



WATCHME

PEDAGOGICAL STUDENT MODELS FOR FEEDBACK IN WORKPLACE BASED LEARNING.

LESSONS FROM THE WATCHME PROJECT

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www.project-watchme.eu



@Project_WatchMe





WATCHME

Workplace-based e-Assessment Technology for Competency-based Higher Multi-professional Education

www.project-watchme.eu



Universiteit Utrecht



Maastricht University



SZENT ISTVÁN UNIVERSITY



University of Reading

TARTU ÜLIKOOL



UNIVERSITÄTSMEDIZIN BERLIN



UMC Utrecht

MQTEUM
MATHEMATISCHE TECHNOLOGIE



JAYWAY
digitizing ideas

NETROM
premium software



EPASS

Overview / Progress / Overview tasks / Capability request

FORMATIVE OVERVIEW | SUMMATIVE OVERVIEW | MY FILES

Progress Narrative feedback

STEP 1 Select | **STEP 2** Insert new summative assessment task | **STEP 3** | **STEP 4** Approved

Capability request - 02. Ontwerpt leeractiviteiten (incl. materialen en media) voor de gestelde leerdoelen. **Approved**

Capability request: EPA: 02. Ontwerpt leeractiviteiten (incl. materialen en media) voor de gestelde leerdoelen.

Assessment: **Approved**
Assessor: 1 Beoordelaar 1
Data assessment: 12-01-2015

Details

Level: Together with other DID(s)

Reasons for request: vaak genoeg geassisteerd

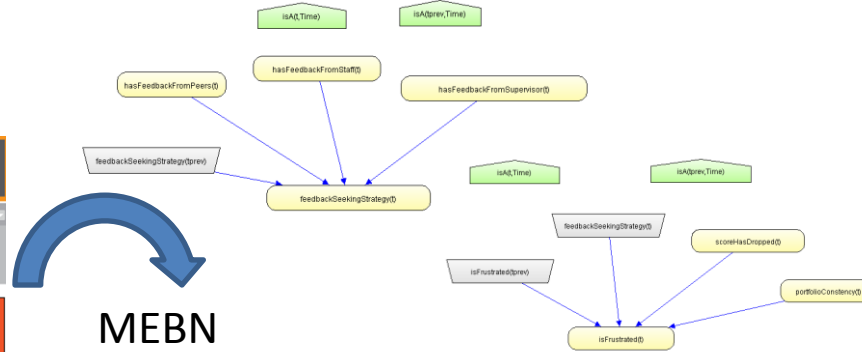
Feedback supervisors: akkoord

Context

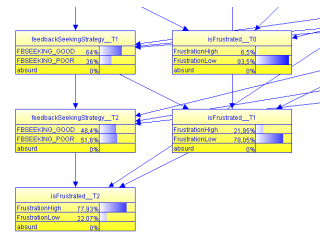
Year of training: 1

Semester: first semester

context & evidence



MEBN personalised student model



Student profile: Hospital: Onkosenoschen, Assessed on: 05-01-2016, Status: New form, Fields with an * are important for the linked EPAs.

Attachments: No attachments

Information: Format (5-10 minutes), optionally after observation

- The student explains the assessed EPA and describes actions and findings.
- The student states actions and findings to relevant background knowledge (anatomy, patho-physiology, diagnostic tests and/or therapeutic options).
- Which risks and complications did the student take into account?
- What would the student have done differently with a patient of different gender, culture, medical history, or in case of unexpected findings?

Context: EPA: 02. What parameters

Show/Hide requirements of this EPA

Show/Hide feedback on this EPA

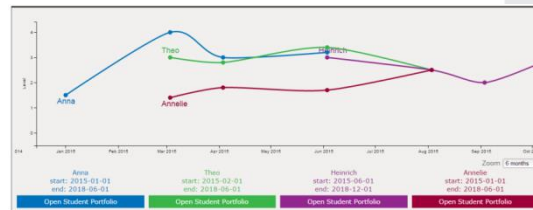
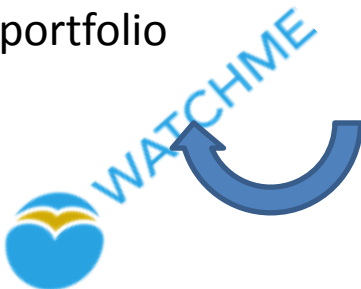
Supervisor feedback
Your supervisor added some feedback on the EPA.

Supervisor feedback
Your Supervisor commented: "Good action" (10/11/2015)

Department: *
The prev:
Function supervisor: *
Surname:

JIT messages

E-portfolio



visualisations



FP7 grnt.no. 619349

THE WATCHME STUDENT MODEL

- **Student Model = A representation of the variables and their relations that play a role in a (workplace-based) learner (e.g., performance level, motivation, consistency).**
- **We use a Bayesian network for this representation. It is grounded in classical probability theory and allows us to predict the inner state of a student on the basis of observed evidence.**
- **The type of Bayesian network we apply is called Multi-Entity Bayesian Network, which makes it possible to take the student's particular context into account, and allows a more clear way of defining the model.**



WATCHME

THE WATCHME STUDENT MODEL

- As input, our model uses e-portfolio content (e.g., assessments, scores), or findings generated from the content (e.g. a sudden drop in scores)
- The output are posterior probability tables for the variables, given the observed. (e.g., $p(\text{motivation}=\text{high})=0.7$, $p(\text{motivation}=\text{low})=0.3$)
- This output is used for presenting appropriate messages to students or their supervisors. (e.g., if $p(\text{motivation}=\text{low}) > 0.5$ display: “Please contact your mentor to talk about your study progress”)



THE WATCHME STUDENT MODEL(S)

- **The PERFORMANCE MODEL : estimates the true present level of performance (using scores and sentiment estimation)**

- **The PEDAGOGICAL MODEL: behavioural and meta-cognitive aspects.**



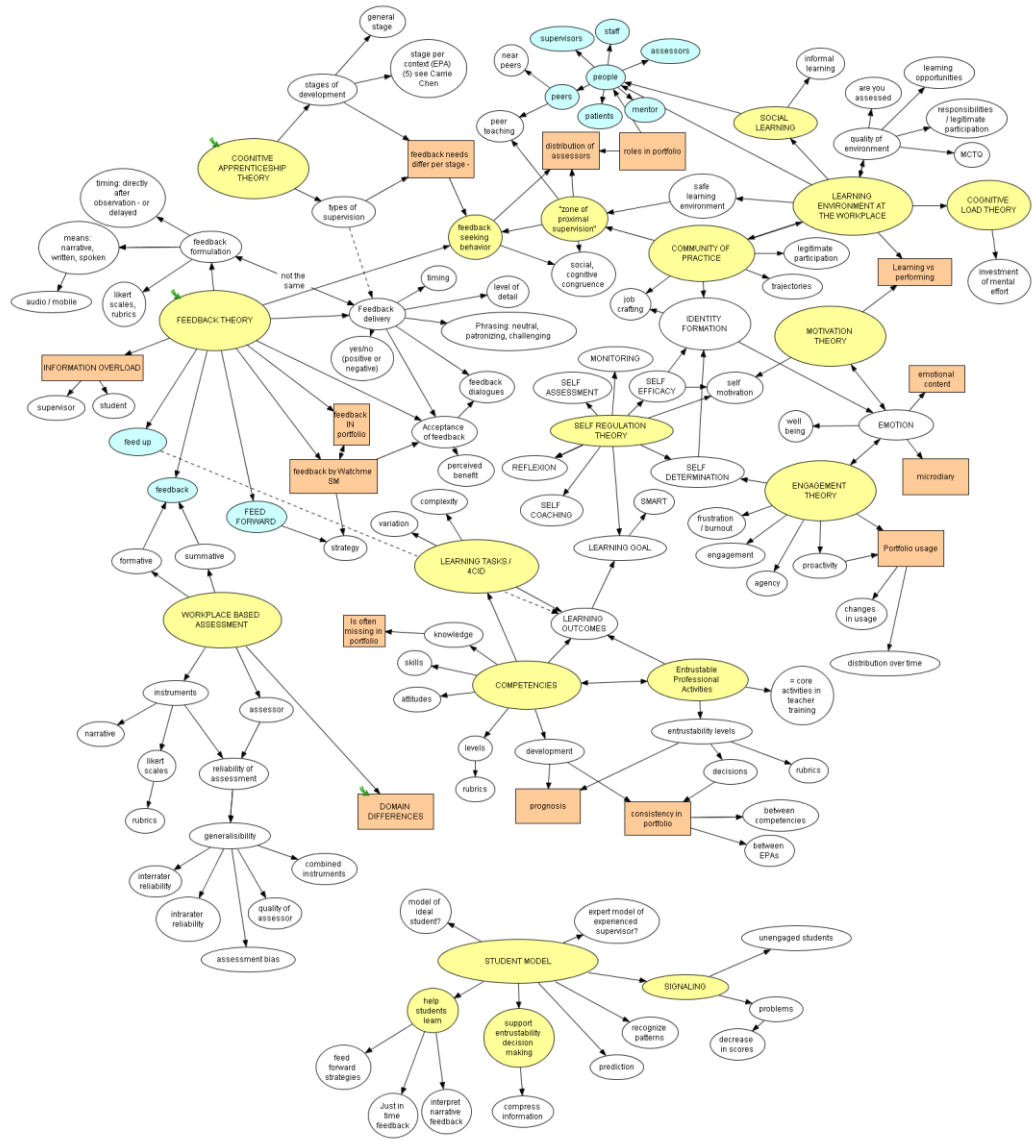
WATCHME

DESIGNING THE MODEL

- **Before building the pedagogical model, we needed to decide on what variables to include in the model.**
- **We interviewed 12 scholars involved in workplace-based learning on what educational theories and concepts that are linked to this area.**
- **From the interviews, a mind-map was created that interlinks all terms and theories mentioned in the interviews**



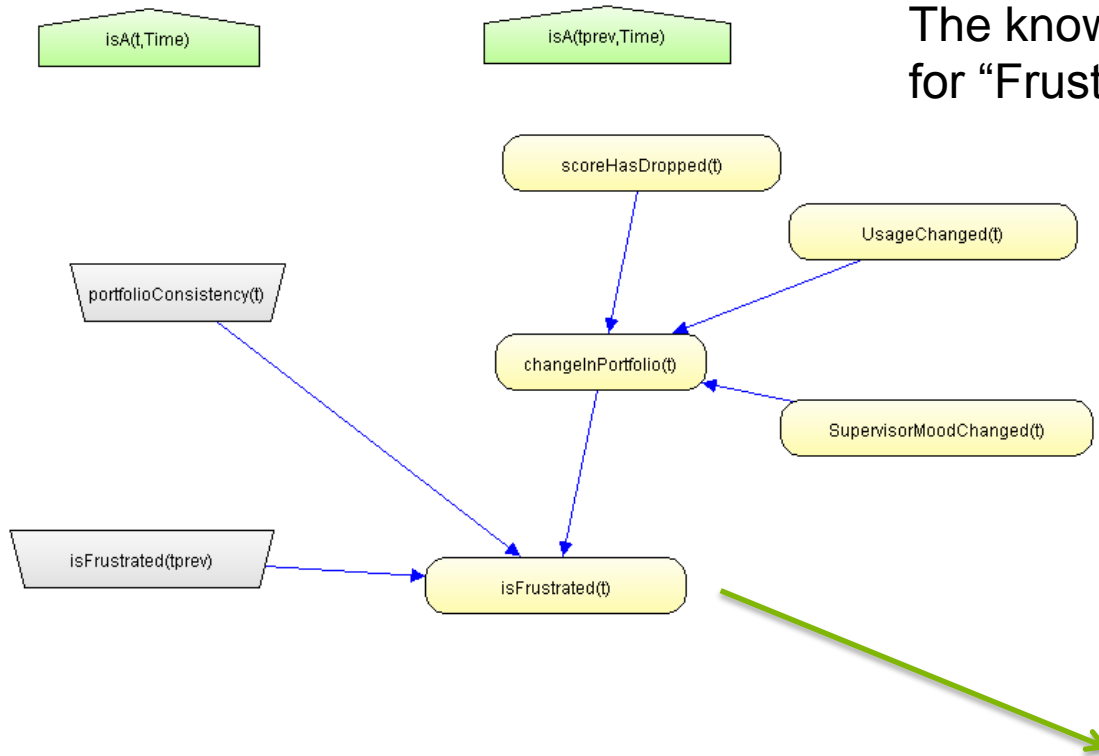
Mind map of concepts in workplace-based learning



DESIGNING THE MODEL

- **From this mind-map, we selected 5 themes, which we judged to be feasible to implement into the student model on the basis of e-portfolio content.**
- **The five selected themes are:**
 - Feedback seeking behaviour
 - “Frustration alert”
 - Completeness of information
 - Portfolio consistency
 - Need for feedback (currently not implemented)
- **We discussed the themes with representatives from each of the three WATCHME application domains for further details and refinement**

BUILDING THE MODEL

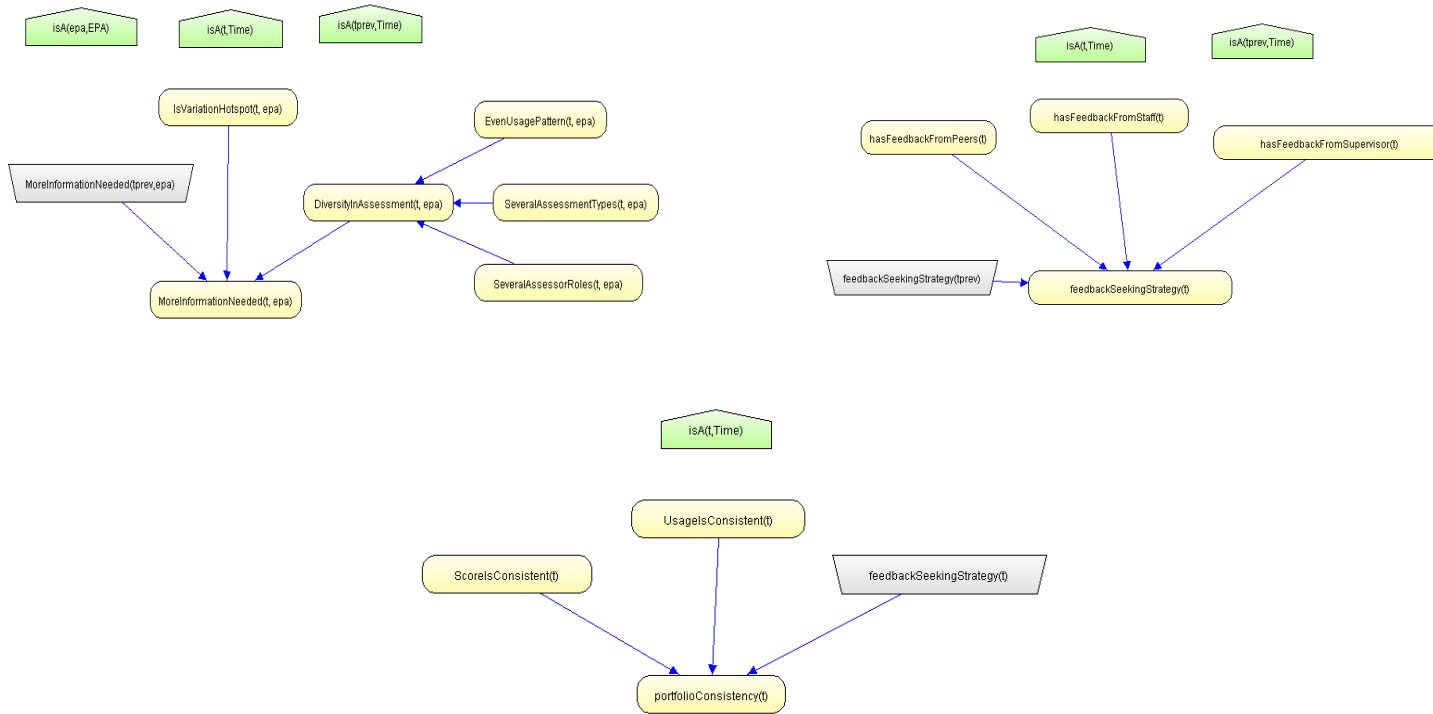


The knowledge fragment for “Frustration alert”

Each variable has a probability function connected to it:

Condition	(low on previous time)		(high on previous time)	
	Low	High	Low	High
High inconsist. & signif. Change	0.20	0.80	0.05	0.95
High inconsist. & no or mild change	0.30	0.70	0.20	0.80
Medium inconsist & Signif. Change	0.40	0.60	0.30	0.70
Low inconsist & mild or signif change	0.80	0.20	0.50	0.50
else	0.95	0.05	0.95	0.05

BUILDING THE MODEL

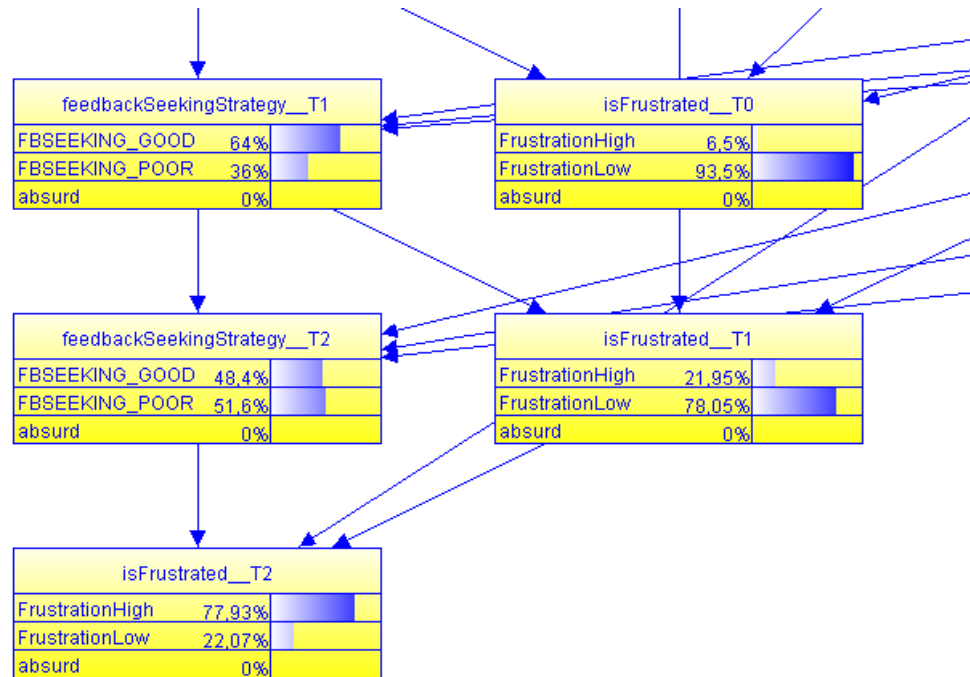


RUNNING THE MODEL

After adding evidence to the model, the model can be queried, e.g.

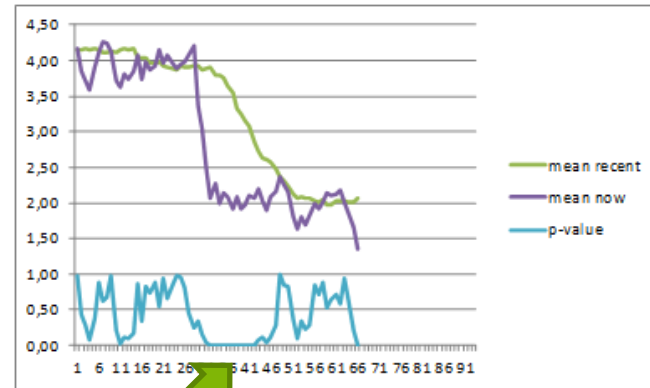
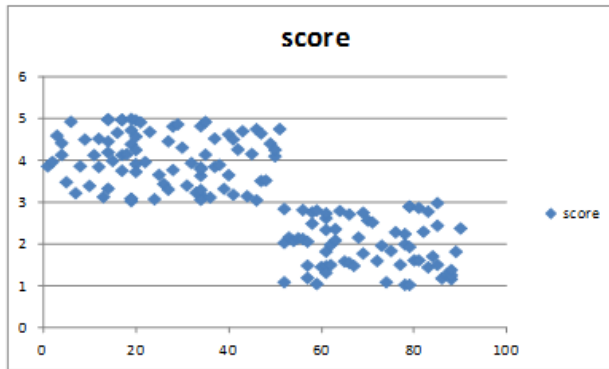
“what is the level of frustration at time T2?”

A Bayesian network will then be created that answers the query:



GETTING THE EVIDENCE

- To fill variables like “scoreHasDropped(t)” we need to extract this information from the e-portfolio – using sliding windows and a t-test



T-statistic

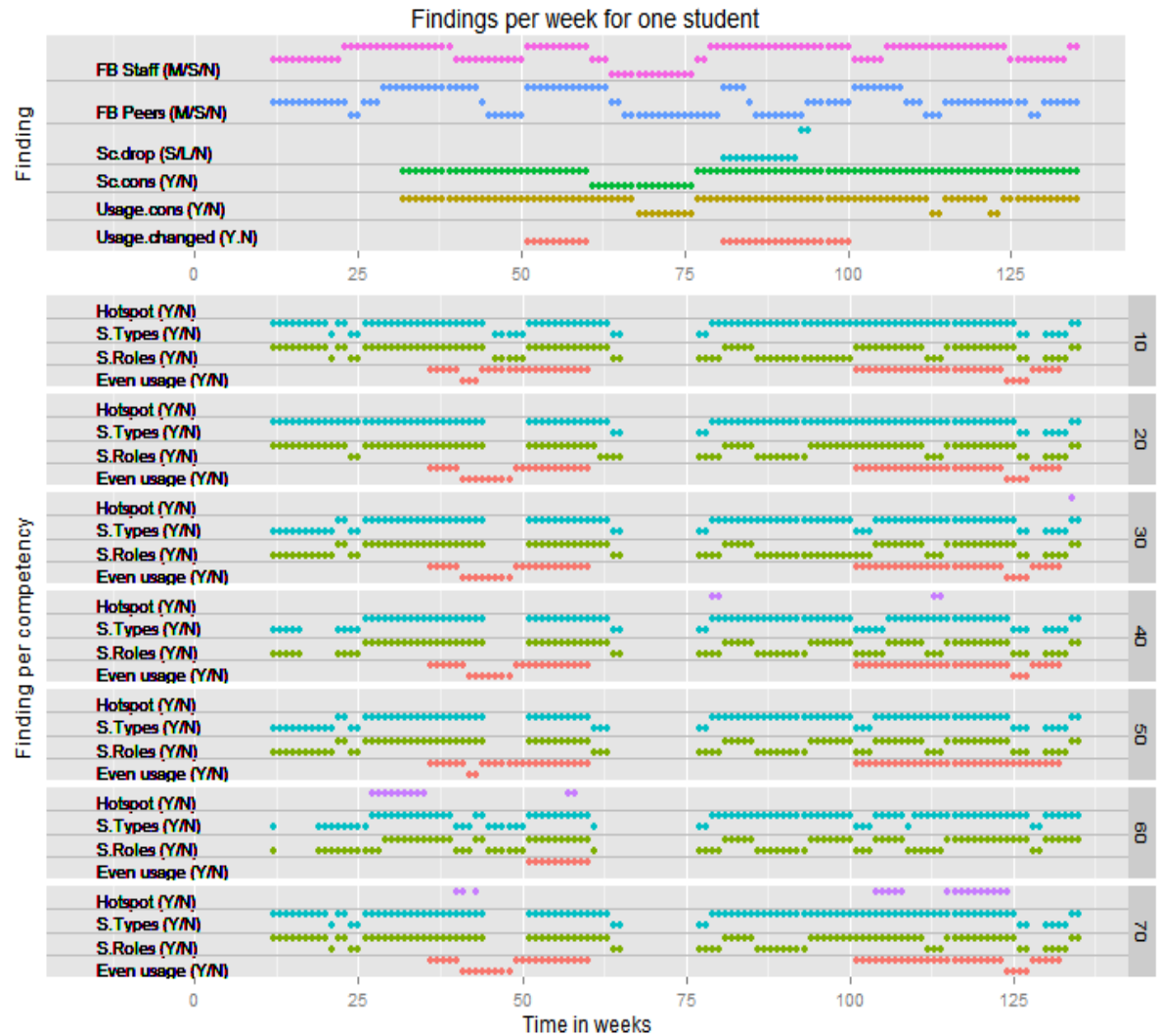


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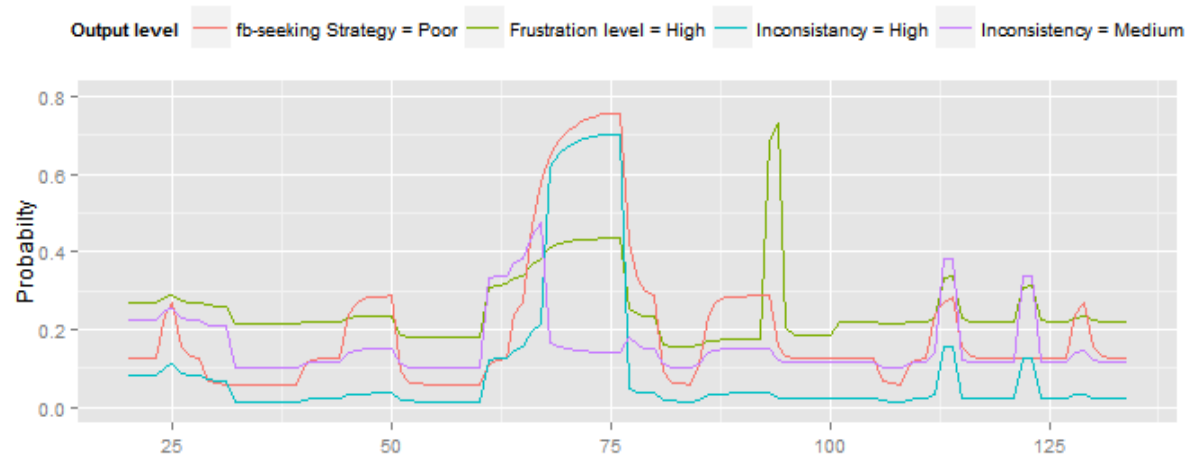
FINDING-GENERATING FUNCTIONS

- **ScoreDropped** (two time windows of scores, t-test)
- **UsageChanged** (two time windows, avg. usage, t-test)
- **MostVariation** (one time window, scores per EPA, F-statistic)
- **usageConsistency** (one time window, avg. usage, ANOVA)
- **scoreConsistency** (one time window, scores, ANOVA)

Findings generated for a fictive student



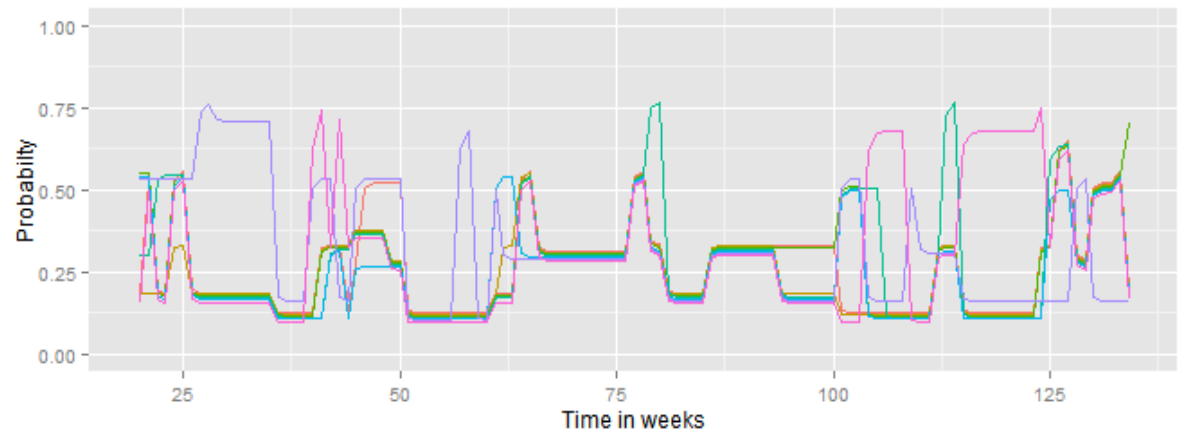
Output of student model for one student



Model output
for a fictive
student

Need more info on Competency:

- 10
- 20
- 30
- 40
- 50
- 60
- 70



EVALUATION AND CONCLUSION

The WATCHME system was tested among 318 students and 50 supervisors in 8 different contexts. Formative and summative

It is possible to catch mega-cognitive processes in functioning probabilistic student models, and e-portfolio content is suitable as input

Design of interaction is crucial: shape and content of messages did not work as intended

Diagnosis of meta-cognitive processes need a longer time span than was available in the evaluation period – so too little signals were generated

Pedagogical student models can be applied in complex and changing environment. The technology can be useful in other domains as well.



ANNOUNCEMENT

Pre conference workshop NVMO conference 13 November 2017, 14u-17u

**Learn how to construct student models for personalized feedback using
MEBN/Pr-OWL2 (lessons from the WATCHME project)**

