS and NOT. Unfortunately, there is evidence to suggest that adults, as well as adolescents have still poor understanding of these (Abd-El-Khalick & Lederman, 2000; Ardie et al., 2013; DiGironimo, 2011).

This research focuses on the interrelationship between geography/earth science (G/ES) education and employability/responsible citizen skills, while paying attention to the value of a focus on the nature of science (NOS) and the nature of technology (NOT). (see also Constantinou et al., 2010; Heap & France, 2013). A deeper understanding of these issues will help geography/earth science graduates in their further employment (Hennemann & Liefner, 2010; Spronken-Smith, 2013).

- Geography (or as sometimes termed - earth science, etc) are not really separate entities as has been portrayed for chemistry, physics and biology. Geography/ES education can be viewed philosophically as interdisciplinary and can go beyond integration of science subjects and be seen as an umbrella to bring science and social studies together.
- From a political consideration, there are clearly historical and cultural differences in different parts of the world and social developments are thus viewed within G/ES education from different perspectives. This can be reflected by comparing social viewpoints across 3 continents (cultures) from an employability and responsible citizen perspective.
- From a global phenomena perspective, natural hazards and interrelated disasters differ in different parts of the world, but their influence and impacts are felt worldwide – mutual understanding of the different experiences and the nature of science and technology are important, as is highlighted in the debates on Global warming. While Estonia is little influenced by many major hazards and has poor experiential understanding compared with citizens of other continents, ethical, social, environmental, attitudes and values are seen as important aspects in a global society.

**Intended Outcomes**

At an educational level:

- Attention to an appreciation of the NOS, NOT, as well as Socio-scientific issues in the study of High School G/ES to better equip students in preparing, handling and interacting with natural hazards and disasters.
- Developed teaching units that encompass a socio-scientific approach focusing on mutual understanding and awareness among students of the importance of G/ES education in promoting employability and responsible citizenship.

At a societal level:
- Awareness of the value of the development of Employability and Responsible Citizenship skills in the context of the wider G/ES platform enabling students greater contributions to world needs and greater student understanding of natural hazards/disasters with respect to reality on 3 different continents.

At the level of research
- Add new dimensions to the research literature on the meaning of NOS/NOT, expressed in terms of employability and responsible citizenry needs.
- Develop a set of original instruments to obtain evidence of teachers’ attitudes, about the place of G/ES education currently perceived, as well as in a more interdisciplinary, global vision interrelating with society needs.
- Models of students’ opinions related to the need for a more socio-scientific G/ES education with greater focus on natural hazards/disasters, interrelated with greater employability skills and attitudes and values associated with responsible citizenry.

8. Doktoritöö plaan (kuni 4000 tähemärki koos tühikutega).
Technology, seen as a process as well as a product, is changing the way we live and work and students need to be prepared during their school education for this technology-rich world (NRC, 2010;2012). Future employability success lies in “being able to collaborate, use information, innovate and extend technology to create new knowledge, human capacity and productivity.

Objectives
1. Solicit science teachers and students cross cultural views and understanding about NOS and NOT and the relationship between these in the context of G/ES education and employability.
2. Develop theoretically justified and validated indicators of the NOS and NOT, with respect to the socio-scientific impact of G/ES education.
4. Develop validated instruments to determine teachers’ readiness to promote NOS and NOT through teaching units.
5. Develop suitable instruments to determine students opinions on the value (including degree of mutual understanding) of such teaching units in G/ES education.
6. Create internationally validated models to indicate paradigmatic changes needed towards greater employability skills and responsible citizenship.
Research Questions
1. How do teachers and students view NOS and NOT and the interrelationship between them in the context of G/ES education?
2. Which NOS and NOT indicators impact most on G/ES education at a cross cultural level?
3. Are socially desirable teaching units developed, based on global aspects associated with natural hazards and disaster, sufficiently adaptable to different cultures and social expectations?
4. Is there any potential link between students’ opinions on employability skills and science teachers’ teaching, using units developed towards responsible citizenship alongside social awareness and intellectual development, and incorporating NOS and NOT?
5. Which aspects indicate paradigmatic changes needed towards greater employability and responsible citizenship?
6. Can internationally validated cross-cultural models, indicating the relationship of NOS and NOT in G/SE, be developed?

Methodology:
Target: Estonian, US and Korean teachers teaching grade 10-12 students G/ES (up to 800 students and 25 teachers, per country).
1. Based on a literature review, develop theoretically justified indicators and instruments on NOS and NOT, with respect to the socio-scientific impact of G/ES education.
4. Validate the units by expert opinion (N=10 in the three countries) and based on an analysis of expert opinion, make modifications as necessary. Administer the teaching-learning units in high school G/ES classes in the 3 countries.
5. Adapt existing instruments: VOSTS (Aikenhead & Ryan, 1992), STEM-CIS, and a qualitative framework developed by DiGironimo (2011). Establish face and content validity of the adapted research instrument, using the expert group. Administer this instrument to the teachers on the 3 continents.
6. Develop, pilot and use suitable instruments to determine students opinions on the value of such teaching units in G/ES education.
7. Using RASCH analyses developed models.

Plan:
2014/2015 Meta analyses of literature; development of instruments for NOS; NOT. Data collection. Publication (re- RQ1&2).
2016 Data analyses and Design of teaching units; piloting units; Publication (RQ 3).
2017 Teaching of units in the 3 countries; Development/validation of instruments: Publication (re-RQ 4&5).

References
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Instituudid otsustavad ise millise kaaluga erinevaid hindeid arvestatakse. LOTE üldkonkursil lähevad hinded arvesse järgmise kaaluga:

1. Doktoritöö innovaatilisus ja tähtsus antud teadussuuna arengule - 10%
2. Juhendaja efektiivsus - 30%
3. Uurimisgrupp, kus doktoritööd tehakse - 20%
4. Tööks vajalike vahendite (ennekõike finantside) olemasolu – 20%
5. Doktoritöö plaani realistlikkus – 20%