# Technology-Enhanced Learning in Higher Education Interactive Workshop IV: Online Self-Regulated Learning



Leiden•Delft•Erasmus Centre for Education and Learning





Erasmus University Rotterdam







What does **Regulation of** Learning mean?



With technology-enhanced learning in higher education becoming a commonplace, what do you think students need to do in order to be successful (online and offline)?



Write down the activities that you think students should be doing (online or offline) on the sticky notes provided.

Please use one sticky note for one activity.



# Regulating ( Learning

### **Self-Regulated Learning**

- The individual as a regulator of a behavior.
- Learners actively interpret and reorganize ideas.

### **Co-Regulated Learning**

- Learners and others share a common problemsolving plane
- A learner and another (often a more capable other, e.g., a more advanced student, peer tutor) sharing in the regulation of learning for the learner.

### Socially Shared-Regulated Learning

- Multiple learners regulating their learning collectively.
- Socially shared cognition whereby goals and standards are co-constructed



With technology-enhanced learning in higher education becoming a commonplace, **how do successful students regulate their learning in terms of self-, co-, and shared-?** 



Categorize the activities that you have written on the sticky notes according to self-, co-, and shared, regulation of learning.

# <u>Key Takeaway 1</u>

With technology-enhanced learning in higher education becoming a commonplace,

students are required to be engaged in various activities involving regulation of learning.



Premise 1: Regulation of learning is broad and complex Premise 2: The 'SELF' plays an important role in regulation of learning





Data from: https://www.class-central.com/report/mooc-stats-2017/

### Weekly Videos Supporting Self-Regulated Learning in MOOCs



### **3** QUESTIONS

Am I setting goals to ensure that I have a good understanding of the course materials?

2 Am I concentrating on learning the materials in this course?

3 Do I understand all the key points of this week's course materials?



Set clear learning goals on what you want to learn and make plans to achieve them.

2 Choose a time and location without distraction when studying for this course.

3 At the end of your learning session, think about what you have learned in the course for this week.

### Mobile Game App to Support Self-Study





# Ace your self-study app

Study Strategies Choose from 20+ study strategies.



#### Study Log

Keep track of your study sessions. Learn what strategies best suit you.

....

#### Study Sessions

Customize your own study session by selecting your study task, strategy, and goal.



Easy to Use

Start, setup and stop sessions as needed. Is a study strategy not working? Start up a new session.





# Key Takeaway 2

With technology-enhanced learning in higher education becoming a commonplace, *there are many possibilities to support (self-)regulation of learning*.

# Part 3: What's Next?

#### Performance Self-Control Imagery

Self-instruction Attention focusing Task strategies

Self-Observation Self-recording Self-experimentation

#### Forethought

Task Analysis Goal setting Strategic planning

Self-Motivation Beliefs Self-efficacy Outcome expectations Intrinsic interest/value Learning goal orientation

#### Self-Reflection

Self-Judgment Self-evaluation Causal attribution

Self-Reaction Self-satisfaction/affect Adaptive/defensive

> SRL Model from Zimmerman and Campillo (2003)

# Activity 3

With technology-enhanced learning in higher education becoming a commonplace, **how can we facilitate** (self-, co-, shared-) regulation of learning?



Mentimeter

Log on to mentimeter and type in as many ideas as you can think of to support (self-, co-, shared-) regulation of learning in online and other environments.

# Key Takeaway 3

With technology-enhanced learning in higher education becoming a commonplace,

supporting regulation of learning requires educators, psychologists, instructional designers, and computer scientists to work together.

# Google

#### question about regulation of learning

Google learning processes learning definition learning assessment learning self-report scale learning psych 635 learning outline learning presentation learning a review learning and test anxiety learning and motivation methodological advances

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# References

• Hadwin, A. F., Järvelä, S., & Miller, M. (2011). Self-regulated, coregulated, and socially shared regulation of learning. *Handbook of self-regulation of learning and performance*, *30*, 65-84.

## Current Study: Examining Effects of Prompting and Recommending Self-Regulated Learning in MOOCs

### Main Research Question:

Do prompting and recommending self-regulated learning strategies and prompting self-regulated learning strategies only have an effect on learning outcomes in MOOCs?



Serious Gaming Erasmus University Rotterdam



#### Econometrics: Methods and Applications

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| Week | Conditions                              |   |  |  |  |  |  |  |  |  |
|------|---|---|--|--|--|--|--|--|--|--|
| week | Control                                 | SRL prompts                             | SRL prompts + recommendations          |  |  |  |  |  |  |  |
| 1    | 1) Consent for participation            | 1) Consent for participation            | 1) Consent for participation           |  |  |  |  |  |  |  |
|      | 2) Demographic questionnaire            | 2) Demographic questionnaire            | 2) Demographic questionnaire           |  |  |  |  |  |  |  |
|      |   | 3) SRL prompts set 1                    | 3) SRL prompts + recommendations set 1 |  |  |  |  |  |  |  |
| 2    | 1) Motivation questionnaire             | 1) Motivation questionnaire             | 1) Motivation questionnaire            |  |  |  |  |  |  |  |
|      |   | 2) SRL questionnaire                    | 2) SRL questionnaire                   |  |  |  |  |  |  |  |
|      |   | 3) SRL prompts set 2                    | 3) SRL prompts + recommendations set 2 |  |  |  |  |  |  |  |
| 3    |   | 1) SRL prompts set 3                    | 1) SRL prompts + recommendations set 3 |  |  |  |  |  |  |  |
| 4    |   | 1) SRL prompts set 4                    | 1) SRL prompts + recommendations set 4 |  |  |  |  |  |  |  |
| 5    |   | 1) SRL prompts set 5                    | 1) SRL prompts + recommendations set 5 |  |  |  |  |  |  |  |
| 6    |   | 1) SRL prompts set 6                    | 1) SRL prompts + recommendations set 6 |  |  |  |  |  |  |  |
|      | Serious Gaming and                      | Serious Gaming and Econometrics*        | Serious Gaming and Econometrics*       |  |  |  |  |  |  |  |
|      | Econometrics*                           | 2) Motivation questionnaire             | 2) Motivation questionnaire            |  |  |  |  |  |  |  |
|      | 1) Motivation questionnaire             | 3) SRL questionnaire                    | 3) SRL questionnaire                   |  |  |  |  |  |  |  |
|      | 2) SRL questionnaire                    |   |  |  |  |  |  |  |  |  |
| 7    |   | 1) SRL prompts set 7                    | 1) SRL prompts + recommendations set 7 |  |  |  |  |  |  |  |
| 8    |   | 1) SRL prompts set 8                    | 1) SRL prompts + recommendations set 8 |  |  |  |  |  |  |  |
|      | Innovation Management*                  | Innovation Management*                  | Innovation Management*                 |  |  |  |  |  |  |  |
|      | 1) Motivation guestionnaire             | 2) Motivation guestionnaire             | 2) Motivation questionnaire            |  |  |  |  |  |  |  |
|      | 2) SRL questionnaire                    | 3) SRL guestionnaire                    | 3) SRL questionnaire                   |  |  |  |  |  |  |  |
|      | , | , | , , ,                                  |  |  |  |  |  |  |  |

## **Overview of the Course**



A – Week 1, B – Week 2, C – Week 3, D – Week 4, E – Week 5, F – Week 6, V – Video, S – SRL-support Video, Z – Discussion, Q – Quiz, T – Assignment, R – Reading

#### Table 2.

*Preliminary results of proportion of completed items and course grades across experimental conditions and MOOCs* 

|  |            | Prop | portion of | completed | Course grade |    |       |       |  |  |
|--|------------|------|------------|-----------|--------------|----|-------|-------|--|--|
|  |            |      | course it  | tems      |              |    |       |       |  |  |
| MOOC                                     | Conditions | n    | Mean       | SD        |              | n  | Mean  | SD    |  |  |
| Econometrics                             | Control    | 842  | 7.49       | 13.48     | -            | 57 | 44.78 | 35.98 |  |  |
| Total no. of course                      | P-SRL      | 554  | 9.86       | 15.87     | P-SRL> C     | 54 | 40.39 | 35.33 |  |  |
| activities<br>= 134                      | PR-SRL     | 605  | 10.42      | 15.26     | PR-SRL>C     | 50 | 45.10 | 34.05 |  |  |
| Innovation                               | Control    | 245  | 15.72      | 15.05     | -            | 71 | 64.62 | 31.54 |  |  |
| <i>Management</i><br>Total no. of course | P-SRL      | 180  | 18.32      | 15.18     | P-SRL> C     | 53 | 66.65 | 30.34 |  |  |
| activities<br>= 45                       | PR-SRL     | 172  | 17.34      | 15.14     | -            | 53 | 67.21 | 29.19 |  |  |
| Serious Gaming                           | Control    | 75   | 9.2        | 12.06     | -            | 19 | 40.23 | 35.66 |  |  |
| Total no. of course                      | P-SRL      | 42   | 13.76      | 11.84     | P-SRL> C     | 23 | 25.25 | 28.47 |  |  |
| activities<br>= 48                       | PR-SRL     | 46   | 12.37      | 9.91      | PR_SRL>C     | 13 | 21.82 | 20.42 |  |  |

## Employing the Use of Learning Analytics Approaches to Examine Sequences of Learner Activity

## <u>Sequential PAttern Discovery</u> using <u>Equivalent classes</u> (cSPADE)

ed sorted AV2 AZ AV3 BS NA AV3 AV4 AS AV3 AV4 AS AV5 AV2 BV1 BS BV5 CV1 CV2 CV3 CZ1 CV4 DR1 BV3 CS CZ2 AV2 AV3 AV4 AS AR1 AV5 BO DV3 AV2 AZ AV3 AV4 ΔS AV2 AV3 Δ\/Δ 20 ΔR1 AV2 AZ AV3 BS BV5 CV2 CS DV2 AV2 AV3 AV4 AV2 AZ AV3 AR2 AV3 AV2 AZ EV4 ES AS EV1 EV2 EV3 EQ2 ER2 AV2 AV3 AV5 AV4 AS BV1 BV2 CV2 AV2 AV3 AV4 AS AR1 AR2 RV2 CV2 AV2 AZ AV3 AV4 AR1 AS AV5 AR2 AV3 AV4 AS AR1 AV5 AR2 BV1 BV2 BV4 BS BV3 BQ NA AV2 AZ AV3 AV4 AS AR1 AV5 AR2 BV2 BV4 BV3 ΒZ RV1 BS BV5 AV2 AV3 AV4 AS AV5 AR2 AR1 BV1 BV2 BV4 BV3 BV5 BQ BR CV1 CV2 CV3 CV4 CQ CR DV1 AV1 AV2 AZ AV3 AV4 AV5 NA AV2 AV3 AV4 AS AR1 BV1 AR2 CV1 CV2 CS CV3 AV5 AT BS BV3 BV5 CR DS AV2 AV3 AV4 AS AR1 AV5 AR2 BV1 AV4 AS AV2 AV3 DR1 AV2 AV3 AR2 AV4 AS AR1 AR1 AR2 AS AV1 AV2 AV3 AR1 AV1 AV2 AZ AV3 AV4 AS AV5 BS BV3 BV5 CV1 CV2 CS CV3 CZ1 CV4 CZ2 CQ AV2 AZ AV3 AV4 AR1 AS AV5 AR2 AT BV4 BS BV3 BZ BV5 BQ BR CV1 CV2 CS CV3 CZ1 CV4 CZ2 CO BV1 BV2

### Using cSPADE to Identify Frequently Occurring Sequences

| _i sorted | sorted_ | sorted | sorted_ | sorted | sorted | sorted | sorted | sorted | sorted | sorte |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|-------|
| e AV1     | AV2    | AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | BV1    | BV2     | BV4    | BS     | BV3    | BV5    | BQ     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 54 AV1    | AV3    | AV4    | AS     | AR1    | AV5    | BQ     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 51 AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | AT     | AV2    | BV1    | BR      | BS     | BV3    | BV5    | BQ     | CV1    | CV2    | CS     | CV3    | CZ1     | CV4    | CZ2    | CQ     | CR     | DV1    | DV2    | DR1   |
| 0( AV1    | AV2    | AV3    | AV4    | AS     | AR1    | AT     | AV5    | BQ     | BV1    | BV2     | BV4    | BS     | BV3    | BV5    | BR     | CV1    | CV2    | CS     | CV3     | CV4    | CQ     | CR     | DV1    | DV2    | DS     | DV3   |
| ∕e AV1    | AV2    | AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 13 AV1    | AV2    | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 3i AV1    | AV2    | AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AT     | AR2    | BV1     | BV2    | BV4    | BS     | BV3    | BV5    | BQ     | BR     | CV1    | CV2     | CS     | CV3    | CV4    | CQ     | CR     | DV1    | DV2   |
| bf AV1    | AV2    | AV3    | AV4    | AR1    | AV5    | AS     | AR2    | BV1    | BV2    | BV4     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| '3 AV1    | AV2    | AZ     | AV3    | AV4    | AS     | CV1    | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 8 AV1     | AR2    | AV3    | AV4    | AS     | AV5    | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 56 AV1    | AV2    | AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | AT     | BV1     | BV2    | BV4    | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| ≥9 DT     | EV4    | ES     | AS     | EV1    | EV2    | EV3    | EZ     | EQ2    | ER2    | ER1     | FV1    | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 52 AV1    | AV2    | AV3    | AV5    | AV4    | AS     | AR1    | BV1    | BV2    | BV4    | BS      | BV3    | BV5    | CV1    | AR2    | CV2    | DR1    | ES     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| e! AV1    | AV2    | AV3    | AV4    | AS     | AR1    | AR2    | BV1    | BV2    | BV4    | BS      | BV3    | BV5    | BQ     | BR     | CV1    | CV2    | CS     | CV3    | CV4     | CQ     | CR     | DV1    | NA     | NA     | NA     | NA    |
| 99 AV1    | AV2    | AZ     | AV3    | AV4    | AR1    | AS     | AV5    | AR2    | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 7C AV2    | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | BV1    | BV2    | BV4    | BS      | BV3    | BQ     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 7 AV1     | AV2    | AZ     | AV3    | AV4    | AS     | AR1    | AV5    | AT     | AR2    | BV1     | BV2    | BV4    | BS     | BV3    | BZ     | BV5    | BQ     | BR     | CQ      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 75 AV1    | AV2    | AV3    | AV4    | AS     | AV5    | AR2    | AR1    | BV1    | BV2    | BV4     | BV3    | BV5    | BQ     | BR     | CV1    | CV2    | CV3    | CV4    | CQ      | CR     | DV1    | DV2    | DV3    | DS     | DR1    | DV4   |
| 35 AR2    | AV1    | AV2    | AZ     | AV3    | AV4    | AV5    | AS     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 5d AV1    | AV2    | AV3    | AV4    | AS     | AR1    | AV5    | AT     | BV1    | BV2    | BV4     | BS     | BV3    | BV5    | BQ     | AR2    | AZ     | CV1    | CV2    | CS      | CV3    | CV4    | CQ     | CR     | DV1    | DV2    | DS    |
| )t AV1    | AV2    | AV3    | AV4    | AS     | AR1    | AV5    | AR2    | BV1    | BV2    | BV4     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| d AZ      | AV4    | AS     | AV2    | AV3    | AT     | BV1    | BZ     | BQ     | BR     | AR1     | CZ1    | CZ2    | CQ     | CR     | DR1    | DS     | DV3    | DV2    | DV4     | DT     | EZ     | ER1    | EQ1    | EQ2    | ER2    | FQ    |
| :5 AV1    | AR2    | AV2    | AV3    | AV4    | AS     | AR1    | AV5    | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| 1c AV5    | AR1    | AR2    | AS     | AV1    | AV2    | AV3    | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA     | NA      | NA     | NA     | NA     | NA     | NA     | NA     | NA    |
| :0 AR2    | AR1    | AV1    | AV2    | AZ     | AV3    | AV4    | AS     | AV5    | AT     | BV1     | BV2    | BV4    | BS     | BV3    | BZ     | BV5    | BQ     | BR     | CV1     | CV2    | CS     | CV3    | CZ1    | CV4    | CZ2    | CQ    |
| :6 AV1    | AV2    | AZ     | AV3    | AV4    | AR1    | AS     | AV5    | AR2    | AT     | BV1     | BV2    | BV4    | BS     | BV3    | BZ     | BV5    | BQ     | BR     | CV1     | CV2    | CS     | CV3    | CZ1    | CV4    | CZ2    | CQ    |

Table 1.

<AV2, AV3, AV4, AS, BV1, BV2, BV4>

Frequent Patterns of Sequential Choice of Course Activities for SRL-prompt Viewers and SRL-prompt Non-viewers

| SRL-prompt viewers                                   | Support<br>Level | SRL-prompt non-viewers                      | Support<br>Level |
|--|------------------|---|------------------|
| 3-item sequence                                      |                  |   |                  |
| <av3, as="" av4,=""></av3,>                          | 0.6410           | <av1, av2,="" av3=""></av1,>                | 0.2656           |
| <av3, av4,="" av5=""></av3,>                         | 0.6153           | <av1, av2,="" az=""></av1,>                 | 0.1250           |
| <av2, av3,="" av4=""></av2,>                         | 0.6153           | <av1, av3="" az,=""></av1,>                 | 0.1250           |
| 4-item sequence                                      |                  |   |                  |
| <av1, as="" av3,="" av4,=""></av1,>                  | 0.5897           | <av1, av2,="" av3="" az,=""></av1,>         | 0.1250           |
| <av1, av2,="" av3,="" av4=""></av1,>                 | 0.5641           | <av1, av2,="" av3,="" av4=""></av1,>        | 0.1093           |
| <av1, av3,="" av4,="" av5=""></av1,>                 | 0.5384           | <bq, eq1,="" eq2,="" fq=""></bq,>           | 0.0625           |
| 5-item sequence                                      |                  |   |                  |
| <av1, as="" av2,="" av3,="" av4,=""></av1,>          | 0.5384           | <av1, av2,="" av3,="" av4="" az,=""></av1,> | 0.0625           |
| <av1, av2,="" av3,="" av4,="" av5=""></av1,>         | 0.4871           | <bq, cq,="" eq1,="" eq2,="" fq=""></bq,>    | 0.0468           |
| <av2, av3,="" av4,="" bv2,="" bv4=""></av2,>         | 0.4615           | <cr, dr1,="" dr2,="" ev4,="" fr=""></cr,>   | 0.0156           |
| 6-item sequence                                      |                  |   |                  |
| <av2, av3,="" av4,="" bv1,="" bv2,="" bv4=""></av2,> | 0.4615           |   |                  |
| <av1, ar2="" as,="" av2,="" av3,="" av4,=""></av1,>  | 0.4358           |   |                  |
| 7-item sequence                                      |                  |   |                  |

0.4102

SRL-prompt viewers (*n* = 39) SRL-prompt non-viewers (*n* = 64)

SRL-prompt viewers gravitated towards following the sequential structure of the course provided by the instructor and less so in the group of SRL-prompt non-viewers.

## Visualization of transitions from one course item to another



## Summary

### • Identifying Self-Regulated Learning Supports

Wong, J., Baars, M., Davis, D., Van Der Zee, T., Houben, G. J., & Paas, F. (2018). Supporting Self-Regulated Learning in Online Learning Environments and MOOCs: A Systematic Review. *International Journal of Human–Computer Interaction*, 1-18.

• Examining Effects of Prompting and Recommending Self-Regulated Learning in MOOCs

Manuscript in preparation

• Employing the Use of Learning Analytics Approaches to Examine Sequences of Learner Activity

Manuscript under review

• Educational Theories and Learning Analytics: From Data to Knowledge

Wong, J., Baars, M., De Koning, B. B., Van Der Zee, T., Davis, D., Khalil, M., Houben, G. J., & Paas, F. (in press). Educational theories and learning analytics: From Data to Knowledge. In D. Ifenthaler, D.K. Mah & J. Yau (Ed.), *Utilizing learning analytics to support study success*.

## Questions?