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Efficiency and Collaboration in a Student Engineering Laboratory: Results of Lean Management Implementation



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Student Engineering Laboratory

“Schluckspecht”



<https://schluckspecht.hs-offenburg.de/schluckspecht>

Schluckspecht



For over 25 years...

Shell Eco-Marathon



<https://schluckspecht.hs-offenburg.de/schluckspecht>

2026	Global Championship 2027 Qualifier
2024	3rd place Urban Concept (Combustion Engine)
2023	1st place Regional Drivers' Championship 2nd place Urban Concept (Internal Combustion Engine)
2022	2nd place Urban Concept (Combustion Engine)
2019	2nd place Autonomous Driving
2018	3rd place Autonomous Driving
2016	1st place Urban Concept (Combustion Engine)
2014	1st Place Urban Concept (Combustion Engine) Winner Shell Helix Tribology Award
...	...

Schluckspecht Lab



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Photos: Marc Hug

A student's question

Why is our lab—where we design and build efficient, resource-saving vehicles—not efficient and resource-saving itself?



With limited project hours, this really hurt productivity and work quality.



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The problems:

Information from employees :

- **general disorder**
- **students to spend considerable time searching for items**
- **students distract employees with frequent questions**

**The longer students had worked on the project,
the lower they rated the lab's order and cleanliness.**



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The goal:

to find a way to reorganize the laboratory, so that order and cleanliness remain at a sufficient, self-maintaining level, without burdening the employees and students with additional time-consuming tasks.

The idea of the solution:

Lean Management

Lean Management

a quality and process improvement method with emphasis on the customer's needs, employee involvement, and continuous improvement.

What does it mean in our case?

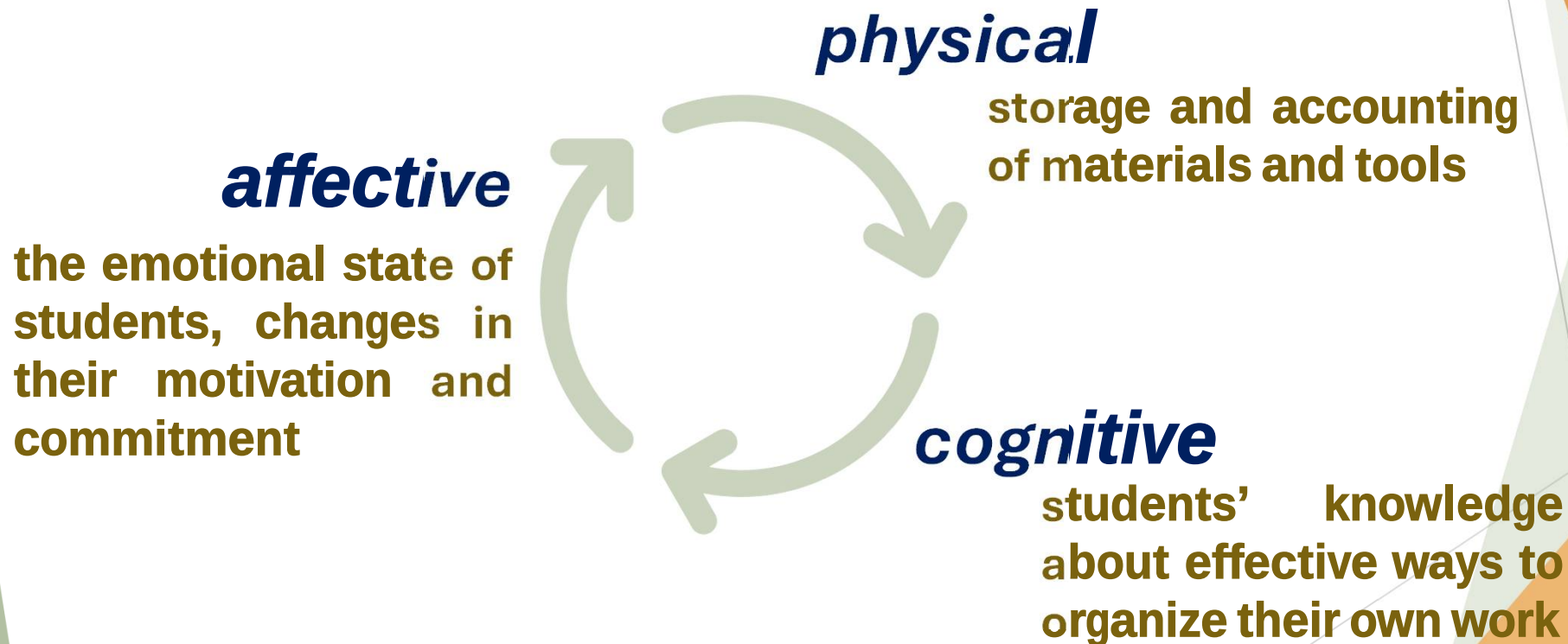
**The changes should affect various areas:
the laboratory itself,
student perceptions of working in the environment.**



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Key aspects of the implemented changes



Pull-System / Kanban-System

Consumable items:
gloves,
protective clothing,
adhesive tapes,
sprays,
glues,
oils,
etc.

SCHLUCKSPECHT	
<u>Kanban-Karte</u>	
Bezeichnung	Schaumhandschuhe 7
Foto	
Menge	12 Paare
Lageort	Schrank 6
Preis	1,85 €/Paar

SCHLUCKSPECHT	
<u>Kanban-Karte</u>	
Bezeichnung	Schaumhandschuhe 7
Beschaffung	www.arbeitshandschuh24.de
Art. Nr.	L-1490-144-7
Lageort (intern)	Hochregal F_____

How does an employee become information that it is time to order the next pack of gloves?



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Target State



SOLLZUSTAND

Blauer Wagen 1



SOLLZUSTAND

Tische 4-6



SOLLZUSTAND

Tische 7-8



SOLLZUSTAND

Schrank 6



Kanban Boards



Results: Stability of the Pull-System



5S methodology
Kanban-System

SCHLUCKSPEDT	
Kanban-Karte	
Bezeichnung	Schaumhandschuhe 7
Foto	
Menge	12 Paare
Lageort	Schrank 6
Preis	1,85 €/Paar



Results: Student Engagement



Appointment
of the
responsible
student

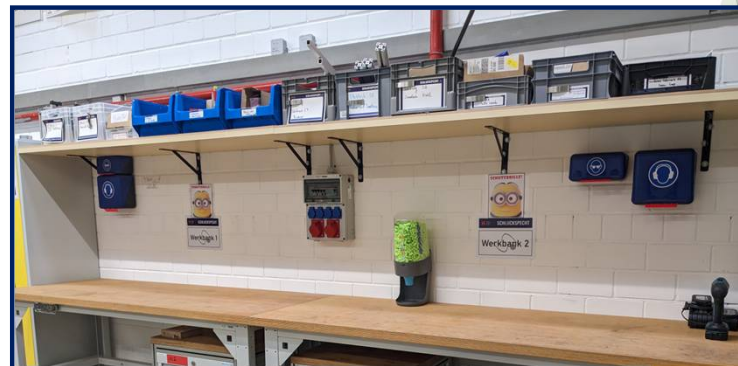


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CUBICAL

In diesem Bereich ist für Ordnung
und Sauberkeit

verantwortlich

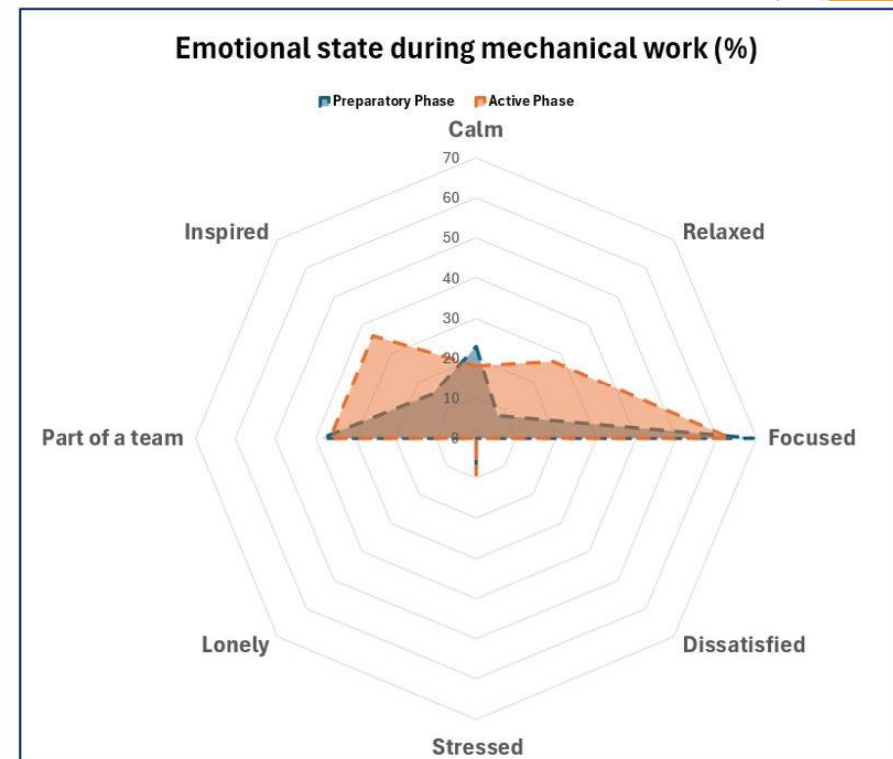
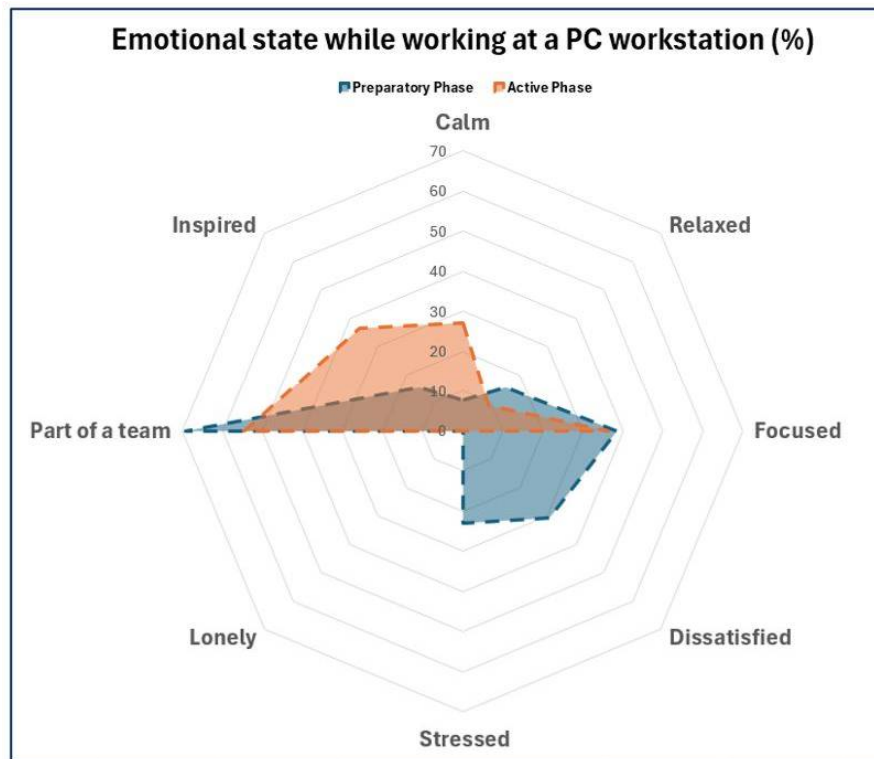


Student Cohorts: preparatory vs. active phase



Category	Preparatory Phase (n = 13 of 39)	Active Phase (n = 11 of 21)
Major	Mechanical Engineering (9) Biomechanics (2) Informatics (1) Media (1)	Mechanical Engineering (10) Biomechanics (1)
Project Experience	1st Sem (5) 2-3 Sems (4) 7-9 Sems (4)	1st Sem (6) 2-3 Sems (3) 7-8 Sems (2)
Motivation	Academic credits Meeting new people Gaining technical knowledge	Same as preparatory phase
Visit frequency per week	Mostly several times	Mostly two or more times
Nature of Tasks	Mostly purely practical or a combination of theory and practice	Mostly a combination of theory and practice

Results: Students' Emotional States



Results: Students' Evaluation of the Laboratory



Selected criteria of lab operations

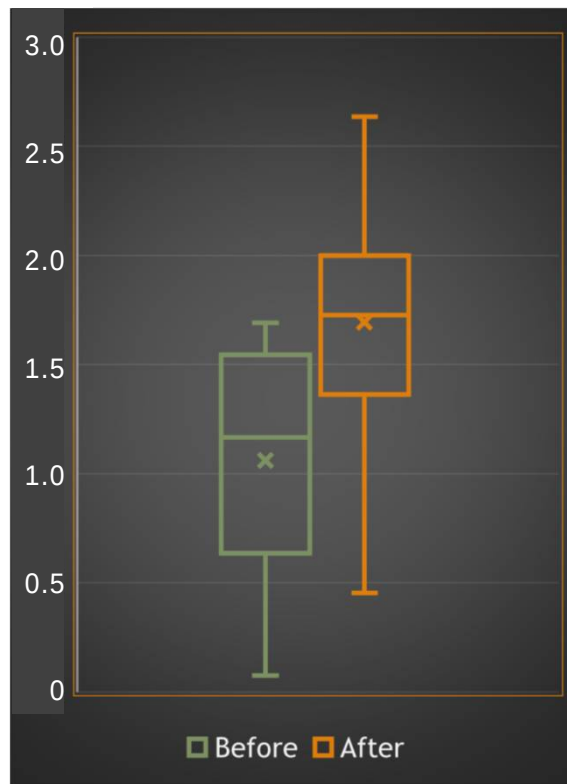
1. Information Flow
2. Team Communication
3. Task Planning
4. Workload Balance
5. Digital Organization
6. Desk & Computer Tidiness
7. Tool Accessibility
8. Lab Cleanliness
9. Ordering Process
10. Coffee Corner Upkeep
11. Cubicle Tidiness

Scale: [-3, 3]

[0.1, 1.7], mean = 1.1



[0.4, 2.6], mean = 1.7



Results: Order Level

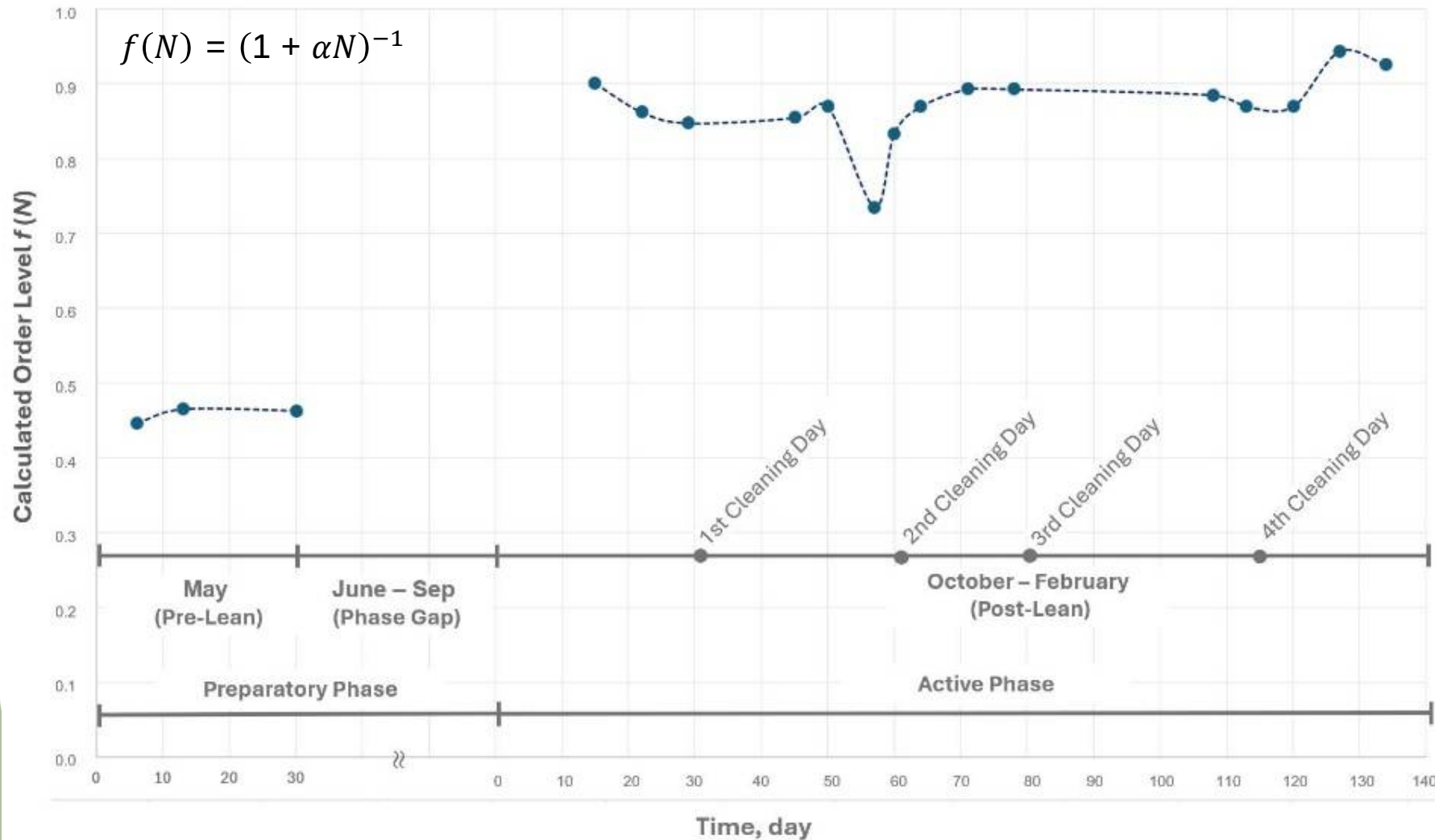


boundary
conditions

$$f(0) = 1$$

$$f(\infty) = 0$$

scale
coefficient
 $\alpha = 0.01$



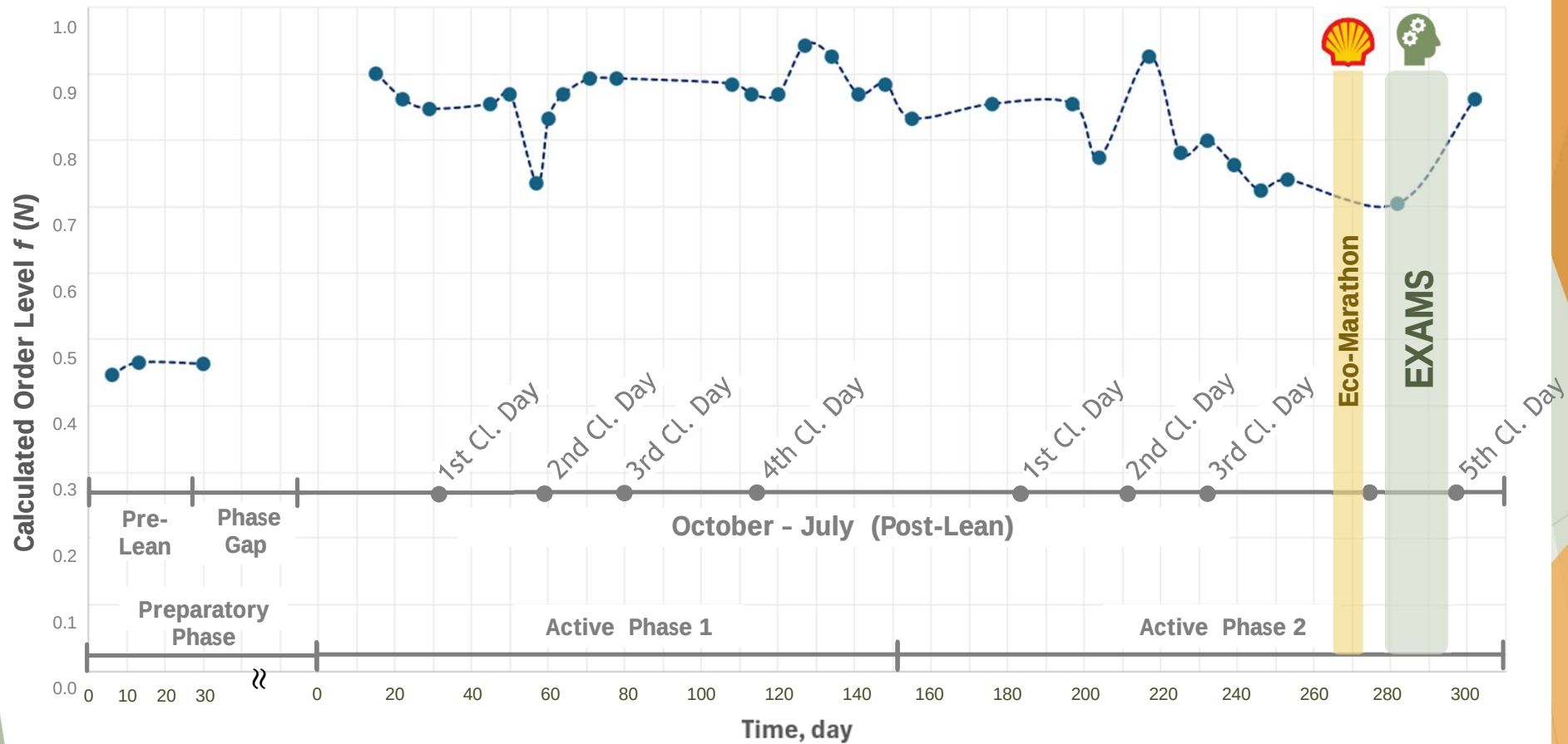
Limitations

First, to assert that our primary goal, establishing a self-maintaining laboratory, is achieved, observations must continue. This is particularly important because the intensity of work in the laboratory increases noticeably during the next semester (in April and May), leading up to the Shell Eco-marathon.

Second, fewer than half of the students answered the questionnaire and rated the different areas of the laboratory each semester. This small sample size means that our survey results may not fully reflect the views of the groups.



Subsequent Measurements



Safety Leadership Award

Judges' Remarks: The winners have consistently demonstrated outstanding safety behaviours and strong leadership throughout the event. The more experienced team and team members have coached and led the newer member, and role modelled the safety behaviours we look for.

<https://www.shellecomarathon.com/programme/poland.html>



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Conclusions

- By adopting Lean Management principles and involving students directly in the reorganization process, we achieved a noticeable improvement in the level of laboratory effectiveness.
- Measurements indicate that students were able to maintain the target laboratory state without significant additional efforts from either the staff or the students themselves.
- The study transformed the laboratory into a model for modern work practices. This provided students with the opportunity to gain valuable experience for their future careers, enabling them to use these methods in industry later on.



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Thank you for attention!

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