

UNCODE Uncovering hidden Cognitive Demands

Globalization and advances in information and communication technologies (ICT) have led global teamwork across geographical and cultural to become a common practice in both education and industry.

In global STEM education, learning takes place in globally distributed settings that experience five discontinuities - time, space, culture (e.g., language, gender, age, and norms), discipline, and technology.

These dimensions put new cognitive and well-being demands on learners and instructors in terms of participation, engagement, knowledge creation and acquisition.

The aim of this exploratory study is to investigate:

- Complexity of distributed, cross-disciplinary, cross-national, and multi-media communications;
- Degrees of engagement among global team members immersed in diverse collaboration environments;
- Impact of variations of sleep-wake cycles in geographically distributed teamwork; and their relations with well-being and cognition in the context of global learning.

We identify, formalize, and test innovative learning analytics, indicators, and methods to determine and assess cognitive load, degrees of engagement, and well-being by investigating:

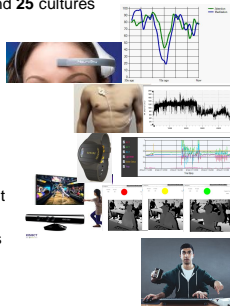
- Warning signs that could be identified from physiological data during or prior to a non-optimal learning/work state;
- Ways learners and instructors can monitor and self-regulate their cognitive load, well-being, and engagement during global collaboration.
- Good and sustainable learning practices for globally distributed learning settings.

The Education Testbed

- 49 Students
- 7 STEM global teams with 7 members
- 17 week PBL construction development
- 5 disciplines from 11 universities
- 5 time zones and 25 cultures

Data & Feedback:

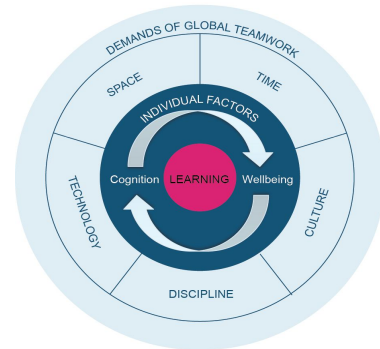
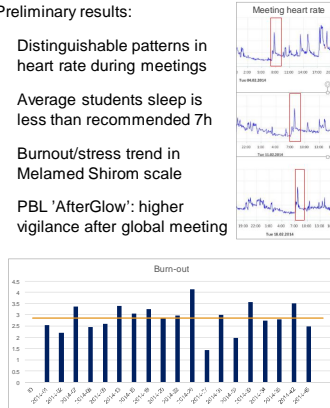
- Brain activity → Attention
- Heart rate → Stress
- Sleep → Recovery
- Body movement → Engagement
- Activity patterns → Work load
- Vigilance → Fatigue



Global STEM Learner Data

Preliminary results:

- Distinguishable patterns in heart rate during meetings
- Average students sleep is less than recommended 7h
- Burnout/stress trend in Melamed Shirom scale
- PBL 'AfterGlow': higher vigilance after global meeting



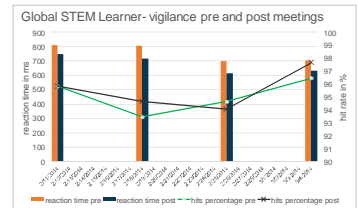
Global STEM Project Team



Communication & Collaboration Technologies



Global Meeting - PBL 'AfterGlow'



STEM Learners need to :

- Gain awareness of potential cognitive overload
- Manage cognitive demands
- Self-regulate and team-regulate to achieve high performance and best well-being

NABC

- Longitudinal study of STEM global student teams
- Multi-method approach combining:
 - Quantitative physiological measurements
 - Qualitative field study methods
 - Survey methods

- Fresh lens to design and examine distributed STEM learning education programs
- Use of mobile, wearable, and ubiquitous sensor technologies in 24/7 real-life project-based learning (PBL) environments

- Apps and Services for Mind & Body Quantified Self