Inverted Classroom und Challenge Based Learning: Eine gute Kombination?

Erste Erfahrungen aus einem Master Kurs in den Pflanzenwissenschaften

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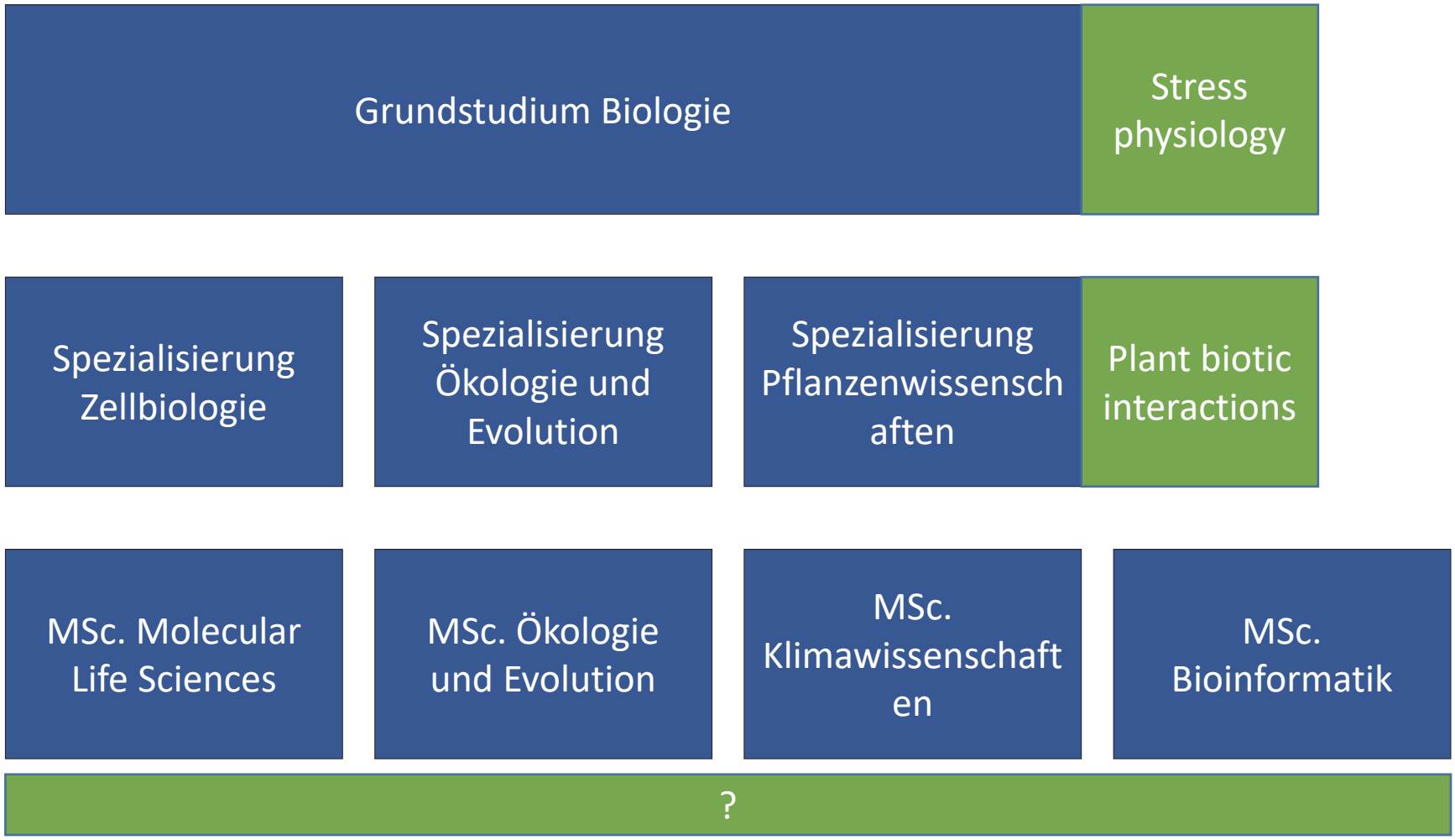
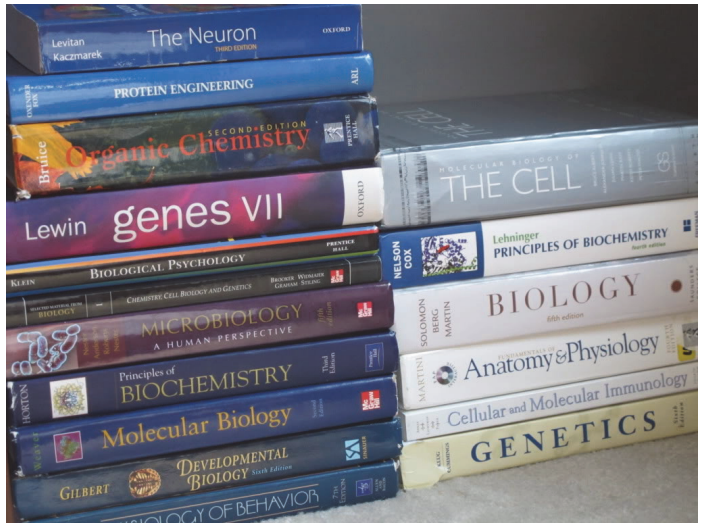
Was war die Motivation, diesen Kurs aufzubauen?


Grundstudium Biologie
Stress physiology
Spezialisierung Zellbiologie
Spezialisierung Ökologie und Evolution
Spezialisierung Pflanzenwissenschaften
Plant biotic interactions
MSc. Molecular Life Sciences
MSc. Ökologie und Evolution
MSc. Klimawissenschaften
MSc. Bioinformatik
?

Wie haben wir Kursinhalt und Form an diese Anforderungen angepasst?

Solving Current Challenges in Plant-Herbivore Interactions. 5 ECTS.

Modul 1-3: Inverted Classroom

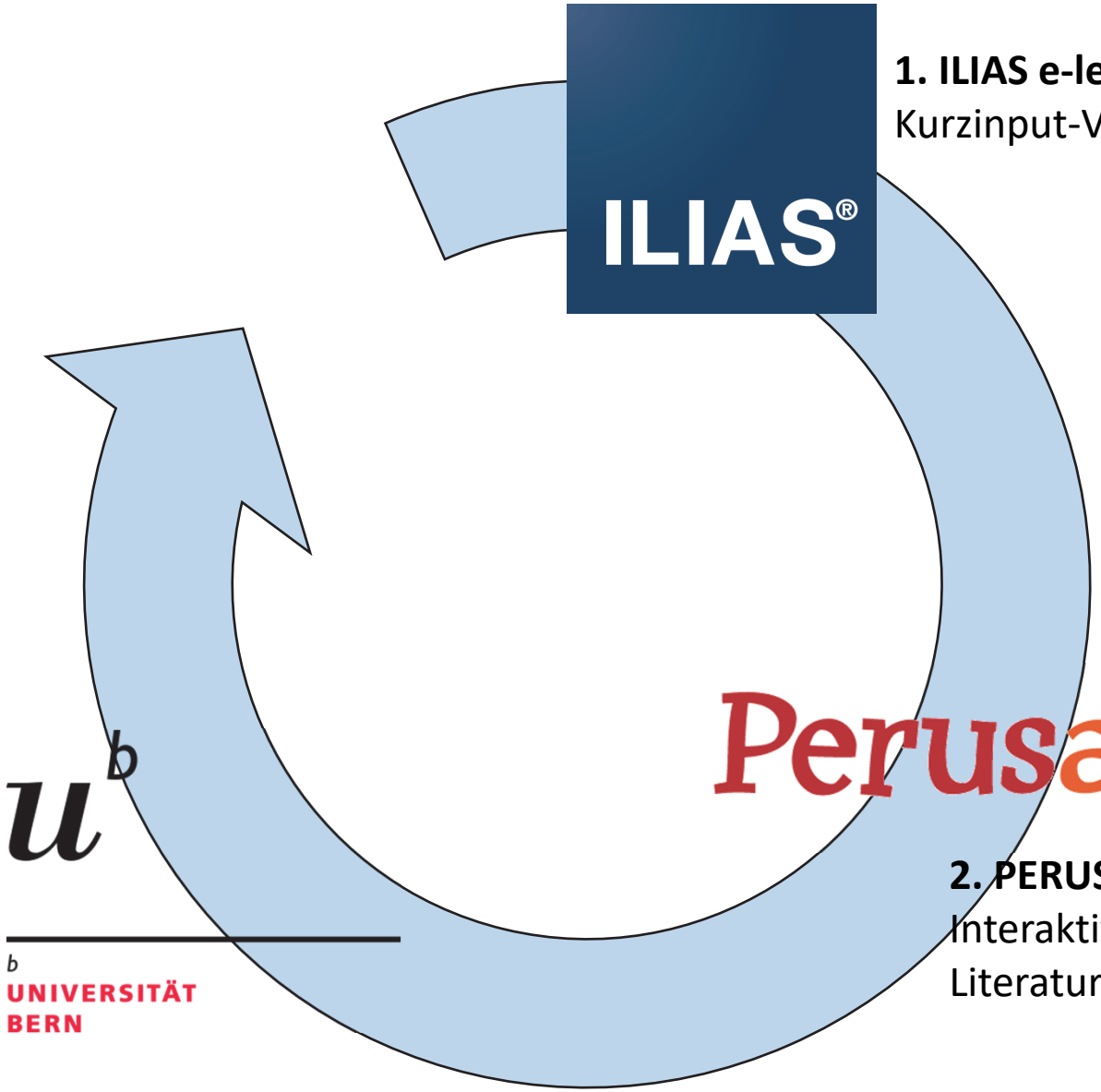


Modul 4-6: Challenge-based learning

Breiter Einstieg

Unabhängigkeit, aktives Lernen

Wie hat der Inverted Classroom Teil funktioniert?



1. ILIAS e-learning platform:
Kurzinput-Videos

2. PERUSALL reading platform
Interaktive Diskussion der Literatur

3. Kurse @ IPS
Antworten auf offene Fragen
Zusätzliche Diskussionen

Module 1, Part 4a

How plants perceive herbivores

Prof. Matthias Erb
Institute of Plant Sciences
University of Bern

Solving Curre...
My Courses and Cl...
Course home
Course setup
Gradebook
People
Notifications
Add to my calendar

Readings

Documents
InsectPlantBiology_Ch...
InsectPlantBiology_Ch...
elife00007
elife-13720-v1
annurev.arplant.59.032...
Show more...

Assignments
Oct 24: EMBR-16-1250
Oct 24: platt1964
Oct 24: festing2003
Oct 24: vaux2014
Oct 10: Reading for M...
Oct 10: Reading for ...
Oct 10: Reading for M...
Oct 10: Reading for M...
Oct 10: Reading for M...
Oct 10: Reading for M...
Oct 3: Reading for Mo...
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Chats

ME eLIFE elife.elifesciences.org RESEARCH ARTICLE

Herbivory-induced volatiles function as defenses increasing fitness of the native plant *Nicotiana attenuata* in nature

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Abstract From an herbivore's first bite, plants release herbivory-induced plant volatiles (HIPVs) which can attract enemies of herbivores. However, other animals and competing plants can intercept HIPVs for their own use, and it remains unclear whether HIPVs serve as an indirect defense by increasing fitness for the emitting plant. In a 2-year field study, HIPV-emitting *N. attenuata* plants produced twice as many buds and flowers as HIPV-silenced plants, but only when native *Geocoris* spp. predators reduced herbivore loads (by 50%) on HIPV-emitters. In concert with HIPVs, plants also employ antidigestive trypsin protease inhibitors (TPIs), but TPI-producing plants were not fitter than TPI-silenced plants. TPIs weakened a specialist herbivore's behavioral evasive responses to simulated *Geocoris* spp. attack, indicating that TPIs function against specialists by enhancing indirect defense.

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Competing interests: See page 26

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Introduction

Plant indirect defenses are traits that disable or remove herbivores by manipulating tri-trophic interactions to the advantage of the plant (***Price et al., 1980***). They attract and inform the third trophic level, predators or parasitoids, resulting in increased attacks on herbivores (***Turlings and Wäckers, 2004***). Indirect defenses are widespread and include domatia, extrafloral nectar, and food bodies which provide shelter and nutrition for predators and parasitoids, as well as herbivory-induced plant volatiles (HIPVs) which convey information about feeding herbivores (***Heil, 2008***). Field studies with the native tobacco *Nicotiana attenuata*, a desert annual, and with maize have shown that HIPVs can reduce herbivore loads by 24% to more than 90%, by increasing both predation and parasitization of herbivores (***Kessler and Baldwin, 2001***; ***Rasmann et al., 2005***; ***Halitschke et al., 2008***; ***Degenhardt et al., 2009***; ***Allmann and Baldwin, 2010***) and deterring herbivore oviposition (***Kessler and Baldwin, 2001***).

If HIPVs really function as defenses, they should increase Darwinian fitness, defined as successful reproduction, for plants under herbivore attack (***Karban and Baldwin, 1997***). But because HIPVs can be perceived by many other members of the ecological community—from herbivores, pollinators, predators and parasitoids to competing or parasitic plants—it is not clear whether HIPVs increase plant fitness in nature (***Dicke and Baldwin, 2010***; ***Kessler and Heil, 2011***). The field studies described above have either spanned too short a time to reveal Darwinian fitness benefits, or have not reported fitness data at all (***Kessler and Baldwin, 2001***; ***Rasmann et al., 2005***; ***Halitschke et al., 2008***; ***Degenhardt et al., 2009***; ***Allmann and Baldwin, 2010***). Two laboratory studies showed that parasitization of herbivores can increase plant reproduction (***van Loon et al., 2000***; ***Hoballah and Turlings, 2001***), but the parasitization in these studies was not mediated by HIPVs. Hence three decades after their description, it remains unclear whether HIPVs are really indirect defenses.

Long-term field studies comparing HIPV-emitting vs -deficient plants are required in order to demonstrate a defensive function for HIPVs. Experimental additions of pure volatiles or mixes to

eLIFE Research article Genomics and evolutionary biology | Plant biology

eLife digest As the population of the world continues to increase beyond 7 billion, and agricultural pests continue to rapidly evolve resistance to pesticides, it is becoming ever more important to cultivate arable land in a way that is sustainable for both humans and the environment. A better understanding of the different mechanisms used by wild plants to deter herbivores will help to increase crop production without harming the environment.

Plants use both direct and indirect methods to fend off herbivores. Direct defense methods include the production of chemicals that are toxic to herbivores or give them indigestion, and the growth of sticky prickles and spines that can injure or kill the herbivore. Indirect defense methods, on the other hand, generally rely on the plant attracting organisms that are either predators or parasites of the herbivore.

Plants produce odors known as herbivory-induced plant volatiles (HIPVs) that are thought to

All conversations

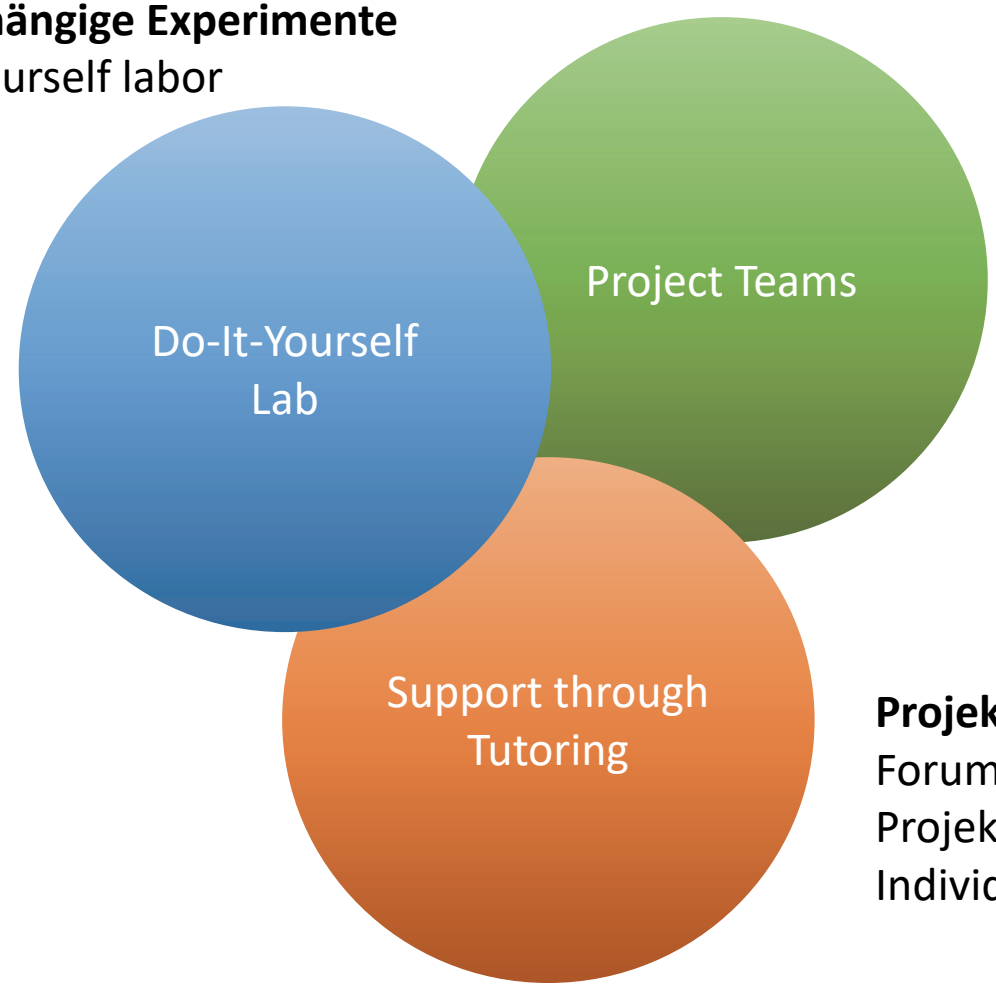
Page 4
irLOX2: I found that ir is an abbreviation for inverted-repeat.D...
I wonder where the precursor molecules of these two genes ... 2

Page 5
Hemizygous means one allele is missing (so one instead of... 2

Page 17
I think that, in a next study, it will be very interesting to stu...
This is a pertinent study that shows how direct plant defens...
This study is very informative, as it shows the effect of HIPV in n...
Would the results differ if the plant is dependend on pollin... 2

Wie hat der «Challenge-Based Learning» Teil funktioniert?

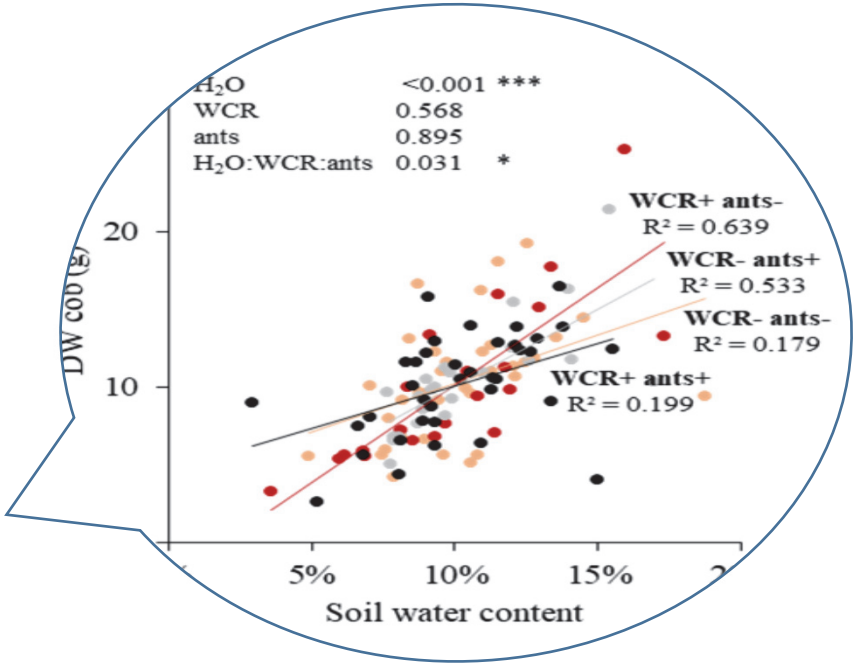
Undabhängige Experimente
Do-it yourself labor



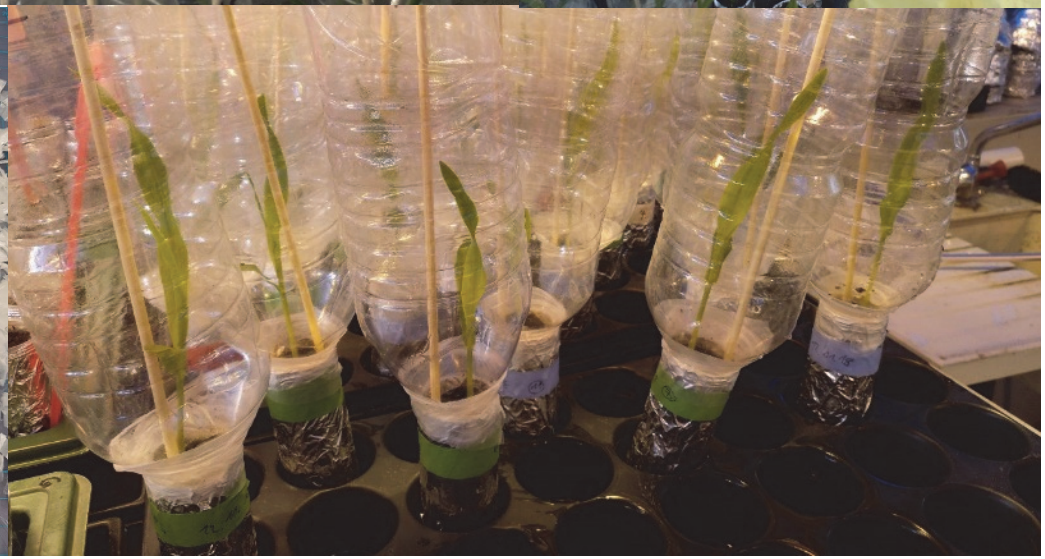
Projektteams
Frage zusammen identifizieren
Experimente planen
Arbeit koordinieren

Projektbetreuung
Forum auf Ilias
Projektpräsentation & Diskussion @IPS
Individuelle Unterstützung

Ziel für die Studierenden: Ein experimenteller Test einer eigenen Hypothese, als Präsentation den Kursteilehmern vorgestellt.




schaterra



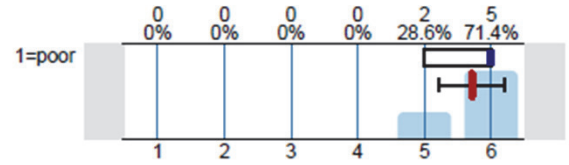
Video: Roman Suter, (ZUW)


Results
• Herbivory has a significant effect
and marginally on biomass (p = 0
• No significant interaction betwe

Wie waren die Rückmeldungen der Studierenden?

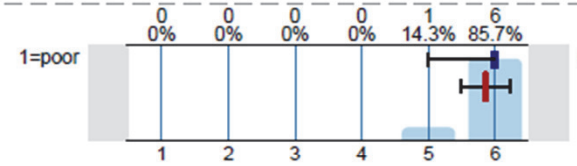
6. Overall Assessment

6.1) How would you grade the course as a whole?



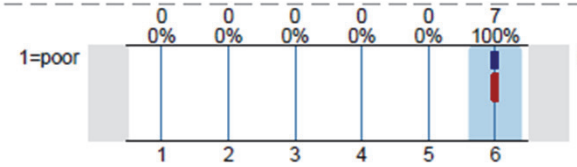
n=7
av.=5.71
md=6
dev.=0.49

6.2) How would you grade the lecturer with regard to subject expertise?



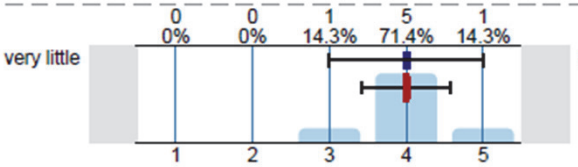
n=7
av.=5.86
md=6
dev.=0.38

6.3) How would you grade the lecturer with regard to teaching methods?



n=7
av.=6
md=6
dev.=0

6.4) The course has taught me:



n=7
av.=4
md=4
dev.=0.58

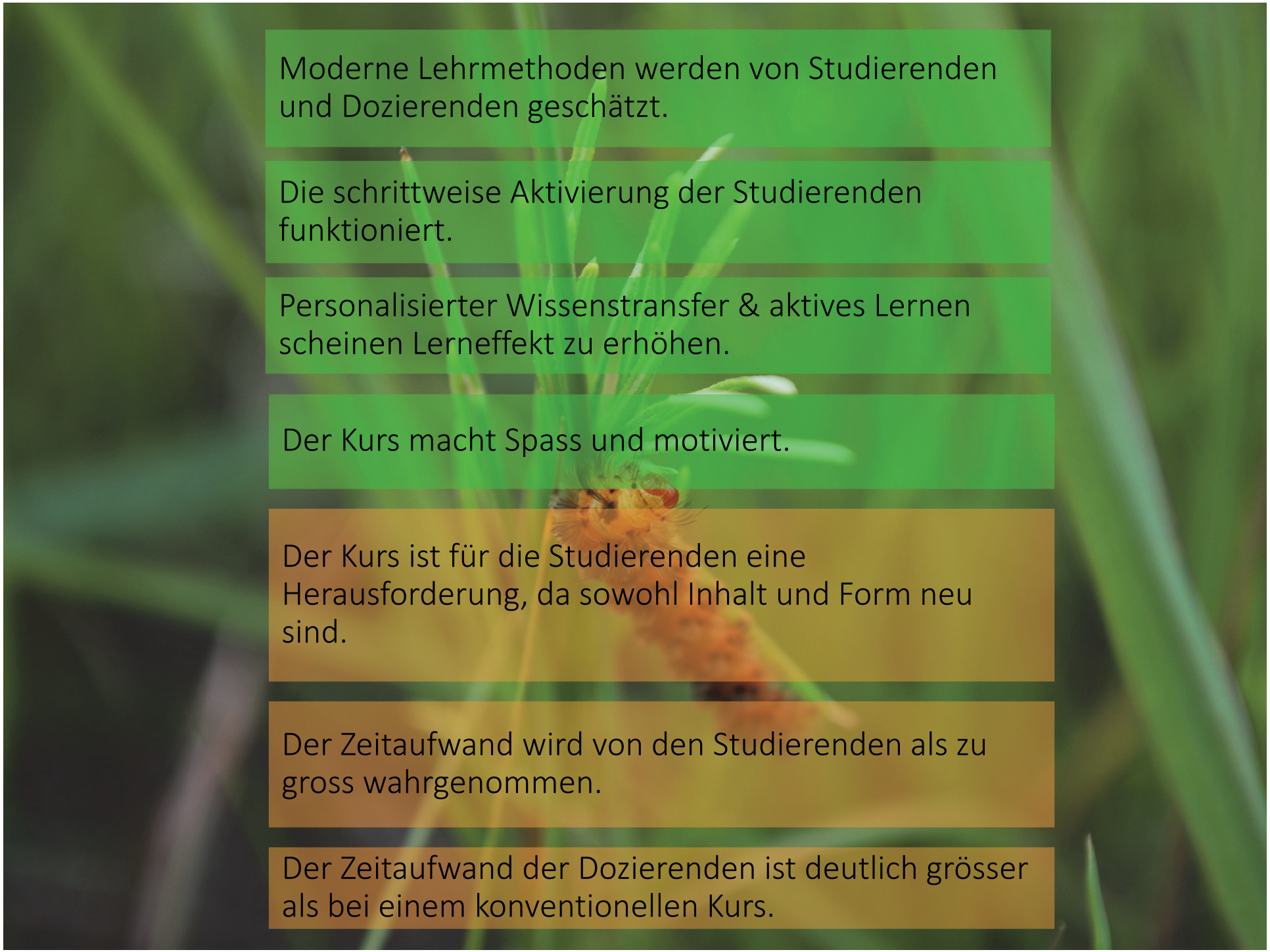
What did you like

- We could really evolve our own ideas. Great!
- I like the interactive tools and methodology
- Inverted classroom
- Teaching style (Perusall, discussions)
- Studying at home, video lectures.
- Interesting new teaching method.
- Assistance quality.

What did you not like?

- Not clear how and when to start experiments.
- Short time left for experimental part.
- Amount of papers too high.
- Too many papers to read.
- 2 questions for each paper too much.
- Short time for the practical part.

Fazit


Moderne Lehrmethoden werden von Studierenden und Dozierenden geschätzt.
Die schrittweise Aktivierung der Studierenden funktioniert.
Personalisierter Wissenstransfer & aktives Lernen scheinen Lerneffekt zu erhöhen.
Der Kurs macht Spass und motiviert.
Der Kurs ist für die Studierenden eine Herausforderung, da sowohl Inhalt und Form neu sind.
Der Zeitaufwand wird von den Studierenden als zu gross wahrgenommen.
Der Zeitaufwand der Dozierenden ist deutlich grösser als bei einem konventionellen Kurs.