Orchestrating ICT for Education
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ICT for Education – a multi-disciplinary research area

- Computer Scientists
- Learning Scientists
- Programmers
- Evaluators
**Potential for Developing the Disciplines in a Multi-Disciplinary Research Area**

**Learning Science**
- Focusing on separate approaches, learning arrangements, and instructional designs

**Computer Science**
- Developing tools centered on technological capabilities to solve ALL possible problems

- Building on evidence for effective instructional designs and gear tool development towards needs of learners and teachers
- Taking context and the synergy of multiple learning arrangements over the long run and on multiple processes and outcomes into account

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E-Learning in context, the Ravensbourne Learner Integration Model
Orchestration Definitions

◊ „process of productively coordinating supportive interventions across multiple learning activities occurring at multiple social levels“ (Fischer & Dillenbourg, 2006)

◊ „process by which teachers and other actors design, manage, adapt and assess learning activities, aligning the resources at their disposal to achieve the maximum learning effect, informed by theory while complying pragmatically with the contextual constraints of the setting“ (Prieto, 2012)
Orchestration

Adaptive Support
Ecology of Devices
Scripted roles and activities
Combination of learning arrangements

Weinberger, 2017

Application of the „Orchestration“ Concept

- Development, Specification, and Analysis of Complex Learning Environments
Blended Learning „Suspension Bridge“

Orchestration of learning arrangements

Dillenbourg (2015)
Graphical Language for MOOC-Designs

Development, Specification, and Analysis of Complex Learning Environments
Design and Categorization of Instructional Approaches and Scaffolds for Complex Learning Environments

Application of the „Orchestration“ Concept
Negative motivational and cognitive phenomena of complex learning scenarios

- Orientation towards minimal requirements ("Satisficing"; Chinn, O’Donnell, & Jinks, 2000)
- Little and heterogeneous participation (Weinberger et al., 2001)
- Knowledge divergence (Weinberger, Stegmann, & Fischer, 2007)

→ Need for Additional Scaffolding

Scaffolding through Feedforward and Feedback

**Scripts**
- Structure group interactions (Fischer et al., 2013)
- External regulation of learning processes

**Awareness Tools**
- Aggregate and visualize process information (Janssen & Bodemer, 2013)
- Supporting internal regulation
Two tracks and examples of co-present and mediated scenarios of learning with ICT

1. Co-Present Learning with Tablets/iPads
2. Learning in Social Networks (Facebook)

Collaborative Drawing on Tablets

Team: Hannie Gijlers, Alieke van Dijk
Results in a nutshell

- Script facilitated the quality of the drawings as well as learning outcomes 🟢 🟢
- Awareness features facilitated learning outcome 🟢

iPads as Mini-Tabletops

Team: Lara Schmitt, Jochen Rick
Results in a nutshell

- Script facilitated the epistemic and transactive quality of the discourse as well as learning outcomes ✅
- Awareness feature = baseline in this iPad-app

Orchestration

- Modes of sharing: Mobiles as shared canvasses and tabletops
- Effective Feedback
- Effective Feedforward
- Productive forms of sequencing individual and collaborative learning arrangements
- Adaptive Support
- Ecology of Technologies
- Scripted roles and activities
- Combination of learning arrangements
Learning in Facebook

Team: Dimitra Tsovaltzi, Thomas Puhl
Results in a nutshell: Lab Study

- Argument script
  - enhances individual learning, learners' argumentation, and knowledge sharing
  - small to medium effects that are overruled by individual preparation

- Individual Preparation
  - Learners prematurely settled on one perspective
  - built less on the reasoning of their peers (transactivity)
  - and share less knowledge
  - also: lower learning outcomes mediated by processes of argument elaboration, taking multiple perspectives, and knowledge co-construction

ArgueGraph Script
(Jermann & Dillenbourg, 1999 & 2003)
**Epistemic quality of argumentation**

- GAT $\times$ time significant, $F(6;606)=2.88$; $p=.009$; $\eta_p^2=.03$
- ARG-script $\times$ time significant, $F(6;606)=7.75$; $p<.001$; $\eta_p^2=.07$
- Significant simple contrasts
  - time $\times$ GAT: t4
  - time $\times$ ARG-script: t3, t6, t7, t8
- Anova t8:
  - GAT: $p=.04$; $\eta_p^2=.04$
  - ARG-script: $p=.000$; $\eta_p^2=.12$
- Correlation t8 and learning outcome: $r=.24^*$

**Formal quality of argumentation**

- GAT $\times$ time, n.s.; $p=.07$
- ARG-script $\times$ time significant, $F(6;606)=2.79$; $p=.011$; $\eta_p^2=.03$
- Significant simple contrasts
  - time $\times$ GAT: n.s.
  - time $\times$ ARG-script: t8
- Anova t8:
  - GAT: $p=.000$; $\eta_p^2=.12$
  - ARG-script: $p=.000$; $\eta_p^2=.31$
- Correlation t8 and learning outcome: $r=.29^*$
Social modes of co-construction

- GAT × time significant, \( F(6;606) = 2.88; \ p = .009; \ \eta^2_p = .03 \)
- ARG-script × time significant, \( F(6;606) = 7.75; \ p < .001; \ \eta^2_p = .07 \)

- Significant simple contrasts
  - time x GAT: t7
  - time x ARG-script: t3

- Anova t8 not significant

Domain-specific knowledge

- Main effect ARG-script: \( F(1;98) = 23.44, \ p = .000, \ \eta^2_p = .19 \)
- Main effect GAT: \( F(1;98) = 11.24, \ p = .001, \ \eta^2_p = .10 \)
- Interaction GAT × ARG-script: \( F(3;102) = 4.89; \ p = .029; \ \eta^2_p = .05 \)
Orchestration – a useful concept

- Not all combinations of learning arrangements are successful
  - Lesson → Home work
  - Individual preparation → joint argumentative knowledge construction vs. comparison and joint improvement of emerging learning objects

- Not alone sequencing, but linking learning arrangements and …

- Additional Scaffolding of learning through Scripts and Awareness Tools in an Ecology of Devices
Thank you for your attention!