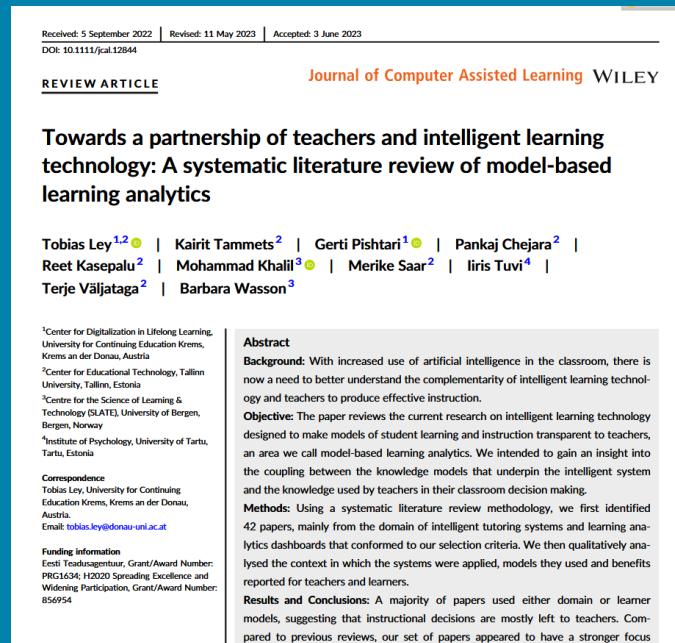


Professional Learning Analytics

Past, Present and Future

How I look at Professional Learning (Analytics)

- Learning as a social and situated activity
- Human-centered Learning Analytics
 - Human agency (individual and collective)
- Model-based Learning Analytics
 - Aligning knowledge models with learning theory



Ley, T., Tammets, K., Pishtari, G., Chejara, P., Kasepalu, R., Khalil, M., Saar, M., Tuvi, I., Väljataga, T., & Wasson, B. (2023). Towards a partnership of teachers and intelligent learning technology: A systematic literature review of model-based learning analytics. *Journal of Computer Assisted Learning*, 39(5), 1397–1417.
<https://doi.org/10.1111/jcal.12844>

A short history of Professional Learning Analytics

1. Adaptive learning environments (2001-2008)
2. The **social turn** in workplace learning technology (2008-2015)
3. Technologies for **situated learning** at the workplace (2015-...)
4. Another AI revolution (2022-?)



The Past **Adaptive Learning Environments and the** **Social Turn**

2001 - 2015

A Review of Intelligent Learning Systems for Workplace Learning

- Knowledge Structures that mediate workplace learning
- The Guidance – Emergence Continuum

Ley, T. (2020). Knowledge structures for integrating working and learning: A reflection on a decade of learning technology research for workplace learning. *British Journal of Educational Technology*, 51(2), 331–346. <https://doi.org/10.1111/bjet.12835>

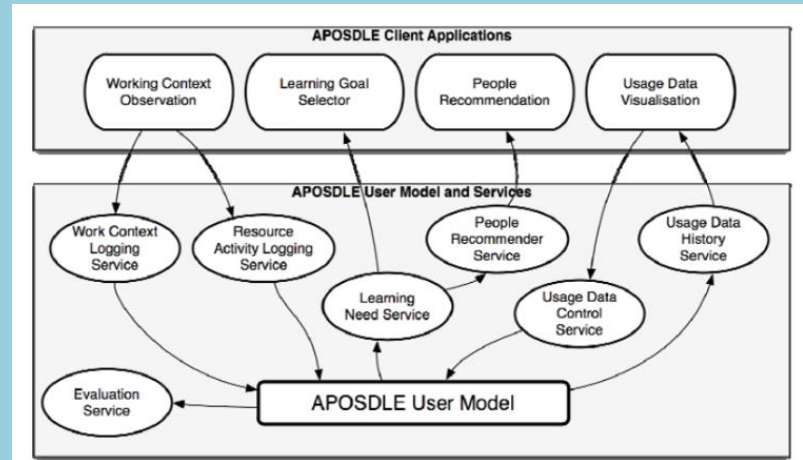
Appendix A

Research Projects related to Workplace Learning funded under the “technology-enhanced learning” (TEL) programmes of the European Commission in FP6, in FP7 and partially in H2020.

Project acronym	Programme	Years	Record on EU cordis repository	Project website
PALETTE	FP6	2006–09	https://cordis.europa.eu/project/rcn/80599_en.html	http://palette.ercim.eu
PROLIX	FP6	2005–09	https://cordis.europa.eu/project/rcn/100253_en.html	–
APOSDLE	FP6	2006–10	https://cordis.europa.eu/project/rcn/80574_en.html	http://www.aposdle.tugraz.at/
TenCompetence	FP6	2005–09	https://cordis.europa.eu/project/rcn/80579_en.html	–
MATURE	FP7	2008–12	https://cordis.europa.eu/project/rcn/85448_en.html	http://mature-ip.eu/
Intelleo	FP7	2009–12	https://cordis.europa.eu/project/rcn/90619_en.html	http://www.intelleo.eu
MIRROR	FP7	2010–14	https://cordis.europa.eu/project/rcn/95667_en.html	–
ARISTOTELE	FP7	2010–13	https://cordis.europa.eu/project/rcn/95597_en.html	–
Learning Layers	FP7	2012–16	https://cordis.europa.eu/project/rcn/106430_en.html	http://learning-layers.eu
EmployID	FP7	2014–18	https://cordis.europa.eu/project/rcn/189121/factsheet/en	https://employid.eu/
LearnPAD	FP7	2014–16	https://cordis.europa.eu/project/rcn/189117/factsheet/en	http://www.learnpad.eu/
WEKIT	H2020	2015–18	https://cordis.europa.eu/project/rcn/200491/factsheet/en	https://wekit.eu/
DEVELOP	H2020	2016–19	https://cordis.europa.eu/project/rcn/200142/factsheet/en	http://www.develop-project.eu/

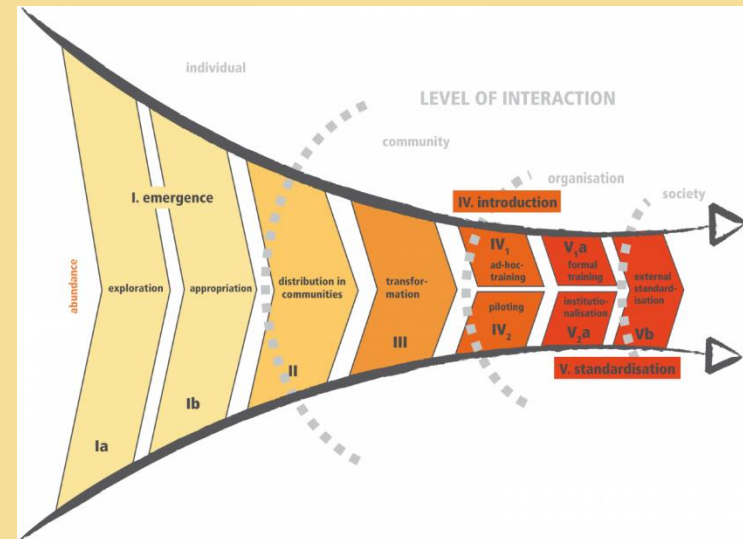
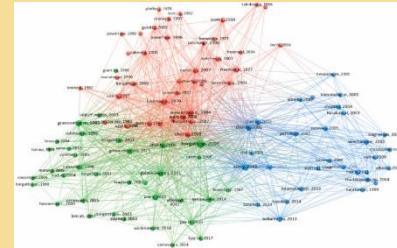
Adaptive Learning Environments

- Modelled as an Expert System
 - Domain Model, Learner Model, Adaptation Model
 - Ontologies
-
- Tracking working activities
 - Recommending resources and experts
 - Building learning paths



The Social Turn

- Web2.0 and participation
- Learning in Professional Networks
- Social Network Analysis
- Emergent structures and knowledge
- Recommending people and resources
- Knowledge creation and maturation



A Review of Professional Learning Analytics Research

Analytics depend on the **fundamental learning paradigm** chosen

Three **metaphors of learning**

Learning as ...	Knowledge Acquisition	Participation	Knowledge Creation
Dominant Knowledge Model	Ontology	Social Network	Combined
Dominant Learning Process	Feedback	Awareness, Social Network Visualization	Topic, Task Visualization

Ruiz-Calleja, A., Prieto, L. P., Ley, T., Rodriguez-Triana, M. J., & Dennerlein, S. (2021). Learning Analytics for Professional and Workplace Learning: A Literature Review. *IEEE Transactions on Learning Technologies*, 14(3), 353–366. <https://doi.org/10.1109/TLT.2021.3092219>

Knowledge acquisition		
Inf. model	Ontology	[35], [37]–[39], [46], [53]–[55], [66], [81]
	Relational model	[62], [84]
	Statistical model	[45], [60], [78], [80], [82]
Functionality	Feedback	[35], [46], [58], [60], [66], [82]
	S.N. Visualization	[80]
	Task Visualization	[46], [59], [81]
	Awareness	[53], [84]
	Model learners	[37], [44]
	Evaluation	[45], [62]
	Prediction	[38]
	Recommendation	[39], [46], [54], [58]
Participation		
Inf. model	Social network	[13], [15], [36], [40], [50], [63], [74]–[76], [83]
	Folksonomy	[42], [56], [74]
	Ontology	[56]
	Relational model	[85]
	Statistical model	[67], [73], [77], [87]
Functionality	Build groups	[50]
	Awareness	[15], [57], [67], [85], [87]
	Improve participation	[73], [87]
	S.N. Visualization	[15], [40], [63], [74], [76], [83]
	Task visualization	[77]
	Topic Visualization	[42]
	Recommendation	[36]
Knowledge creation		
Inf. model	Relational Model	[43]
	Social Network	[41], [49], [65], [68], [79], [86]
	Folksonomy	[49], [64], [79]
	Ontology	[47]–[49], [79], [86]
	Statistical model	[14], [65]
Functionality	Awareness	[43]
	Network visualization	[41], [49], [79]
	Topic visualization	[47], [49], [65], [79]
	Task visualization	[49], [79]
	Recommendation	[14], [49]
	Evaluation	[48]
	Improve participation	[48]

The Present

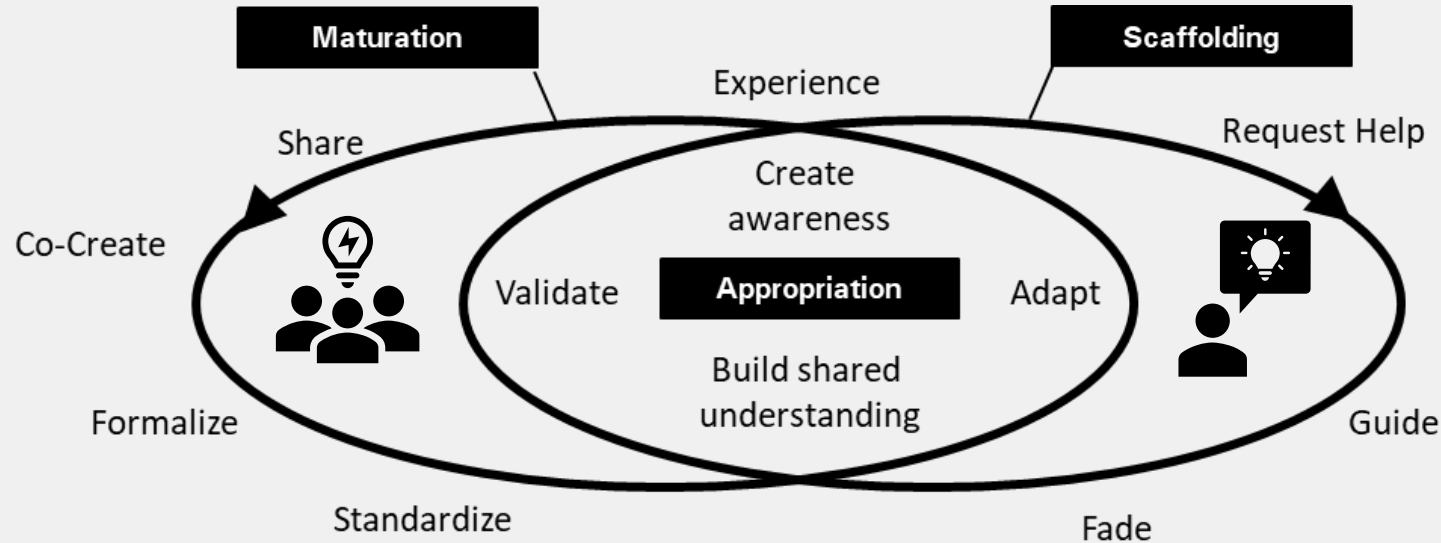
Situated learning and knowledge creation

The Knowledge Appropriation Model

Integrating Perspectives on Professional Learning and Innovation

- A **social-situated approach** to learning
- Socio-cultural theory (Rogoff 1995) (Lave & Wenger 1991) (Billet 2002)
 - Cultural practices are created in a community
 - Role of tools and artefacts for supporting these practices
 - Individual learning integrated into cultural development
 - Cultural tools (“cognitive tools”) become critical for cognitive development
- Collective Agency
 - Knowledge Creation Theory (Paavola & Hakkarainen 2014)
& Knowledge Maturation Model (Maier & Schmidt 2014)
- Individual Agency
 - Scaffolding in Informal Workplace Learning
(Twidale 2005; Tammets et al. 2013)

Knowledge Appropriation in Professional Learning



Knowledge Appropriation Model – previous applications

- **Healthcare**

- General Practices (clinics) in the UK: Staff learn while creating new organizational procedures

- **Building and Construction**

- Construction professionals in Germany: Learn about new construction techniques connected to sustainable building
- Vocational education trainers in a vocational school: Learn while creating digital technologies for learning

- **Teacher Education**

- Primary and Secondary Education Teachers learn about application of digital technologies in schools and create new learning designs



Learning Layers

Scaling up Technologies
for Informal Learning in
SME Clusters

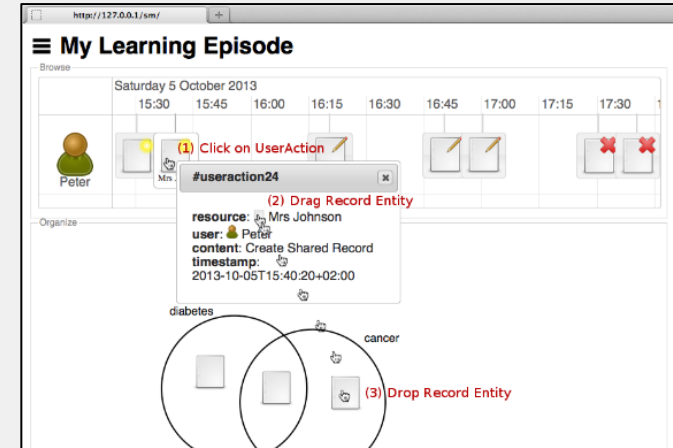
www.learning-layers.eu



www.edulabs.ee

Healthcare Professionals Informal Learning at Work

- Professionals collect learning episodes from their work in the form of notes
 - e.g. articles read, patient conversations, training materials
- Individual and Collaborative Sensemaking
- Social Semantic Server recommends tags and resources

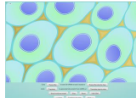


Professional Teacher Community for Learning Design

- Online Learning Platform GRAASP
- Teachers design digital resources for inquiry learning (Inquiry Learning Spaces, ILS)
- Digital laboratories for science education
- Analysis of all ILS in Graasp (Nov 2015 – Nov 2018), N = 24.485



Rate Of Photosynthesis Lab (Html5)
 ★★★★★ Rating: 4.5 - 4 votes
 This lab is an abridged Html5 version of the Flash-based Photolab. It has been optimized to work with tablet computers.



DNA To Protein
 ★★★★★ Rating: 4 - 2 votes
 Explore how the code embedded in DNA is translated into a protein. The process of converting the information in DNA into protein is a two-step process, involving transcription and translation. In transcription, an mRNA copy is made of the DNA.



Study Plant Population Density By Quadrat Method
 ★★★★★ Rating: 4.5 - 2 votes
 This lab is used to study plant population density by the quadrat method.



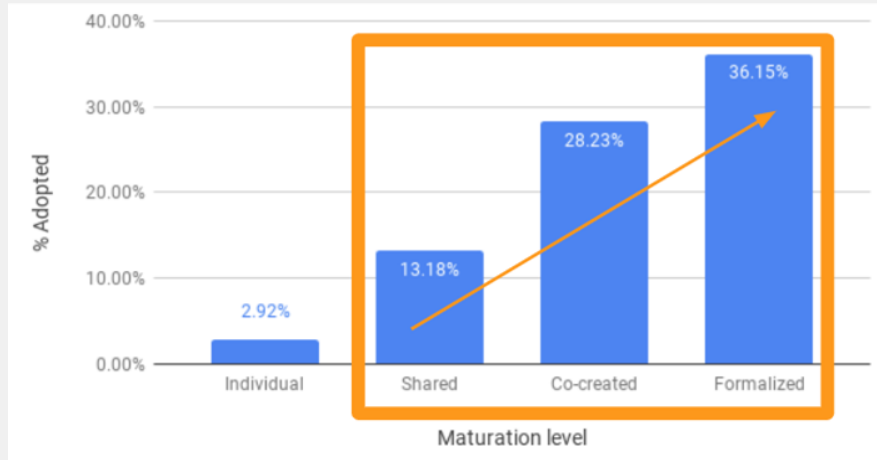
Photolab

Analysis of 24.000 Learning Designs

- Knowledge Maturation: Reach of an ILS in the community
- Knowledge Appropriation: Teachers building on other teachers' learning designs
- Adoption: Actual adoption in the classroom

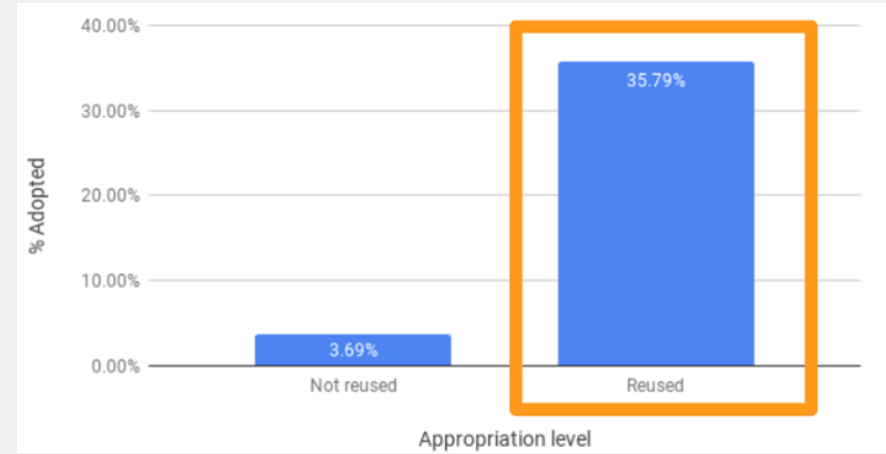
Level of adoption depends strongly on Knowledge Maturity and Appropriation

Adopted ILSs per Maturation level (N = 24,485)



maturation is strongly related to adoption
 $(\chi^2 = 2549.2, p < 0.001)$

Adopted ILSs per Appropriation level (N = 24,485)



appropriation is strongly related to adoption
 $(\chi^2 = 2035.9, p < 0.001)$

Other examples of situated learning analytics

- **Knowledge-Agency Window framework** (Buckingham Shum et al. 2022)
 - Focus on **learner agency** and **knowledge creation**.
 - e.g. personal and team skills profiles (skills analytics); making sense of challenging workplace experiences (reflective writing analytics); reflecting on orientation to learning (dispositional analytics)
- **Learning Analytics as situated tools for teacher professional development** (Tammets et al. 2022, Tammets & Ley, 2024)
 - Teacher professional noticing and decision making
- **Epistemic Network Analysis** (Shaffer et al, Elmoazen et al. 2022): Combining connections and interpretations
 - Applications in single case LA (Prieto et al. 2021)

Guest Editorial: Designing Technologies to Support Professional and Workplace Learning for Situated Practice



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Allison Littlejohn received the Ph.D. degree in chemistry from the University of Strathclyde, Glasgow, U.K., in 1987. She was a Senior Researcher with R&D, Learning Innovation Division, Royal Dutch Shell, London, U.K., in 2006–2010; the Founding Director of the Caledonian Academy, Glasgow Caledonian University, Glasgow, U.K., in 2006–2014; and the Dean of Learning and teaching with the College of Social Sciences, University of Glasgow, and Academic Director of digital innovation with the Open University, Milton Keynes, U.K., in 2015–2019. In January 2020, she joined University College London (UCL), London, where she is currently a Professor of Learning technology, the Chair of the UCL Digital Research Domain, and the Director of the UCL Knowledge Lab, London, a transdisciplinary research center shaping the future of society and technology. Her work has made contributions to knowledge practices across the energy, finance, health, education, and international development sectors. She led 40 funded research projects and has authored or coauthored around 300 articles. Her research interests include reshaping digital technology and new ways of knowing in professional contexts.

Pammer-Schindler, V., Ley, T., Kimmerle, J., & Littlejohn, A. (2022). Designing Technologies to Support Professional and Workplace Learning for Situated Practice. *IEEE Transactions on Learning Technologies*, 15(5), 523–525. <https://doi.org/10.1109/TLT.2022.3207306>

The Future

The rise of Large Language Models

How do LLMs influence model-based and situated Learning Analytics?



Focus on **natural language production** make them suitable for a much more **intuitive interaction** with models and data

- From “dashboards” to “conversations”



Lack of **transparency** of models raises concerns about biases, **human learning and agency**

- Where is the the “domain model” in LLMs?



A photograph of a modern building with large glass windows and a red-tiled roof, viewed through a glass railing. The image is partially obscured by a dark blue overlay on the right side.

Professional Learning Analytics

From **adaptive** to **social** to **situated** learning

Social and situated learning highlight the special character of professional learning

The **knowledge appropriation model** can guide learning support and analytics

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