

Big data from a little person – using multimodal data for understanding regulation of learning

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EARNING & EDUCATIONAL

Overview

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- 1) Learning scientists want to understand how people learn – SRL theory helps
- 2) It is time for SSRL
- 3) LA for understanding data about learners in their contexts.
- 4) Examples of multimodal data collection
- 5) Big and complex data needs multidisciplinary collaboration
- 6) Who wants to help?





What is self-regulated learning?

(Winne & Hadwin, 1998; Zimmerman 2010)

Active and proactive learning

Process of learning to monitor, evaluate, and regulate (or change) your own

- Thinking
 - Motivation
 - Emotion
 - Behaviour
 - Learning

Adaptive process that you develop and refine over time



2017







It is time for socially shared regulation of learning







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SRL theory helps to understand the complex process of learning







What is regulation in learning ? - our perspective

(Winne & Hadwin; 1998; Hadwin, Järvelä & Miller, 2011; 2017; Järvelä & Hadwin, 2014)





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How SSRL can be investigated?

How to make invisible mental processes visible?

How to capture the interaction of internal, external and shared conditions of learning?



As a learning scientist, we face serious methodological problems because the learner's cognition, motivation, and emotion are neither visible for the researcher to study it, nor for learners so that they are able to regulate those processes to learn effectively.



1. Investigate regulatory processes in authentic collaborative learning situations

2. Explore what multimodal data can tell us about critical SRL processes

3. Develop scaffolds and support for SSRL in CSCL



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1) Understanding the sequential and contextual aspects of regulated learning

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Malmberg, J., Järvenoja, H., & Järvelä, S (2013). Patterns in elementary school students' strategic actions in varying learning situations. *Instructional Science* 41(5), 933-954,

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2) Focusing on the individual and group level shared regulatory activities with technological tools data

Self- and social regulation processes can promote each other (CoRL) and exist simultaneously (SSRL) in dual interaction (Hadwin, Järvelä & Miller, 2011)

S-REG tool - html5 application for SSRL



Järvelä, S., Kirschner, P. A., Hadwin, A., Järvenoja, H., Malmberg, J. Miller, M. & Laru, J. (2016). Socially shared regulation of learning in CSCL: Understanding and prompting individual- and group-level shared regulatory activities. International Journal of Computer Supported Collaborative Learning 11(3), 263-280.

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3) Characterizing temporality of (S)SRL progress



Malmberg, J., Järvelä, S. & Järvenoja, H. (2017, in press). Capturing temporal and sequential patterns of self-, co- and socially shared regulation in the context of collaborative learning. *Contemporary Journal of Educational Psychology*





Why?



Multichannel data collection in advanced high school physics



Big data don't tell all – if not contextualized, where the learning actually takes place

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Data about individuals



...and individuals interacting as a group



Struggling to capture invisible reactions of body and brain

Construction of "conscious self" emerge from deep interdependencies between all basic systems of the body and brain, including perception, beliefs, action, emotion, memory, goal management and learning.

(e.g. Azevedo, 2015; Gabriano et al., 2014; Harley et al., 2015; Reimann, Markauskaite & Bannert, 2014)



SENSORS — physiological reactions

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ON-LINE EVALUATION FORMS & retrospective dashboards









All resulting BIG & COMPLEX data:

101 hours of video,266 216 000 data points of physiological data,236 000 EdX log events...



GRAPHICAL USER INTERFACE VISUALIZING COMPLEX DATA

Collaboration with LA, data-mining and signal processing experts

(Alikhani, I., Juuso, I., & Seppänen, T. 2017)



Multidisciplinary collaboration in multimodal data analysis



Why this is useful for investigating SSRL? — individuals in a group



³³ Sobocinski, M., Malmberg, J. & Järvelä, S. (2016). Exploring temporal sequences of regulatory phases and associated interaction types in collaborative learning tasks. *Metacognition and Learning.*



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Why this is useful for investigating SSRL ? – Tendency of reactions among group members



Haataja, E., Malmberg, J. & Järvelä, S. (2017, in preparation)

Our next step: FACE READING

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Micro-expressions and socially oriented micro-gesture analysis in groups



X. Li, X. Hong, A. Moilanen, X. Huang, T. Pfister, **G. Zhao**, and M. Pietikäinen. Towards Reading Hidden Emotions: A Comparative Study of Spontaneous Micro-expression Spotting and Recognition Methods. IEEE Transactions on Affective Computing, 2017

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Why multimodal data & LA can help?



Reveal complexity and range of cognitive and non-cognitive processes







\overleftrightarrow

Where do we need to struggle more?



Data triangulation is a messcleaning the data

Sampling rates of each technique and data granularity

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How LS & LA can help a little person and groups to learn better?

- 1) How we can progress from "more data" to "deep data."
- 2) Multimodal data sets trace simultaneously a range of cognitive and non-cognitive processes, which are parallel and overlap strong theory and **conceptual understanding** are needed.
- 3) Minimize the **costs** of multimodal data collection: errors, missing data, automated/hand-coded, multidisciplinary teams...





Break traditional boundaries of "learning" – for more bold and ambitious implications for increasing human competence for the 21st century.

First we need to unlock our well locked data.



Who would like to help?

LET, University of Oulu the international SLAM project team





Allyson Hadwin

EARLI Center for Innovative Research (E-CIR)

"Measuring and Supporting Student's SRL in Adaptive Educational Technologies"



Thank you!

http://www.slamproject.org

www.oulu.fi/let

Twitter: @LET_Oulu





LEARNING & EDUCATIONAL TECHNOLOGY RESEARCH UNIT



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Recent related SLAM publications:



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Järvelä, S. & Hadwin, A. (2013). New Frontiers: Regulating learning in CSCL. *Educational Psychologist, 48(1), 25-39.* DOI:10.1080/00461520.2012.748006

Järvelä, S., Kirschner, P. A., Panadero, E., Malmberg, J., Phielix, C., Jaspers, J., Koivuniemi, M., & Järvenoja, H. (2015). Enhancing Socially Shared Regulation in Collaborative Learning Groups: Designing for CSCL Regulation Tools. *Educational Technology Research and Development, 63, 1, 125-142.* DOI: 10.1007/s11423-014-9358-1

Järvenoja, H., Järvelä, S. & Malmberg, J. (2015). Understanding the process of motivational, emotional and cognitive regulation in learning situations. *Educational Psychologist*, *50*(*3*), *204-219*.

Järvelä, S., Malmberg, J. & Koivuniemi, M. (2016). Recognizing socially shared regulation by using the temporal sequences of online chat and logs in CSCL. *Learning and Instruction, 42, 1-11*. DOI: 10.1016/j.learninstruc.2015.10.006 Järvelä, S., Järvenoja, H., Malmberg, J., Isohätälä, J. & Sobocinski, M. (2016). How do types of interaction and phases of self-regulated learning set a stage for collaborative engagement? *Learning and Instruction 43*, 39-51. doi:10.1016/j.learninstruc.2016.01.005

Pijeira-Díaz, H. J., Drachsler, H., Järvelä, S., & Kirschner, P. A. (2016). Investigating collaborative learning success with physiological coupling indices based on electrodermal activity. *Proceedings of the Sixth International Conference on Learning Analytics and Knowledge*. ACM. doi: 10.1145/1235

Järvelä, S., Kirschner, P. A., Hadwin, A., Järvenoja, H., Malmberg, J. Miller, M. & Laru, J. (2016). Socially shared regulation of learning in CSCL: Understanding and prompting individual- and group-level shared regulatory activities. *International Journal of Computer Supported Collaborative Learning 11*(3), 263-280. doi:10.1007/s11412-016-9238-2

Malmberg, J., Järvelä, S. & Järvenoja, H. (2017, in press). Capturing temporal and sequential patterns of self-, co- and socially shared regulation in the context of collaborative learning. *Contemporary Journal of Educational. Psychology*

Sobocinski, M., Malmberg, J. & Järvelä, S. (2016). Exploring temporal sequences of regulatory phases and associated interaction types in collaborative learning tasks. *Metacognition and Learning*. doi:10.1007/s11409-016-9167-5

Malmberg, J., Järvelä, S., Holappa, J., Haataja, E., & Siipo, A. (2016). Going beyond what is visible –What physiological measures can reveal about regulated learning in the context of collaborative learning. Submitted

Hadwin, A. F., Järvelä, S., & Miller, M. (2017). Self-regulation, co-regulation and shared regulation in collaborative learning environments. In D. Schunk, & J. Greene, (Eds.). *Handbook of Self-Regulation of Learning and Performance* (2nd Ed.). New York, NY: Routledge.

Järvelä, S., Hadwin, A.F,. Malmberg, J. & Miller. M. (2017). Contemporary Perspectives of Regulated Learning in Collaboration. In F. Fischer, C.E. Hmelo-Silver, Reimann, P. & S. R. Goldman (Eds.). *Handbook of the Learning Sciences*. Taylor & Francis.