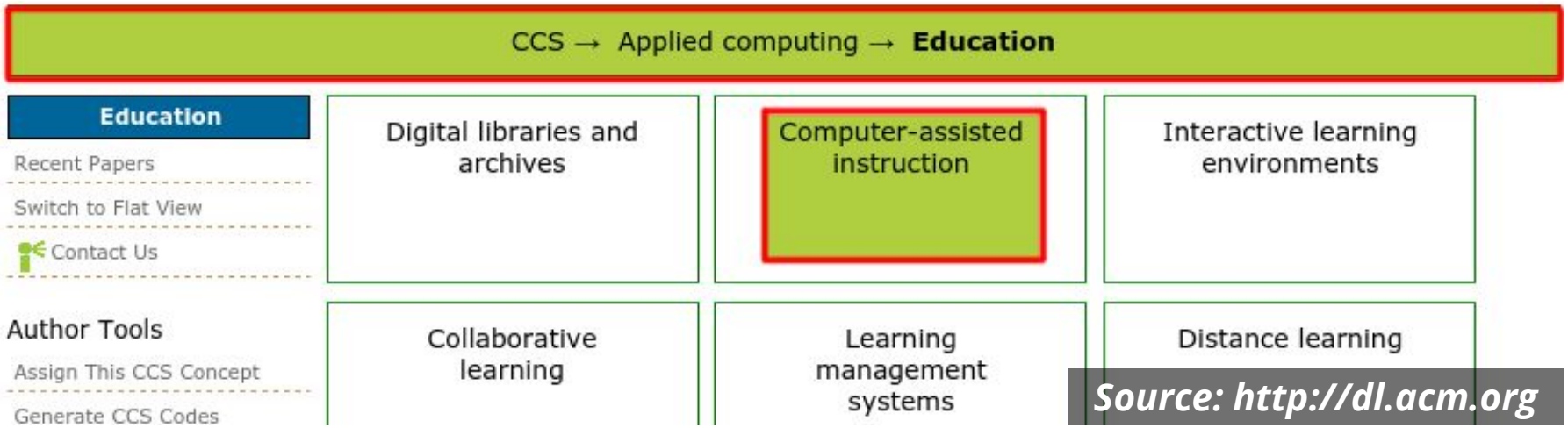
Understanding the effects of Streamlining the Orchestration of Learning Activities

Lighton Phiri (HPI-CS4A)

Supervisors:
A/Prof. Hussein Suleman | Prof. Dr. Christoph Meinel

HPI-CS4A Spring Workshop | August 30 2016

Introduction



We study technology-driven orchestration in order to understand the impact of organised orchestration of teaching.

- Study the use of an orchestration workbench for achieving streamlined technology-driven orchestration
- Demonstrate the successful use of approach

Motivation (1)

Formal learning spaces are inherently complex ecosystems—actors, activities, constraints.

Motivation (2)

Formal learning spaces can be turned into effective learning environments by supporting educators with orchestration.

Orchestration is challenging & ad hoc

Orchestration is challenging due to its multi-faceted nature

- Constraints such as time

Technology-driven orchestration is ad hoc—no standard way of orchestrating learning activities

- Analysis 1: Interviews
  - Expert reviews with eight UCT teaching staff
- Analysis 2: Observations
  - Classroom observations—END1020S; END1021F; STAT1100S
- Analysis 3: Archival records
  - UCT archived lecture recordings

Thesis statement

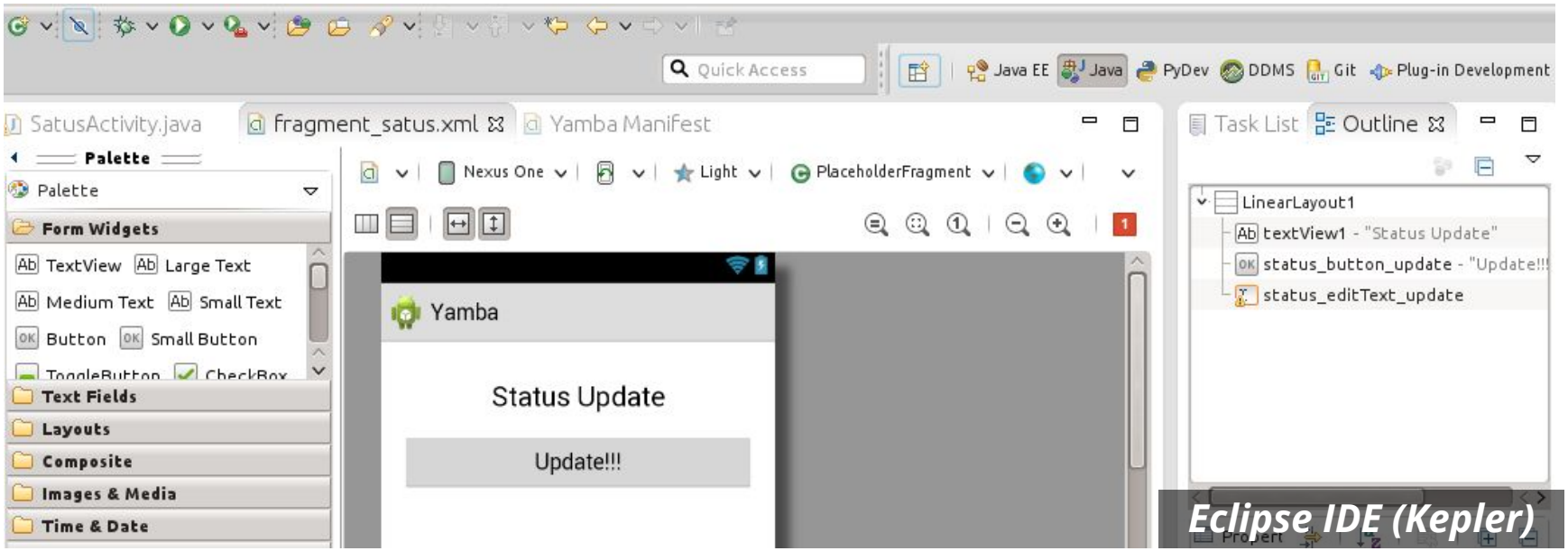
Streamlined orchestration—attainable through explicit organisation of learning activities using an orchestration workbench—could potentially make educators more effective.

Research questions

1) Does an orchestration workbench enable educators to become more effective?
2) What is the impact of an orchestration workbench on educators' teaching experience?

Inspiration

We draw inspiration from the success of explicit organisation of tasks and activities in other domains; for instance IDEs have proved successful in software development.

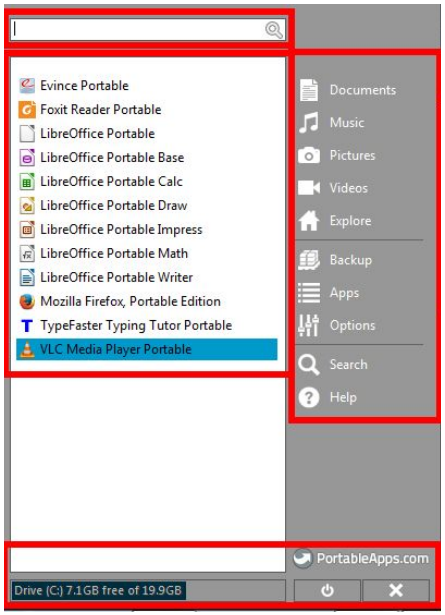


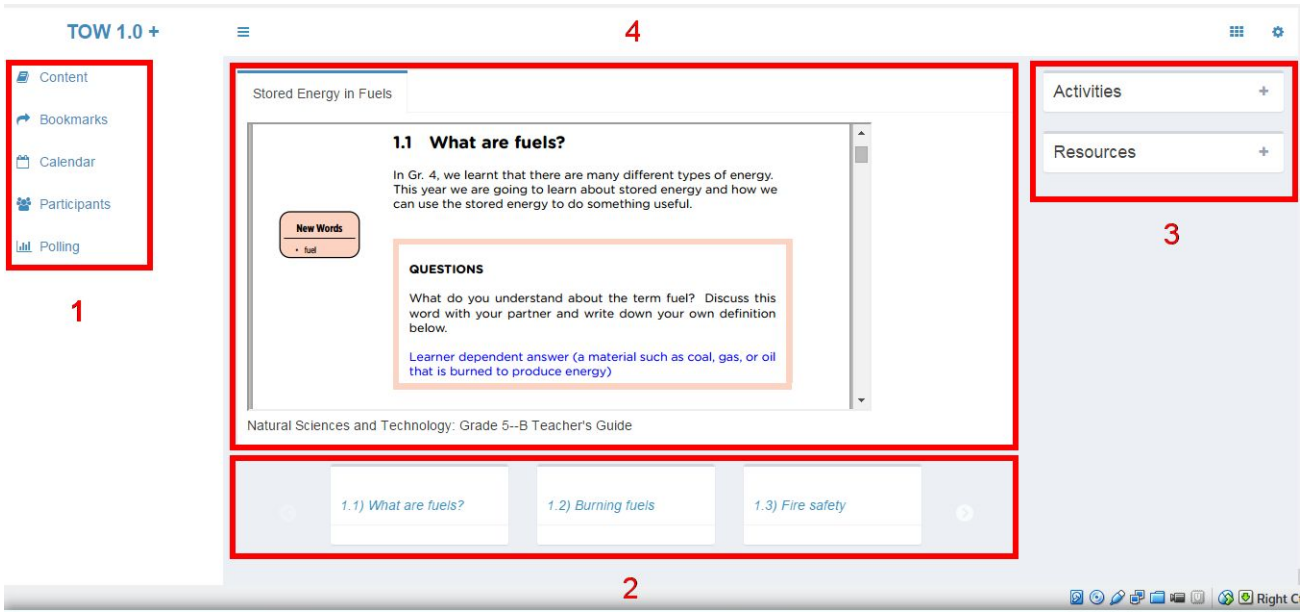
Streamlining orchestration

Using the concept of cross-plane integration [3] we view orchestration as a function of the scale of learning activities—individual, group or class—with respect to time.

- Enactment of learning activities
- Sequencing of activities
- Learning activity management
- Centralised access to tools and services

Study 1: Ad hoc vs. organised orchestration (1)





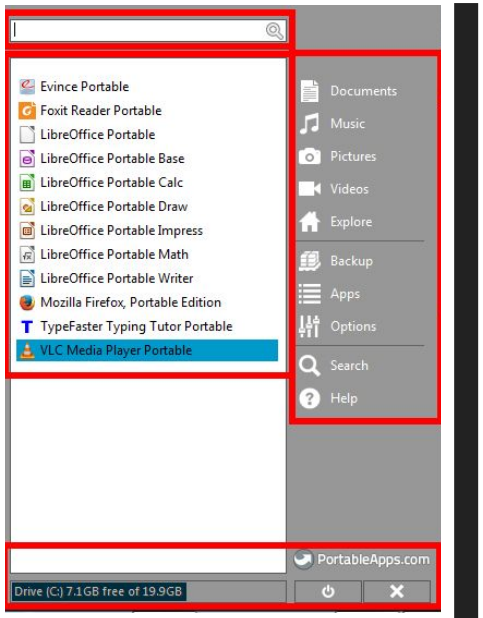
PortableApps

Prototype Workbench

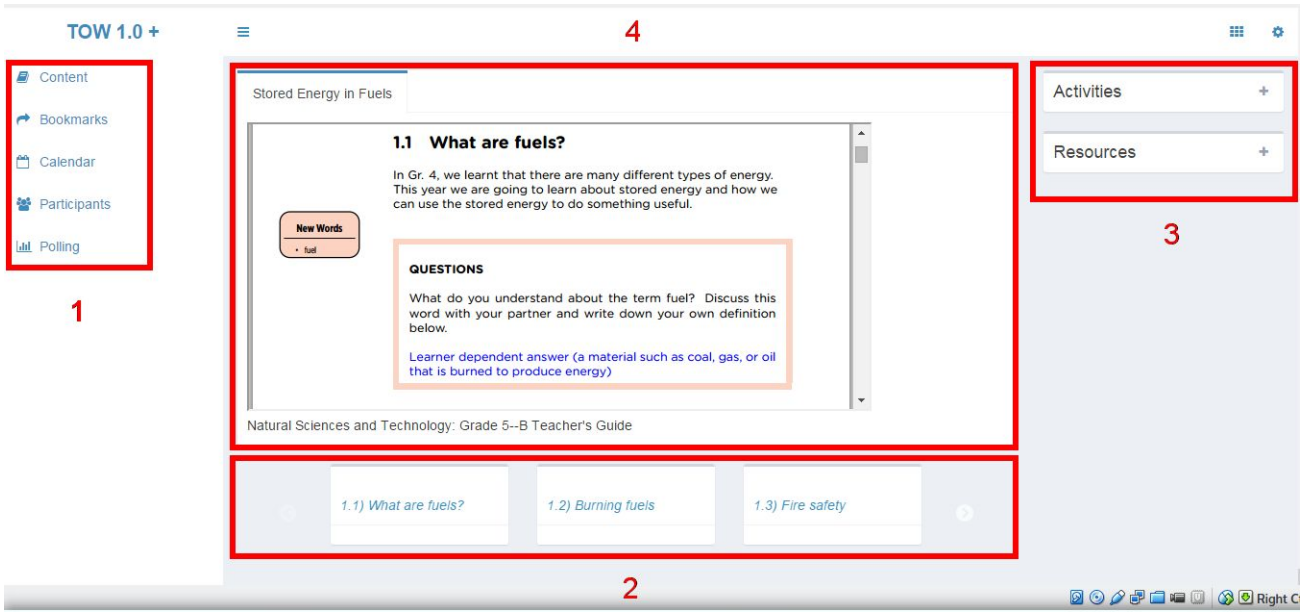
Ad hoc vs. Organised Orchestration (Under review).
Lighton Phiri, Christoph Meinel and Hussein Suleman.
T4E 2016.

Study 1: Ad hoc vs. organised orchestration (2)

- *PortableApps used to simulate ad hoc orchestration*
- *Workbench UI used to simulate organised orchestration*



PortableApps



Prototype Workbench

Study objectives

How does effectiveness & UX of organised orchestration, using an orchestration workbench, compare with ad hoc orchestration?

- H1: Workbench is more effective
- H2: Workbench results in positive user experience

RQ	***AH***	***Factor***	***Variable***	***Scale***	***Description***
RQ1	*H1*	*Task speed*	T_t	*Min*	*Task time*
		Success	*PQ*	*[-3 – 3]*	*AttrakDiff 2*
		Comfort	*HQ-I*	*[-3 – 3]*	*AttrakDiff 2*
RQ2	*H2*	*UX*	*HQ-*;ATT*	*[-3 – 3]*	*AttrakDiff 2*

Evaluation aspects

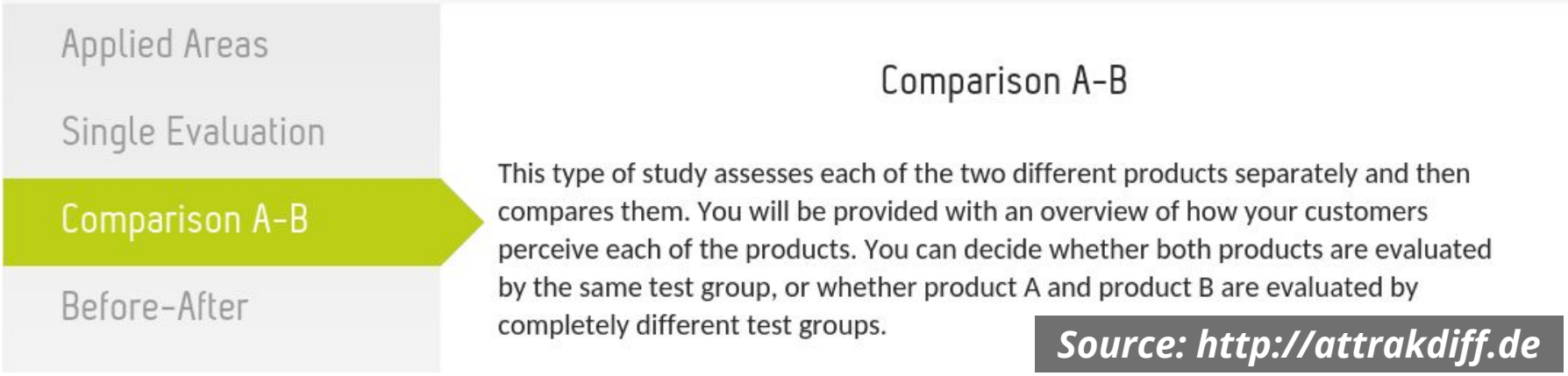
Effectiveness interpreted as follows:

- Learning activities orchestrated better, easier or faster
- Extent towards which orchestration goals were realised
- Participants’ level of comfort while orchestrating learning activities

User experience interpreted as participants' subjective views of orchestration technique's potential at meeting orchestration needs

Measurement instrument

AttrakDiff 2 used as primary measurement instrument



- Measures pragmatic quality (PQ), hedonic quality (HQ-I and HQ-S) and attractiveness quality (ATT) of interactive products
- Four dimensions associated with seven bipolar word-pairs—opposite adjectives

Study participants

61 participants from Cape Peninsula University of Technology recruited, with 55 of them completing all experimental tasks.

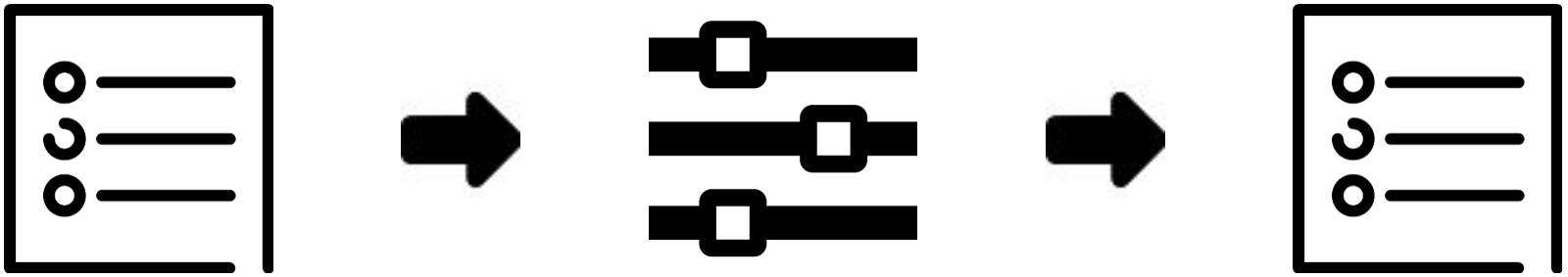
Participants' levels of study ranged from second year to fourth year. In addition, participants had varying experience teaching and experience using computers

Experimental design (1)

Pre-task activities

Orchestration tasks

Post-task activities



- Within-subject design using random experiment blocks

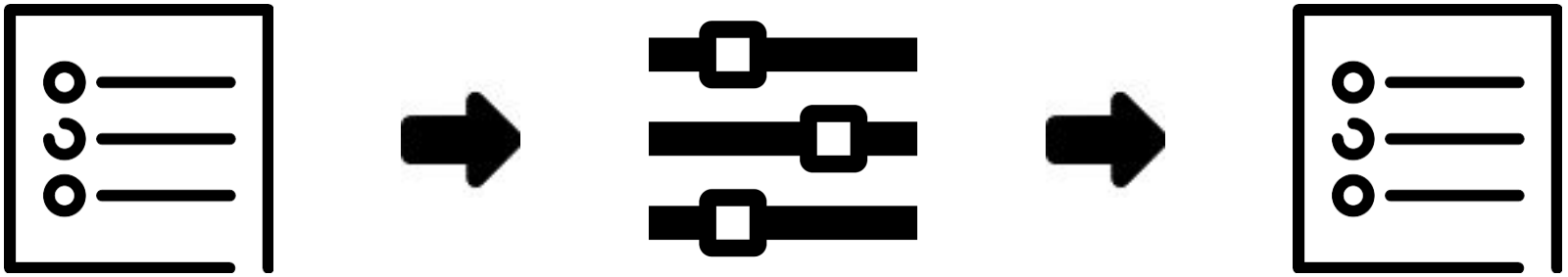
	Participants	***Approach 1***	***Approach 2***
Group 1	*29*	*Workbench*	*PortableApps*
Group 2	*26*	*PortableApps*	*Workbench*

Experimental design (2)

Pre-task activities

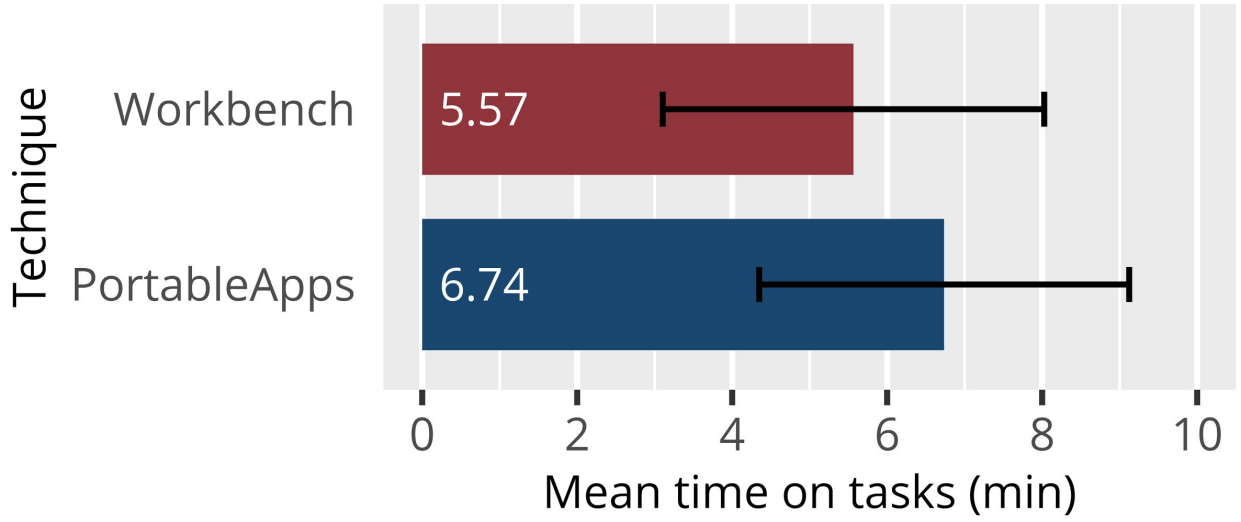
Orchestration tasks

Post-task activities



- Two experimental conditions
  - IV: Orchestration technique
  - DV: Time on tasks; AttrakDiff 2 dimensions
  - CV: Level of study; Teaching experience; Computing experience

Results 1: Time on tasks



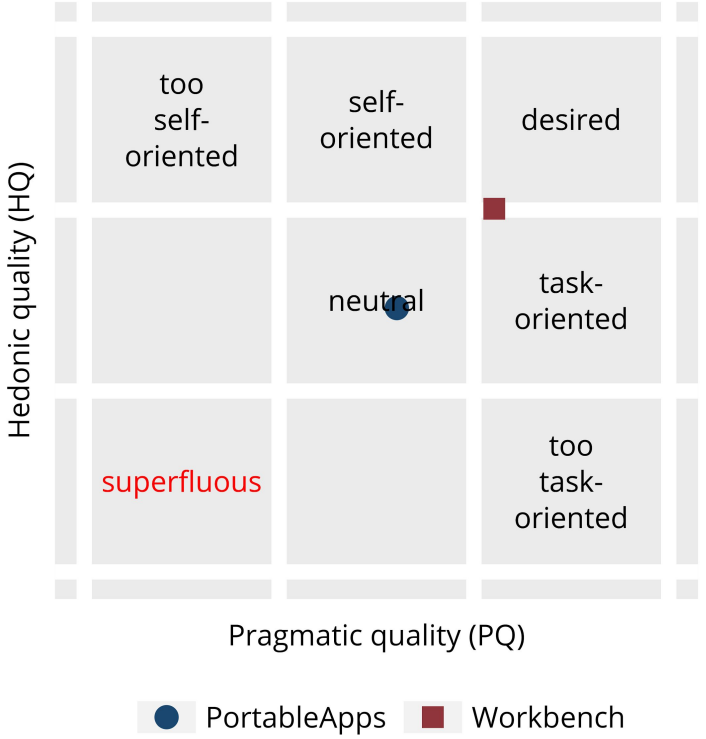
- On average, orchestration of learning activities was 21.0% faster using workbench

paired samples t-test; p-value < 0.05

Results 2: AttrakDiff 2 (1)

AttrakDiff 2
portfolio-presentation

- Both orchestration approaches fall within the same character region
- Workbench approach falls closer to desired character region

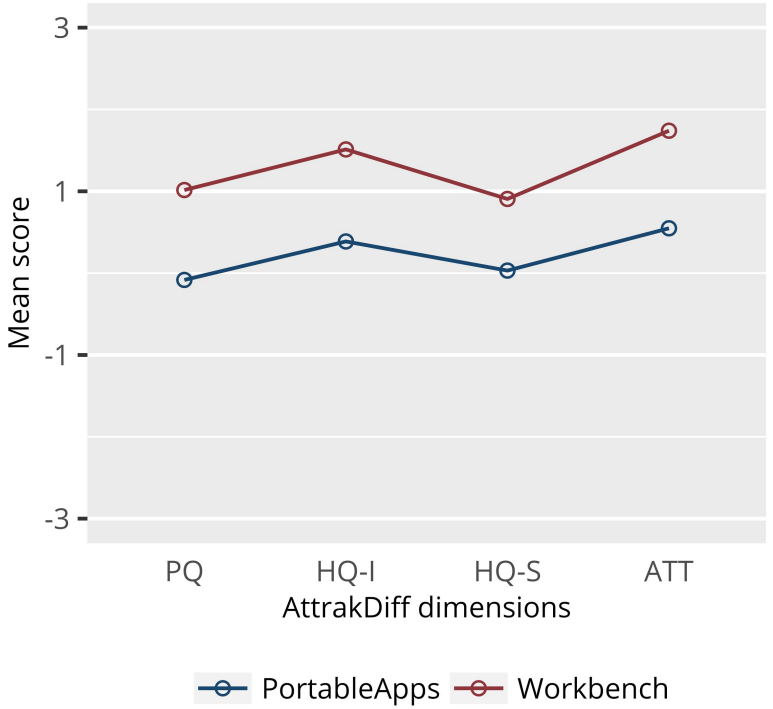


paired samples t-test; PQ: p-value < 0.001; HQ-I: p-value < 0.001; HQ-S: p-value < 0.001; ATT: p-value < 0.001

Results 2: AttrakDiff 2 (2)

AttrakDiff 2 dimension means

- PQ; HQ-I; HQ-S; ATT
  - Mean score higher for workbench on average
- Further analysis of dimension means done using word-pairs



paired samples t-test; PQ: p-value < 0.001; HQ-I: p-value < 0.001; HQ-S: p-value < 0.001; ATT: p-value < 0.001

Analysis 1: Technique effectiveness

Time on tasks

- On average participants orchestrated learning activities faster using workbench

AttrakDiff 2 dimensions

- Higher scores for PQ and HQ-I dimensions
- Participants' perceived success at orchestrating learning activities greater using workbench

Analysis 2: User experiences

AttrakDiff 2 dimensions

- Higher scores for HQ-S and ATT dimensions

Participants' comments

"Having to use approach 2 with my learners would take longer than doing the first one" —Group 1

"I liked it more than the first approach. This was really good and creative, easy to access your resources and activities" —Group 2

"The second activity was harder for me to do." —Group 1

Analysis 3: Counterbalancing

Potential impact of approach complexity during transition

	Approach 1	***Approach 2***
Group 1	*Workbench: 5.84 (2.30)*	*PortableApps: 7.44 (2.24)*
Group 2	*PortableApps: 6.10 (2.38)*	*Workbench: 5.32 (1.05)*

Similar trends as overall results for dimension means

	Approach	***PQ***	***HQ-I***	***HQ-S***	***ATT***
Group 1	*Workbench*	*0.83 (1.03)*	*1.27 (1.00)*	*0.82 (0.69)*	*1.46 (1.19)*
	PortableApps	*-0.38 (1.09)*	*0.18 (0.72)*	*-0.11 (0.69)*	*0.32 (1.02)*
Group 2	*Workbench*	*1.22 (0.85)*	*1.79 (0.84)*	*1.01 (0.79)*	*2.05 (0.88)*
	PortableApps	*0.25 (1.32)*	*0.62 (1.23)*	*0.19 (1.06)*	*0.80 (1.40)*

Analysis 4: Demographic differences

The influence of control variables resulted in minor variations from overall results

- Participants' times of task patterns were similar for both approaches
- Fourth year students orchestrated activities quicker using both approaches

Study findings

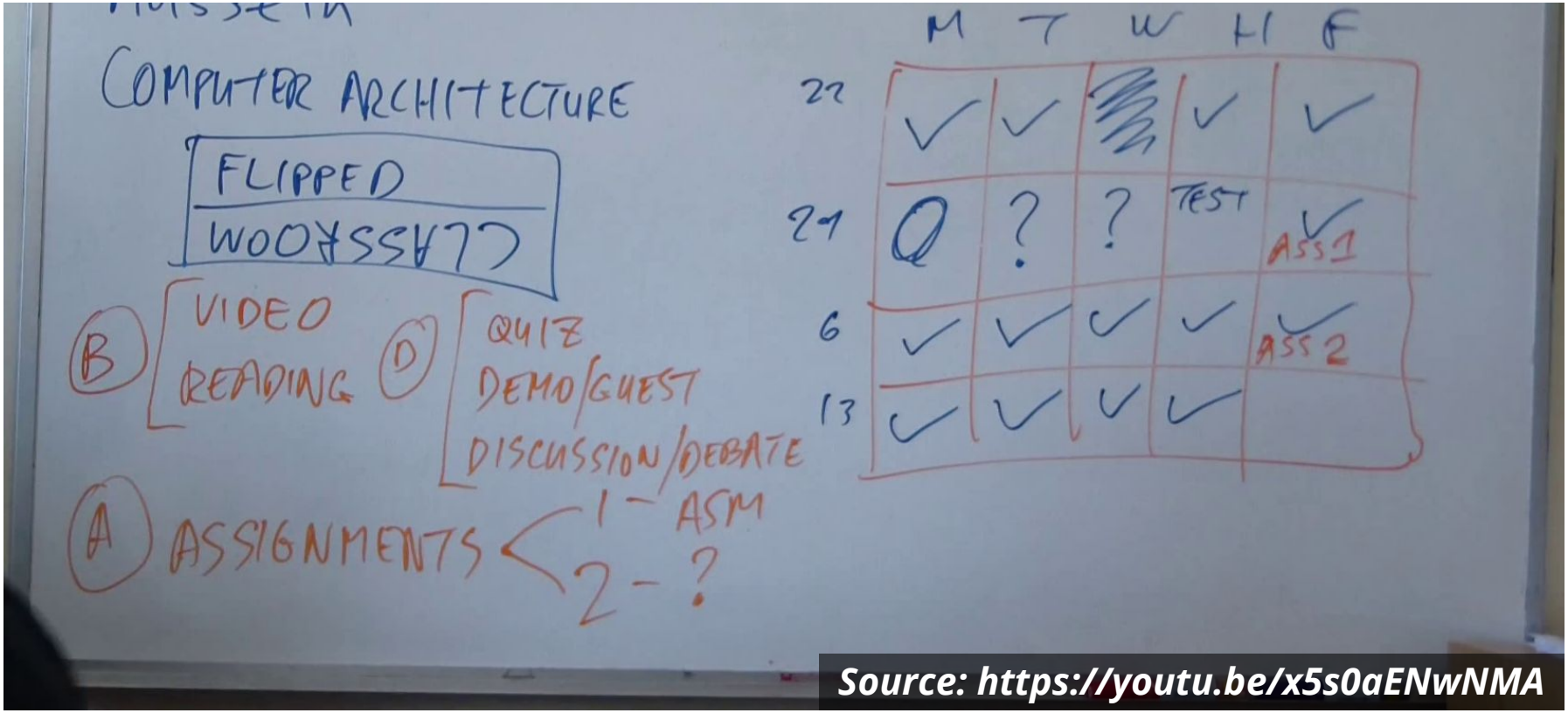
Workbench approach potentially more effectiveness

- Learning activities orchestrated faster using workbench
- Perceived success more pronounced with workbench

Positive user experience for workbench approach

- Workbench had higher mean score for HQ-I and ATT dimensions

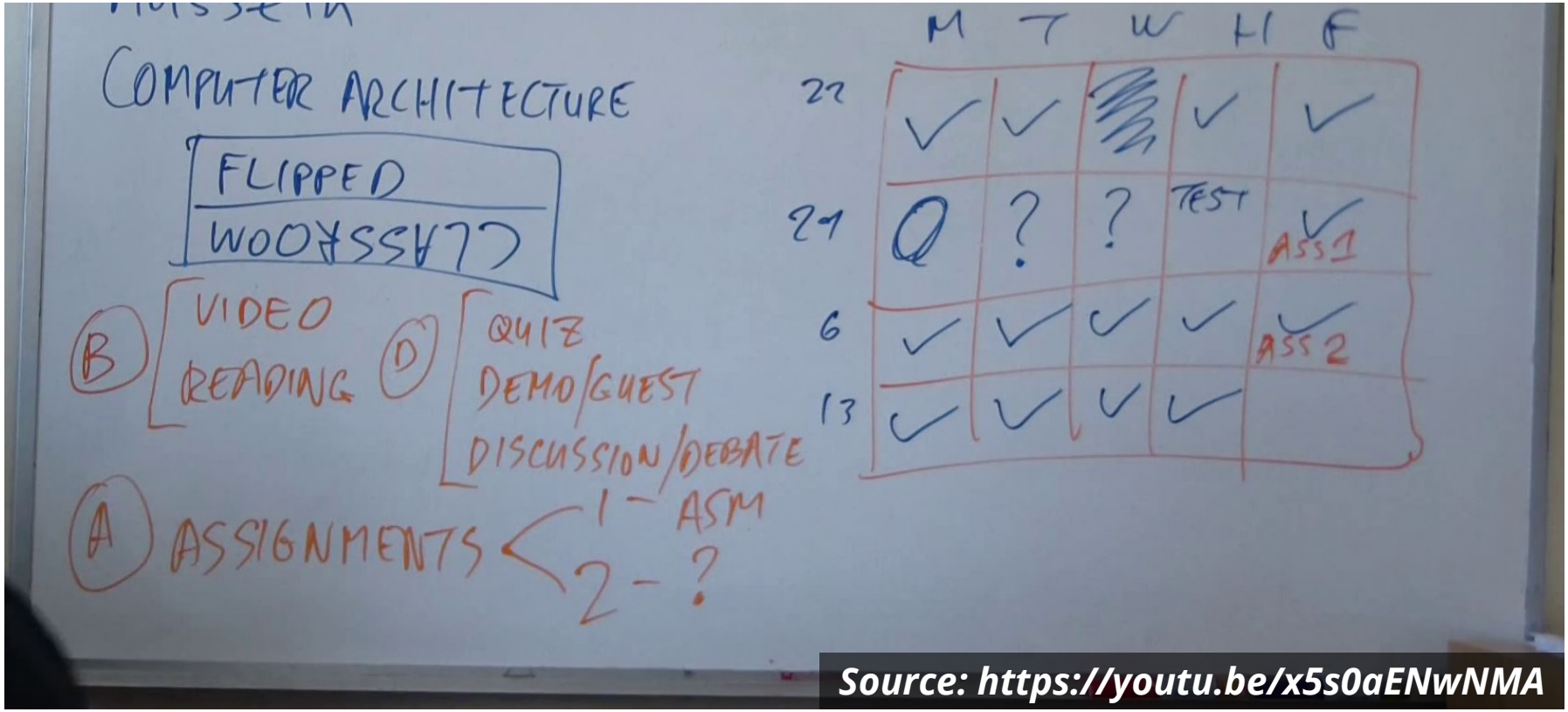
Study 2: Orchestrating a flipped class (1)



Streamlined Orchestration.
Lighton Phiri, Christoph Meinel and Hussein Suleman.
Computers & Education 2016.

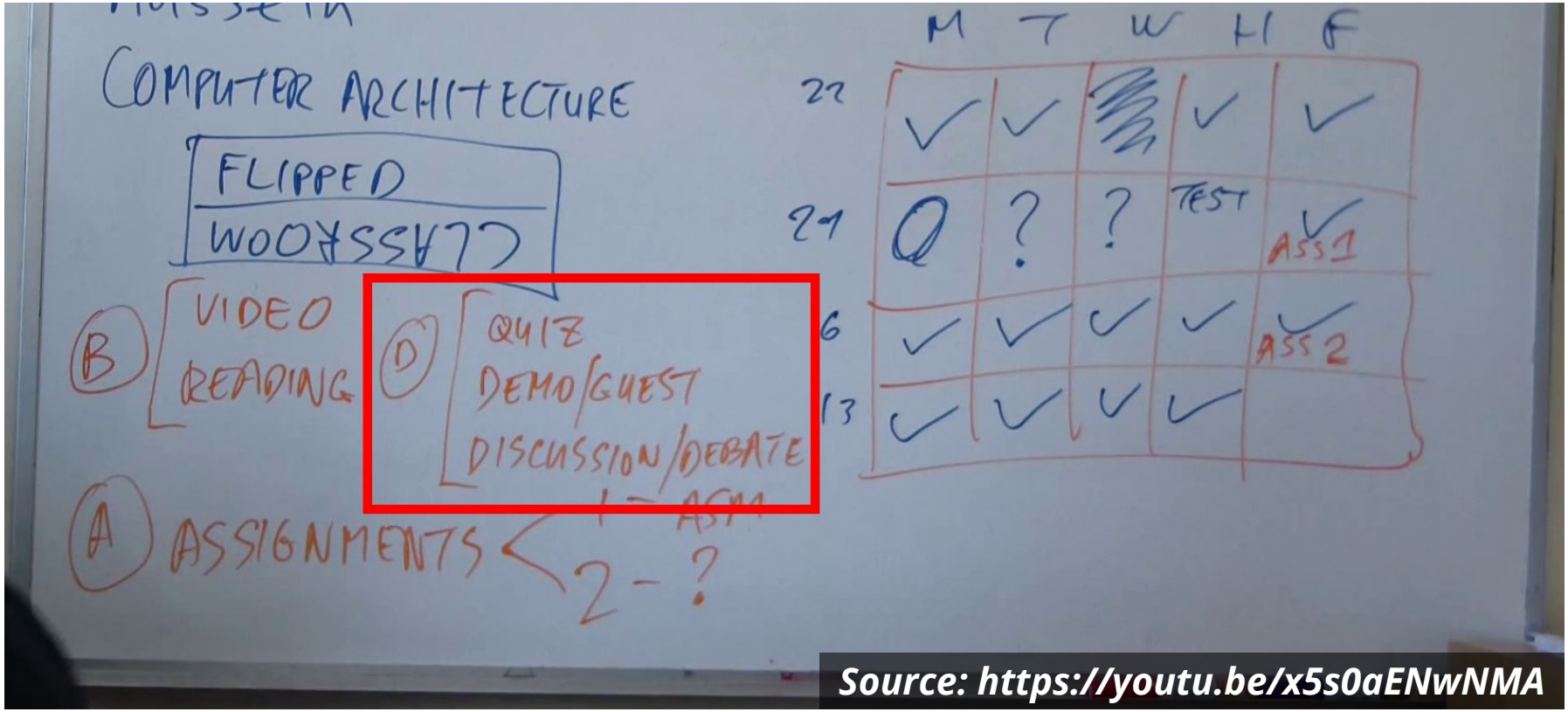
Study 2: Orchestrating a flipped class (2)

CSC2002S—Computer Architecture flipped class outline structure



Study 2: Orchestrating a flipped class (2)

CSC2002S—Computer Architecture flipped class outline structure



Study objectives (1)

Study aimed at assessing the feasible and potential of organised orchestration in authentic educational settings.

- To what extent does workbench approach aid orchestration?
- What is the potential impact of workbench approach on learning?

RQ	***Object***	***Instrument***	***Scale***	***Description***
RQ1	*Educator*	*Video segments*	*Min*	*App usage*
	Educator	*Interviews*	*[-3 – 3]*	*Interviews*
RQ2	*Learners*	*Survey*	*[-3 – 3]*	*Questionnaire*

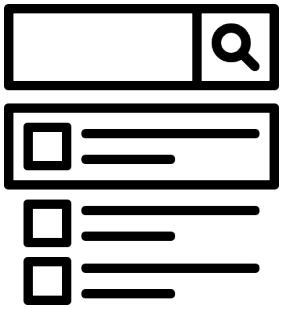
Study objectives (2)

Workbench UI implemented to orchestrate core activities

Source: http://media.uct.ac.za

Evaluation procedure (1)

(1)
Usage



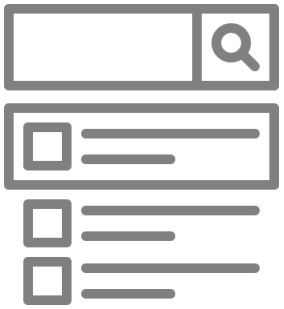
(2)
Educator

(3)
Learners

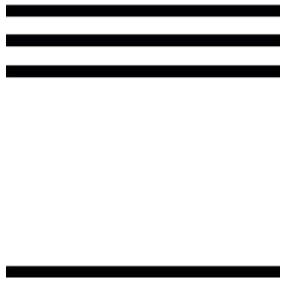
- Usage pattern analysis involved video analysis of lecture recordings—”Presentation View”
  - Opencast Matterhorn segmentation analysis
  - 11 sessions analysed
  - Orchestration tools and usage frequencies noted

Evaluation procedure (2)

(1)
Usage



(2)
Educator

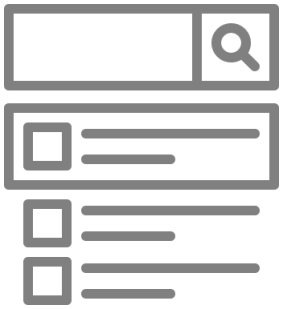


(3)
Learners

- Educator interaction with workbench tool was evaluated two-fold
  - Informal interview sessions
  - Direct observations of tool use

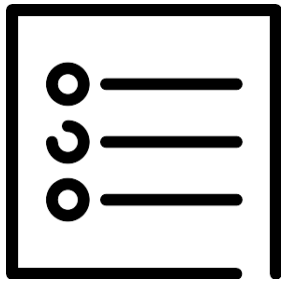
Evaluation procedure (3)

(1)
Usage



(2)
Educator

(3)
Learners



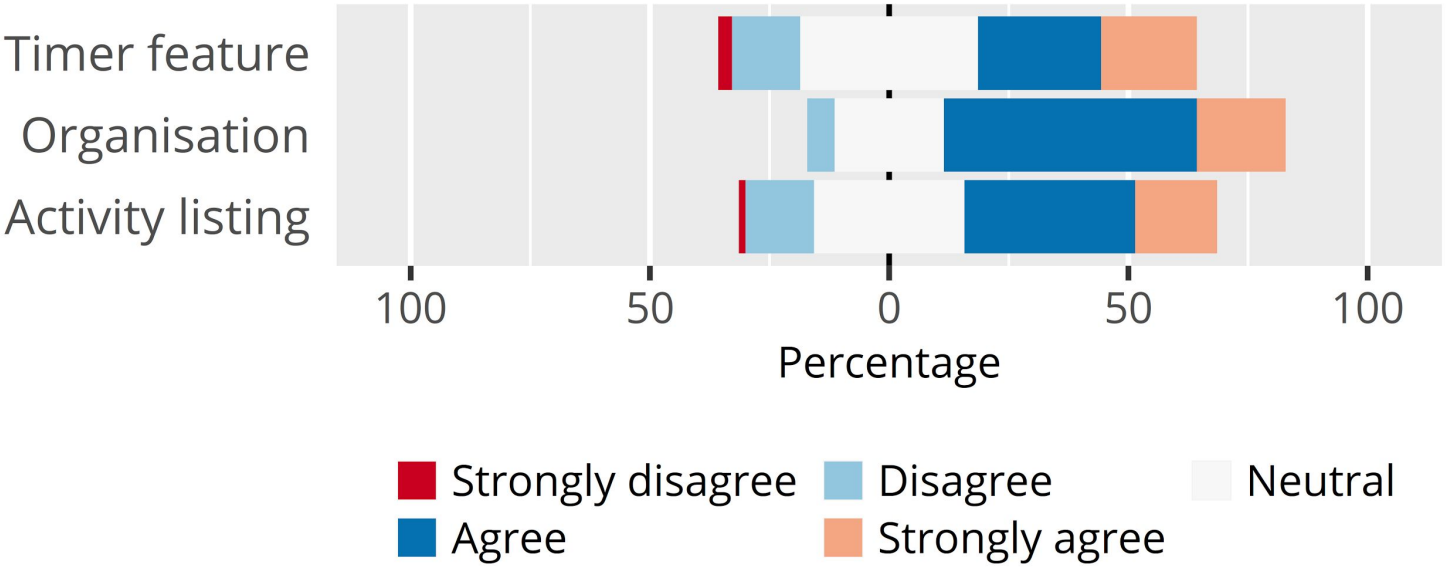
- Learner survey conducted on last day of class to elicit subjective experience
  - 71 participants recruited
  - Static sequencing, learning activity organisation, and specific prototype features

Analysis 1: Tool usage pattern

- Nine orchestration tools used during duration of course
  - Most tools used to render content
  - Specialised tools once-off tasks
- On average prototype used most of the time
  - Used 66.72% on average
  - Switching occurred an average of two times with noticeable time during switchover

Tool	Freq.	Duration
Workbench	*10*	*00:30:31*
VideoGlide	*8*	*00:07:56*
Firefox	*1*	*00:21:29*
Impress	*1*	*00:38:26*
Evince	*1*	*00:00:50*
QtSpim	*1*	*00:12:47*
Robotic Arm	*1*	*00:01:24*
TextEditor	*1*	*00:02:07*
VirtualBox	*1*	*00:00:58*

Analysis 2: Learner experience



- Tool perceived to have helped organise activities
- Static sequencing (activity listing) found helpful
- Timer feature perceived useful

Study findings

Feasibility of organised orchestration

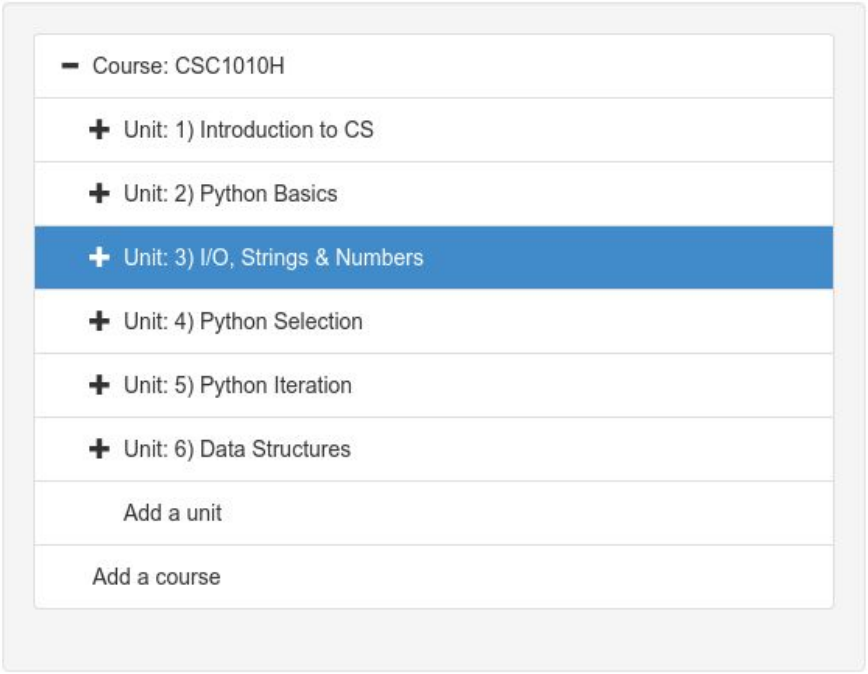
- Facilitated neutral flow of activities
- Results from learner survey indicate tool was impact neutral

Potential to facilitate improved learning outcomes

- Learner survey suggests orchestration workbench has the potential to positively impact learning experience

Dynamic simple scripting

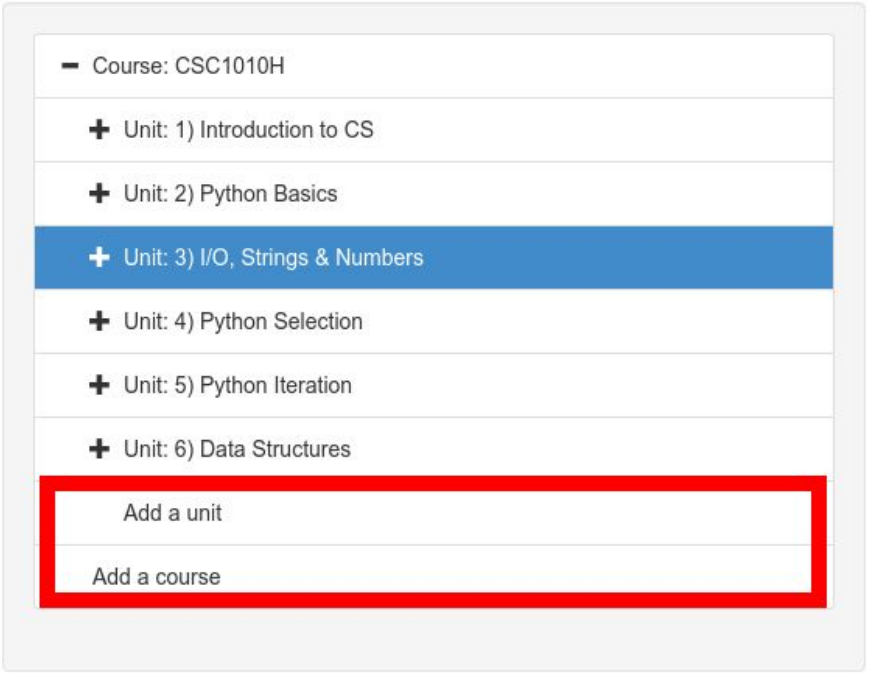
Dynamic scripting based of IMS Global Simple Sequencing



Source: http://simba.cs.uct.ac.za/indefero

Dynamic simple scripting

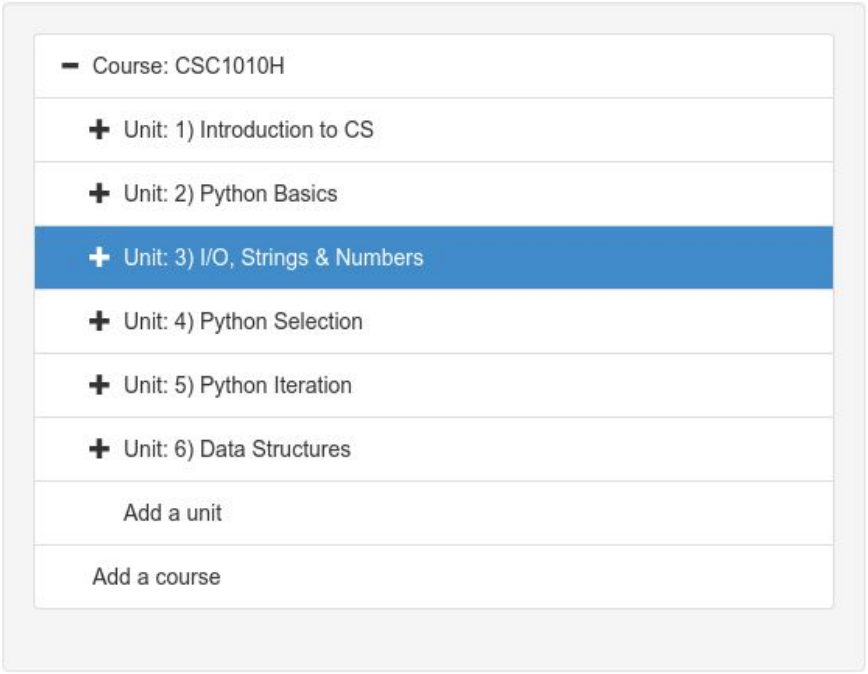
Basic CRUD functionality for management of activities



Source: http://simba.cs.uct.ac.za/indefero

Dynamic simple scripting (2)

Pre-session directed sequencing of session activities



Source: http://simba.cs.uct.ac.za/indefero

Dynamic simple scripting (3)

Orchestration of sequenced session activities

Source: http://simba.cs.uct.ac.za/indefero

- Current viewer leverages MS PPT
- API implemented to plug-in different viewer
- Reuse and remixing of sequenced session activities

Future directions

1) Experiment: Guided orchestration for peer learning
    - Authentic learning environment
    - Measuring effectiveness, orchestration load and user experience
2) Experiment: Dynamic enactment of learning activities
    - Pre-session management
    - Measuring orchestration load and user experience
3) Analysis: Comprehensive analysis of UCT lecture recordings
    - Support for ad hoc orchestration claim
4) ~~Experiment: Sharable orchestration OERs~~
    - ~~Reusable and sharable orchestration appliances~~

Revised timeline

#	Milestones	Timescale
1)	Study 3: Guided orchestration experiment	October 2016
2)	CSEDU 2016 submission	December 2016
~~3)~~	~~ICALT 2016 submission~~	~~January 2017~~
4)	Study 4: Dynamic enactment experiment	February 2017
5)	Thesis draft manuscript	May 2017
6)	Thesis final submission	June 2017
7)	IEEE TLT submission	TBA

Bibliography

[1] Jeremy Roschelle et al. "*Classroom Orchestration: Synthesis*". Computers & Education, 6a9:523–526, 2013.

[2] Pierre Dillenbourg. "*Design for Classroom Orchestration*". Computers & Education, 69:485–492, 2013.

[3] Pierre Dillenbourg and Patrick Jermann. "*Technology for classroom orchestration". New Science of Learning*. 525–552, 2011.

[4] Luis P. Prieto et al. "*Orchestrating technology enhanced learning: a literature review and a conceptual framework*". International Journal of Technology Enhanced Learning, 3(6):583, 2011.

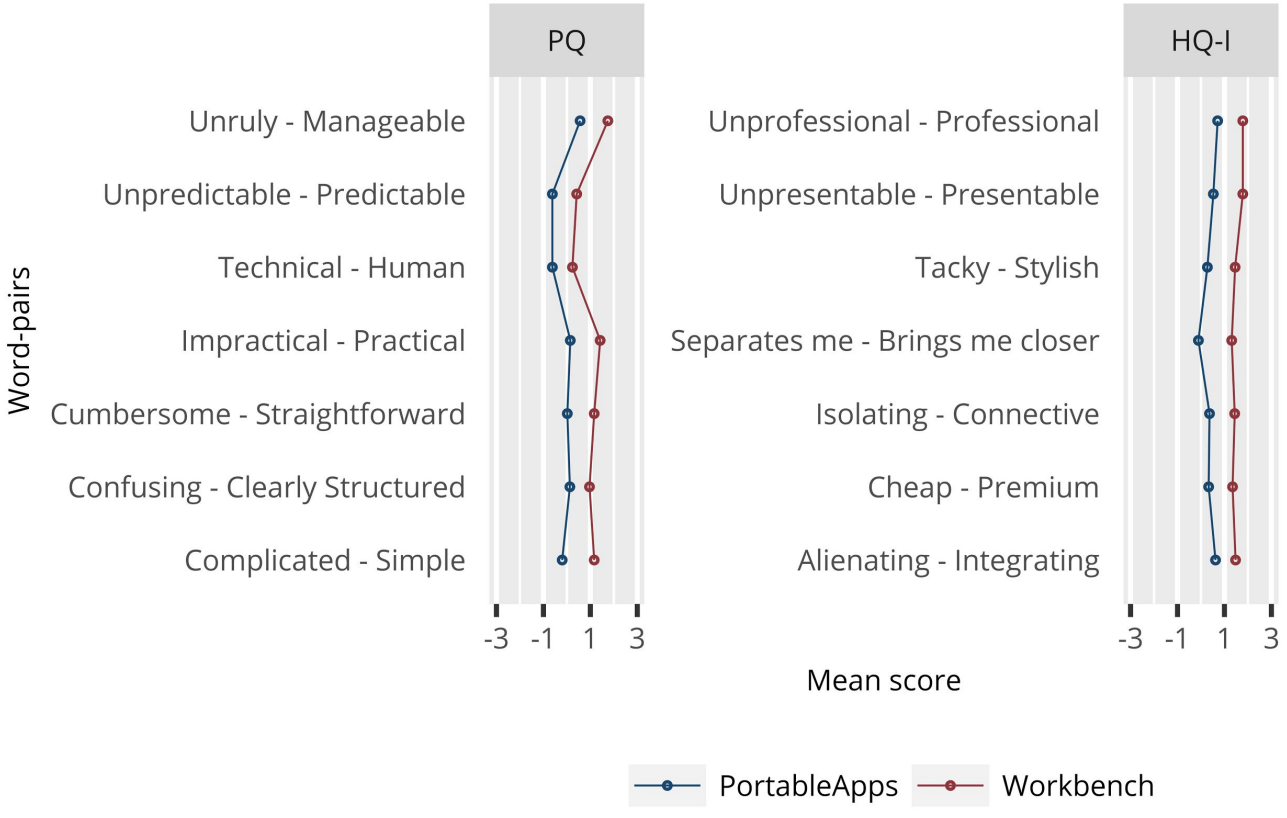
Understanding the effects of Streamlining the Orchestration of Learning Activities

Lighton Phiri (HPI-CS4A)

Supervisors:
A/Prof. Hussein Suleman | Prof. Dr. Christoph Meinel

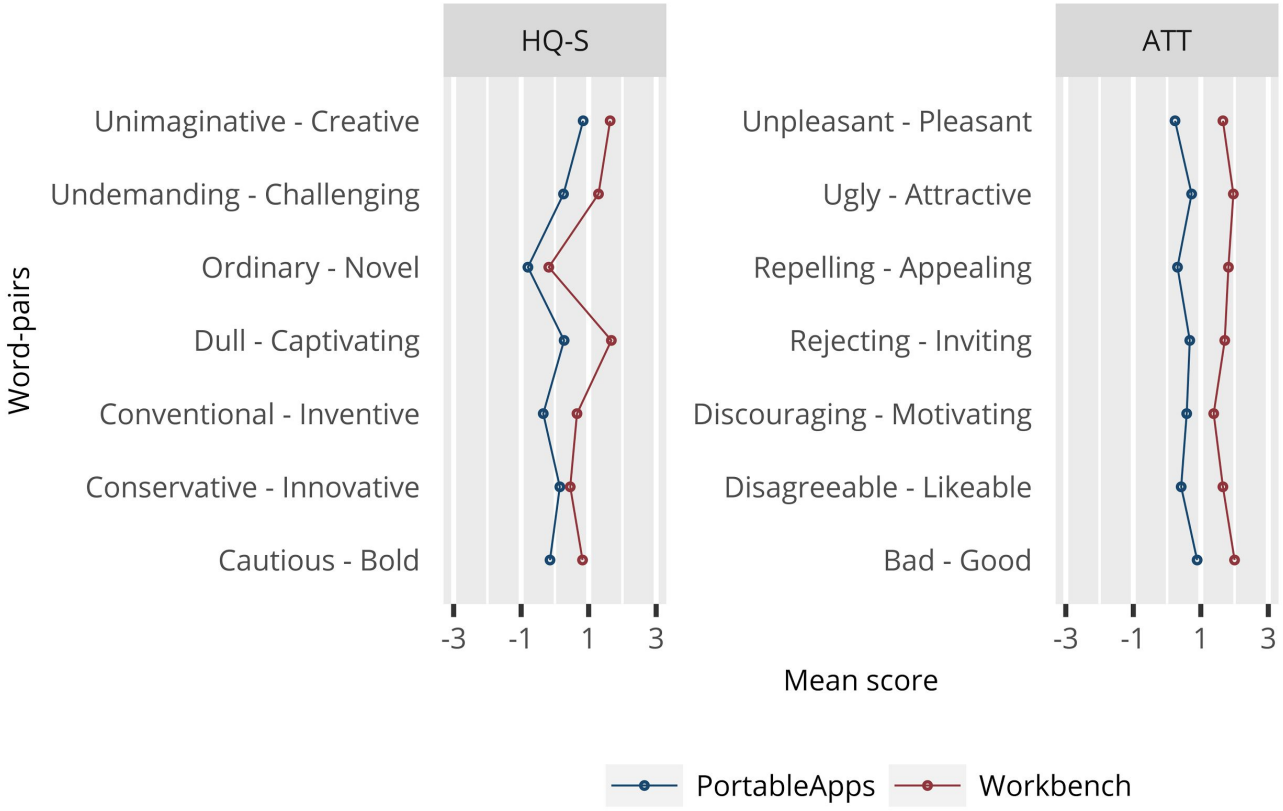
HPI-CS4A Spring Workshop | August 30 2016

Study 1: AttrakDiff word-pairs (1)



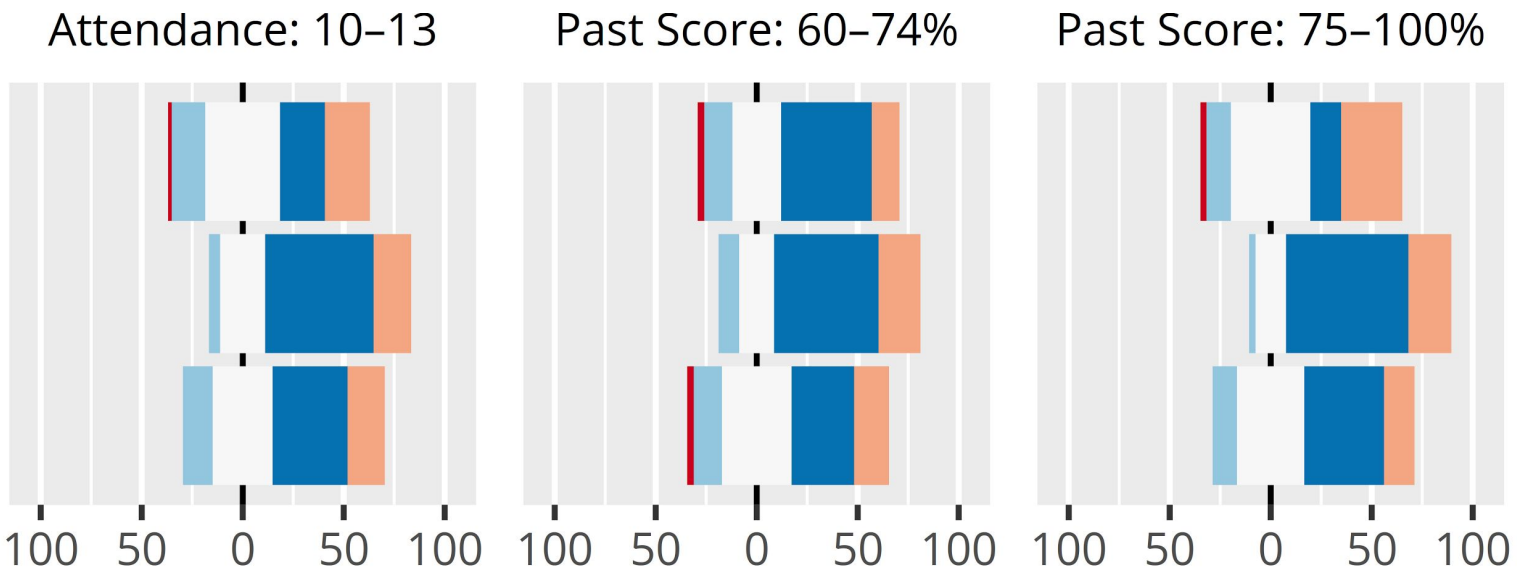
PQ and HQ-I word-pair means

Study 1: AttrakDiff word-pairs (2)



HQ-S and ATT word-pair means

Study 2: Learner demographic differences (1)



Learner survey responses by demographic