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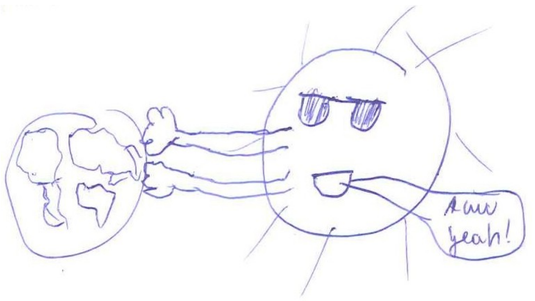
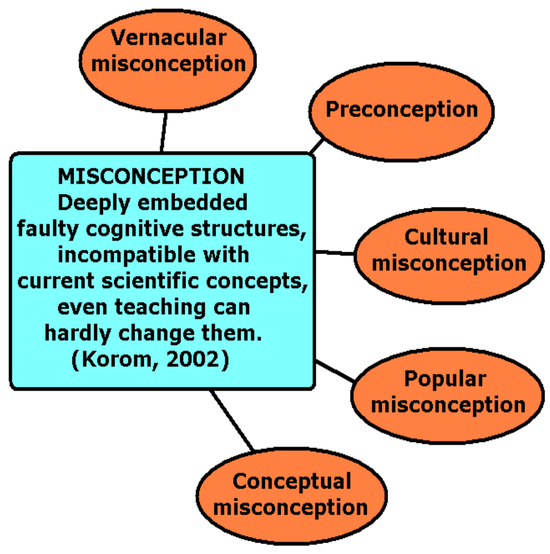
How do Hungarian students perceive our climate?



A comparative analysis of climate-related misconceptions

Theoretical background

Research on scientific misconceptions has been one of the favored topics in science education literature for the last four decades. However, it was only in the 1990s that the research of misconceptions in the fields of physics, chemistry, biology, and history started in Hungary. Unfortunately, the study of geographical misconceptions has been underrepresented so far. Numerous international studies have proved that a wide range of misconceptions exist in geography as well. Since misconceptions strongly prevent children from learning even basic concepts, it is essential for teachers to be aware of their relevance.



Main aims

We aim at finding climate-related misconceptions, determining their nature, and finding those sources of geographical information which may result in the formation of misconceptions.

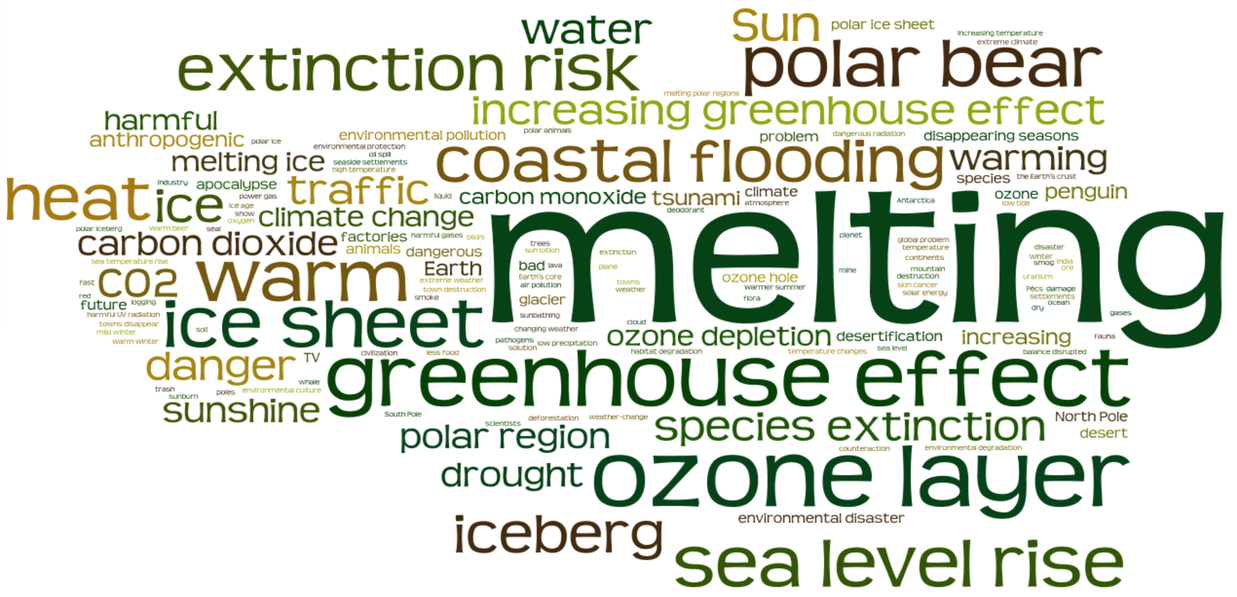
Groups	Age	Number
Grade 3	8-9 years	85
Grade 11	17-18 years	99
Geography BSc	21-22 years	56

Data acquisition methods	Data analysis methods
Word association test (six stimulus words)	Content analysis Word cloud based on word frequency Garskof-Houston relatedness coefficient (RC) → graphs
Open ended questions (six basic climate- and climate-change-related questions)	Content analysis based on *Abraham et al., 1992*
Sources of geographical information	Ranking sources of geographical information and indicating examples
Questionnaire on the sources of geographical information	Ranking Content analysis

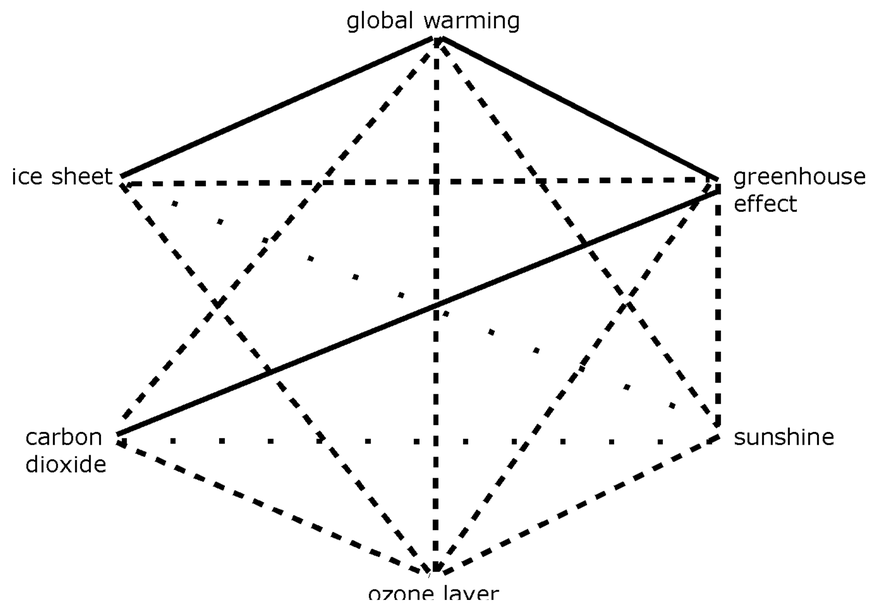
Stimulus word	Grade 3 students	Grade 11 students	Geography BSc
Global warming	7% – ozone layer 1% – the Sun is moving nearer to Earth	10.5% – ozone layer 3% – tsunami 2% – ozone hole	8.9% – ozone depletion
Greenhouse effect	–	8.4% – ozone layer 1% – decreasing oxygen level	19.6% – ozone layer/hole
Sunshine	–	–	–
Ozone layer	3% – global warming 2% – ozone hole 1% – protecting warmth	40% – ozone hole	1% – greenhouse effect 1% – global warming 1% – melting ice sheets
Carbon dioxide	5% – poisonous	4% – ozone layer 4% – poisonous	1% – ozone
Ice sheet	–	1% – ozone hole	1% – ozone depletion

Age group	**Type of misconceptions** (answers to open ended questions)
Grade 3 students	4% – The ozone hole causes global warming. (preconception) 1% – The Sun is getting closer to the Earth. (preconception)
Grade 11 students	22.9% – Either ozone depletion or the "ozone hole" causes global warming. (conceptual misconception) 3% – A great tsunami will destroy the Earth. (popular misconception) 1% – "Water will cover all continents, and we will live on boats as in *Waterworld*." (popular misconception)
Geography BSc	7% – Greenhouse effect and global warming are caused either by ozone depletion or "ozone hole". (conceptual misconception)

Global warming word cloud of Grade 11 students

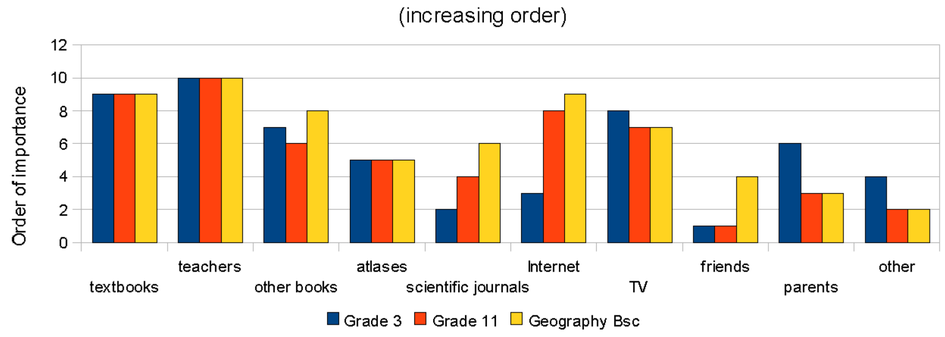


Conceptual graph of Grade 11 students based on the Garskof-Houston Relatedness Coefficient (RC)



Importance of geographical information sources

(increasing order)



Pedagogical implications

In order to reduce the formation of misconceptions and design a more successful teaching process, we emphasize the significance of the following areas:

Fitting curriculum to children's cognitive development.

Helping children develop stable reading and interpreting techniques that help learning and knowledge consolidation.

Developing engaging and interactive textbooks that guide children through the curriculum easily and, at the same time, anchor their knowledge into everyday life.

Professionalizing teacher training to meet the standards of the 21st century AND to prepare teachers for the children of the 21st century.

Utilizing smart devices in the process of teaching and learning so that they can provoke meaningful and responsible learning and action.

Conclusions

Misconceptions are obstacles in the process of teaching and learning alike. In order to achieve successful learning, teachers have to be taught how to identify them, and teaching should be planned and carried out with a special emphasis on "misconception hot spots". Our results also imply that geographical concepts introduced too early in the curriculum may result in misconceptions that are difficult to change in higher education. Also, we, teachers, have to strive for making our students internalize basic geographical information in a way that this information remains anchored in everyday life and helps students make responsible decisions concerning their and their community's life.

References
Brewer, William F., Vosniadou, Stella, and Samarapungavan, Ala. 1996. Mental Models of the Earth, Sun, and Moon: Indian Children's Cosmologies. *Cognitive Development, 11*, 491-521.
Korom, Erzsébet. 2005. *Fogalmi fejlődés és fogalmi váltás* [Conceptual Development and Conceptual Change]. Budapest: Műszaki Könyvkiadó
White, Richard T. and Gunstone, Richard F. 2008. *The Conceptual Change Approach and the Teaching of Science.* In: Vosniadou, Stella (ed.). *International Handbook of Research on Conceptual Change.* Routledge: New York and London.
Sources of pictures: Help fight global warming hourglass - www.theadmad.com/2009/07/16/help-fight-global-warming/help-fight-global-warming_hourglass.jpg
Global warming hourglass by courtesy of Alejo Accini // Word clouds generated by John Feinberg's Wordle // Poster layout by Christian Hambalko

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