Scaffolding feedback in complex dynamic system context:
Effect of online interactive learning environments

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Presentation highlight

- Introduction - the Problem
- Notion of Scaffolding Feedback
- Application of Scaffolding feedback
- Research Questions
- Results and Discussions
- Conclusion

Introduction – the Problem

- Research shows that most people, even experts, have difficulties comprehending complex dynamic systems (CDS) and communicating their understanding about such systems.

- These difficulties arise from limitations in three different types of capabilities:

  - Cognitive capability to comprehend structural complexity
  - Skills to infer dynamic behavior of a system from its underlying structures.
  - Effectiveness of methods, techniques, and tools that are available to us in our analysis of such systems

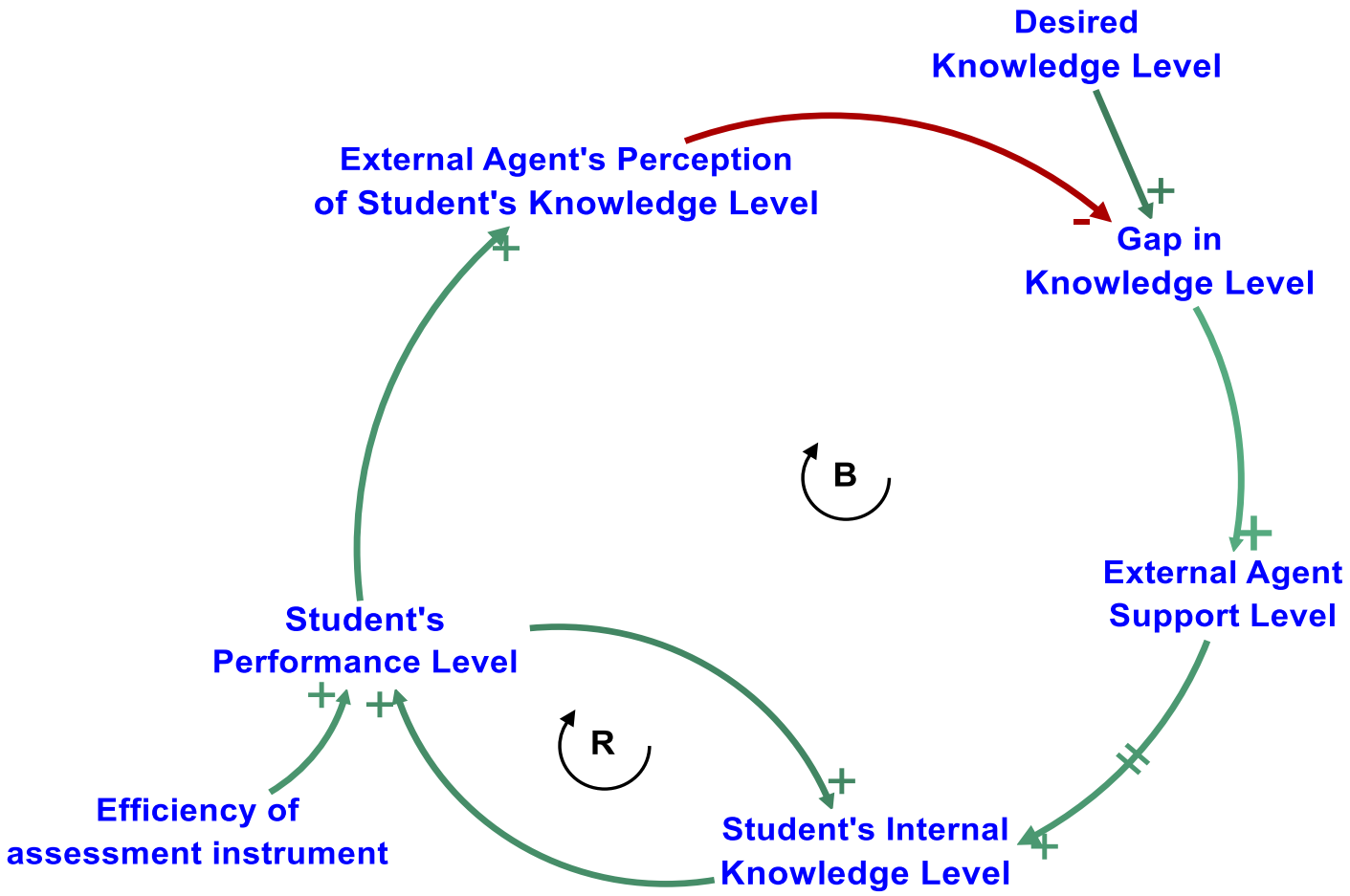
Introduction …

- There are significant gaps in our understanding of how to improve cognitive and communicative capabilities in and about CDS and also of how to measure improvements.

- This study intends to enhance students' learning in and about CDS by developing an educational feedback, scaffolding feedback that supports students learning in and about CDS.

- Feedback is as an information communicated to a learner about a gap in performance between actual and desired performance so as to alter the gap (Ramaprasad 1983)

Notion of Scaffolding Feedback



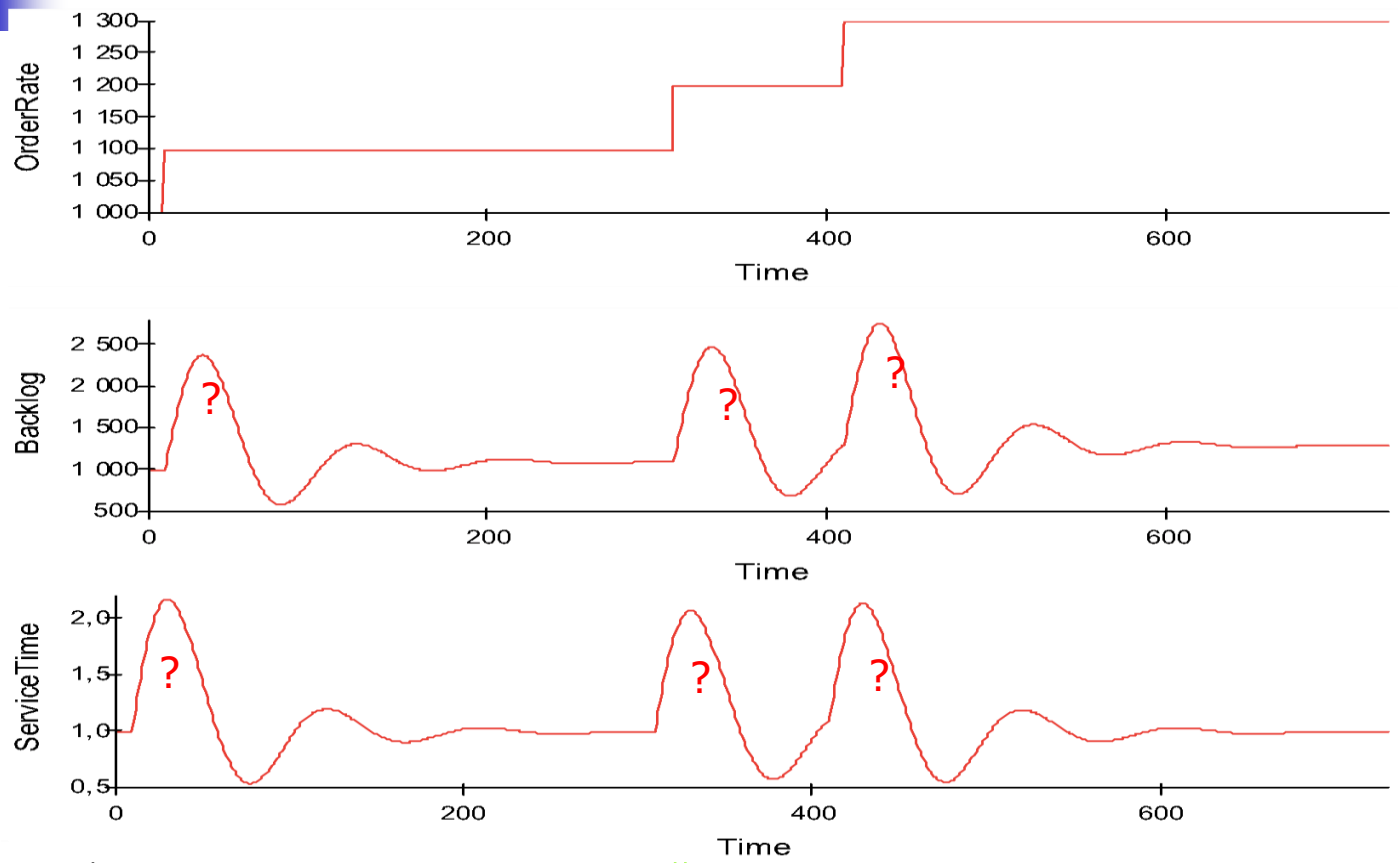
Notion of Scaffolding …

- The scaffolding feedback has been integrated with a personalized and adaptive OILE that has the following characteristics:
  - It presents a complex, dynamic problem that learners should address in its entirety. It then allows learners to progress through a sequence of learning tasks from easy to complex
  - After completion of each learning task, the OILE provides learners with supportive information based on their individual performance. The support fades away as learners gain expertise.
  - The OILE tracks and collects information on learners' progress and generates learning analytics.

Application of Scaffolding feedback: Mr. Wang Case Study

- Mr. Wang is a reputable Bicycle Repair Shop in Shanghai established by Mr. Wang's great grandfather in 1912.
- It delivers your bike in top shape after one day.
- Shanghai is a dynamic city with lots of events and bicycle rental is booming there.
- After each event, Mr. Wang experiences lots of bicycles coming in and oscillations (major disturbances) in the business

Mr. Wang's Problem



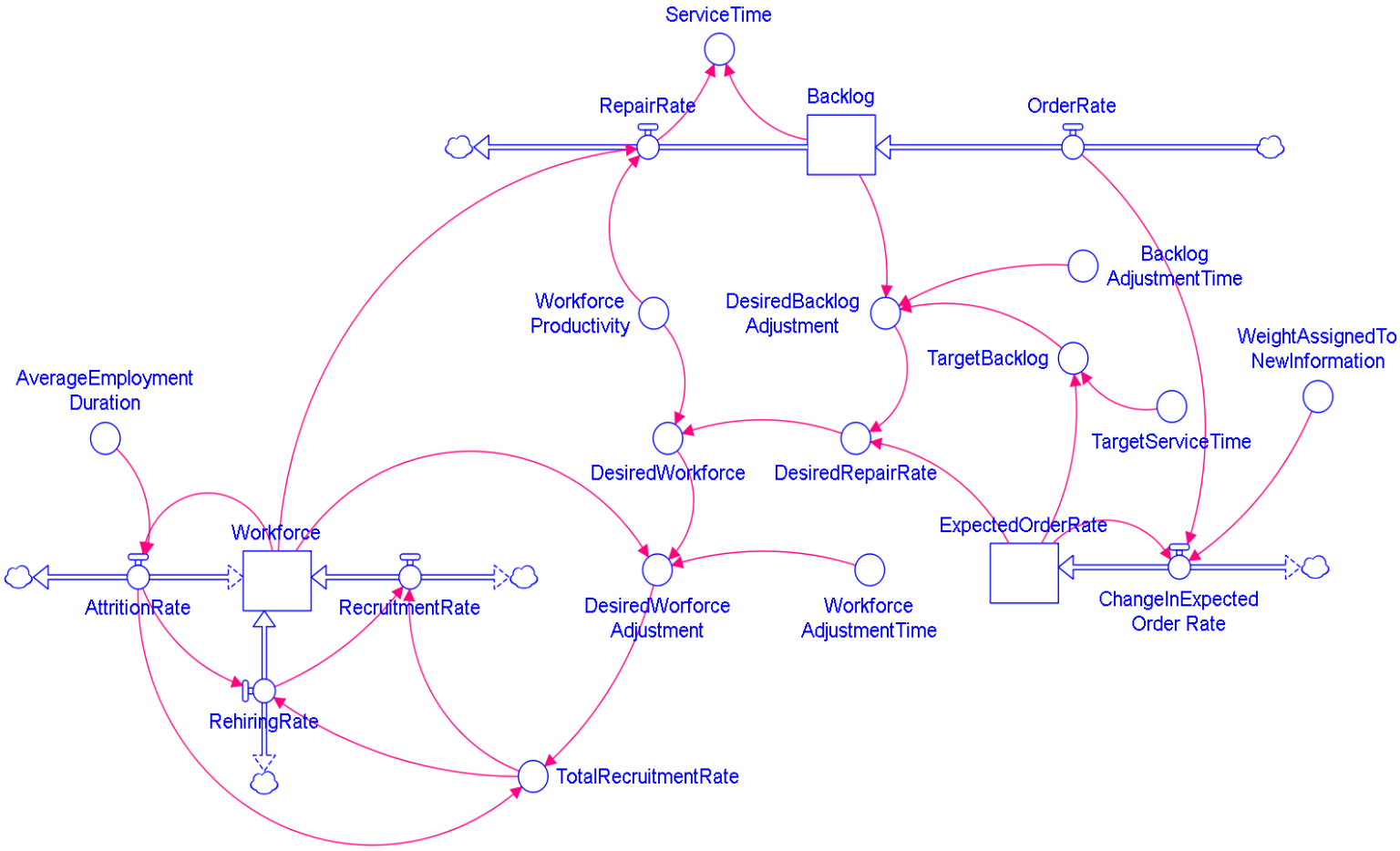
- In the short run, the company is not able to tackle the increase in demand very well. In the very long run, there are signs that indicate it works to the satisfaction of Mr. Wang, - stabilizing the Backlog and the Service Time

The Mr. Wang OILE

Sample welcome page

The Mr. Wang OILE

When a student successfully complete the Mr. Wang OILE …



Research Questions

1. Does providing scaffolding feedback reduce the performance gap existing between High- and Low-performing students?

2. Will Exp'tal groups have significantly higher gains in an exercise that measure transferable skills than those in a comparable Control group?

3. Will there be any difference in performance between Exp'tal and Control groups across focus areas of competency?

4. Will there be significant linear relationship between students' performance in the transferable skill exercise and the
   a) average number of feedback the students received per question through the OILE?
   b) average amount of time the students spent per feedback while working on the OILE?

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Results & Discussions

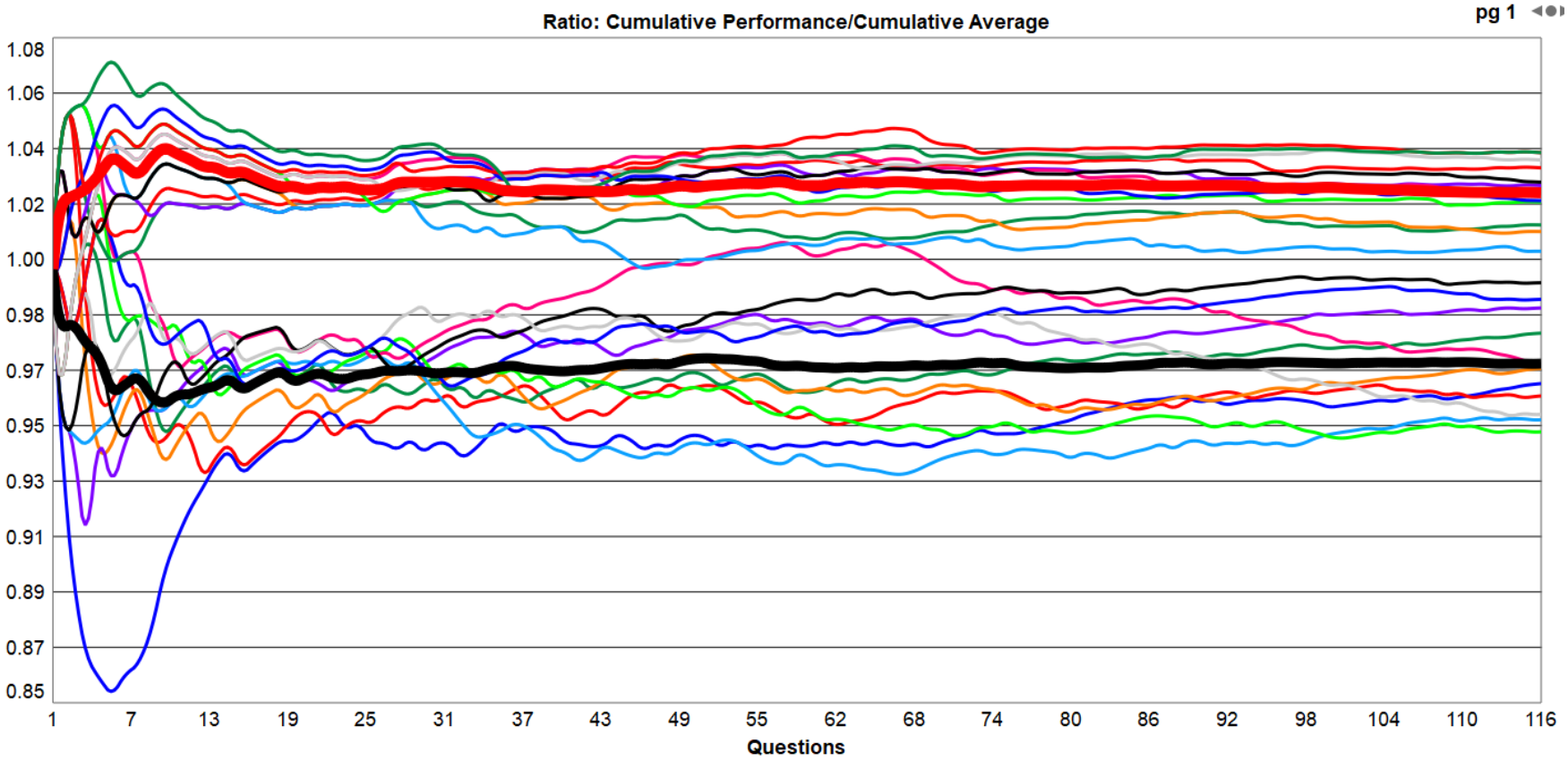
1a. Statistical Results

High- and Low-performing students' avg performance across the 5 Tasks

Task Number	High-Performers' Avg	Low-Performers' Avg	GAP(%)
Task 1	7.86	6.66	**18.02**
Task 2	7.88	7.67	**2.65**
Task 3	7.64	7.35	**4.01**
Task 4	7.62	7.19	**5.96**
Task 5	7.77	7.54	**3.10**
	Avg GAP		**6.75**

Results & …

1b. Graphical – Cumulative Performance/Cumulative Average



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Results & ...

2. Statistical Results -

Independent Samples t-test: Prior & After experiments

Study group	# of Students	Mean	SD	df	t	Sig. (2-tailed)	Effect Size (Cohen's d)
Experimental	24	7.67	1.34	49	-0.35	**0.728**	
Control	27	7.81	1.64				
Experimental	24	13.62	5.12	49	2.07	**0.044**	**0.58**
Control	27	10.86	4.40				

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Results & ...

3. Statistical Results- Difference in percentage gain: Experimental - Control

Question number		Hypothesis formulation		Analysis				
Sub group	S.No	Verbal	Using S&F Diag.	Identify model variable	Def. eqn.	Determine units of measure	Describe behavior	Interpret structure
Group 1	1	8.3	7.4			6.9		25.5
	2		24.5	-2.8	12.5			
	3						-25.5	5.6
	4						-0.9	0.0

Question number		Hypothesis formulation	Analysis					
Sub group	S.No	Verbal	Using S&F Diag.	Identify model variable	Def. eqn.	Determine units of measure	Describe behavior	Interpret structure
	5		6.9	-20.8		9.3		4.6
	6						-3.7	23.1
	7						-19.0	15.3
Group 2	8						6.0	12.0
	9						21.3	33.3
	10						0.5	11.1
	11						-13.4	5.1
	12		45.8	13.9	35.2	27.8		**49.1**
	13			-0.9	1.9			**34.7**
	14			-0.9	9.7			**38.4**
	15						**21.3**	**37.5**
Group 3	16						**29.6**	**44.9**
	17						13.4	**37.5**
	18						**24.1**	**47.2**
	19			38.4			11.1	
Overall average		8.3	**21.2**	4.5	14.8	14.7	5.0	**25.0**

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Results & …

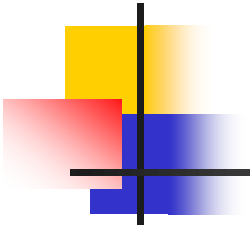
4. Statistical – Pearson product moment correlation coefficients

		Avg # of feedback per question	Avg time spent per feedback
Performance level	Pearson Correlation	-0.665**	0.143
	Sig. (2-tailed)	0,000	0.505
	N	24	24

** Correlation is significant at the 0.01 level (2-tailed)

Conclusion

- In light of the supportive evidence, this study concludes that OILEs that integrate scaffolding feedback offer promising potential in supporting students' learning in and about CDS.



Thank You!

Questions?

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