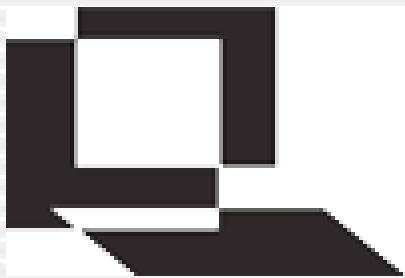


Leibniz Universität Hannover

Erfahrungen im Einsatz von Neuen Medien in der Physiklehre

Gerd Kortemeyer
Michigan State University
November 2006



Gliederung

- Teil 1: Hintergrund
- Teil 2: Übungs- und Prüfungsaufgaben
- Teil 3: Ergebnisse und Erfahrungen
- Teil 4: Diskussionsanalyse als ein spezielles Forschungsgebiet
- Teil 5: Ausblick

Teil 1

- Teil 1: Hintergrund

Hintergrund

- 1992: CAPA (Computer-Assisted Personalized Approach) - Hausübungs- und Prüfungssystem
- 1997: *LectureOnline* - Kursmanagement und kursübergreifende Lehrinhaltsverwaltung
- 2000: NSF Grant, „Investigation of a Model for Online Resource Creation and Sharing in Educational Settings“ - \$2.1 Millionen, 5 Jahre
- 2006: Verlängerung, endete August

Hintergrund

- Ziele des NSF Projektes:
 - Aufbau einer über Institutionsgrenzen hinweg nutzbaren Bibliothek wiederverwendbarer Lernobjekte
 - Entwicklung von Geschäftsprozessen innerhalb des Verbundes
 - Entwicklung von didaktischen Leitlinien zur Erzeugung effektiver Lernobjekte
 - Entwicklung von Mechanismen zur Qualitätskontrolle der Lernobjekte
- Modelsystem: LearningOnline Network with CAPA (LON-CAPA)



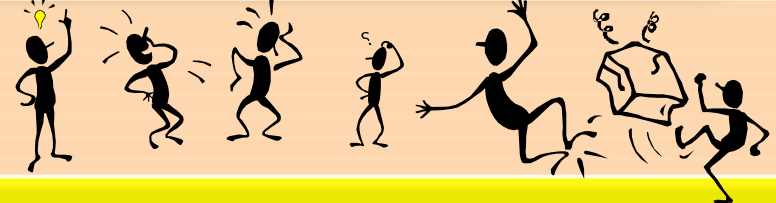
Hintergrund



Kursverwaltungssystem

Campus A

Inhalts
-zusammenstellungs
-werkzeuge



Kursverwaltungssystem

Campus B

Inhalts
-zusammenstellungs
-werkzeuge

Verteilte Inhaltsbibliothek
über Campusgrenzen hinaus

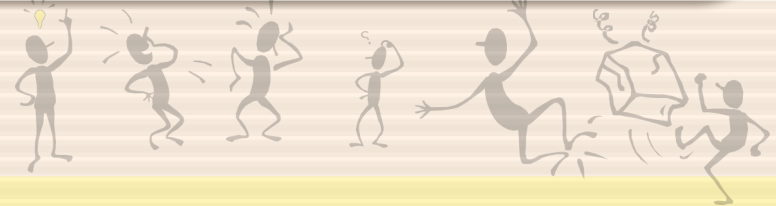
Hintergrund



Kursverwaltungssystem

Campus A

Inhalts
-zusammenstellungs
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Kursverwaltungssystem

Campus B

Inhalts
-zusammenstellungs
-werkzeuge

Verteilte Inhaltsbibliothek
über Campusgrenzen hinaus

Verteilte Inhaltsbibliothek

- Virtuelles Filesystem
- Geordnet nach
 - Domain
 - Autor
 - Verzeichnisstruktur des Autors

“Supermarkt”

▶	Domain - sc (University of South Carolina)
▼	Domain - sfu (Simon Fraser University)
▶	batchelo
▶	chem281
▶	exafs
▶	hanlan
▶	mxchen
▶	slavieri
▶	vjungic
▶	Domain - sunysb (SUNY Stony Brook)
▼	Domain - tmcc (Truckee Meadows Community College)
▶	jensen
▶	mbauer
▼	souza
▶	Greenberg
	default.sequence (metadata)
▶	samples
▶	testuser1
▶	Domain - ucf (University of Central Florida)

Verteilte Inhaltsbibliothek

Impedance

The addition of the three currents (through the resistor, the inductance, and the capacitance), each of which is 90° out of phase with each other, in quadrature yields:

$$\begin{aligned}
 V &= \sqrt{V_R^2 + (V_C - V_L)^2} \\
 &= \sqrt{(IR)^2 + (IX_C - IX_L)^2} \\
 &= I\sqrt{R^2 + (X_C - X_L)^2} \\
 &= IZ
 \end{aligned}$$

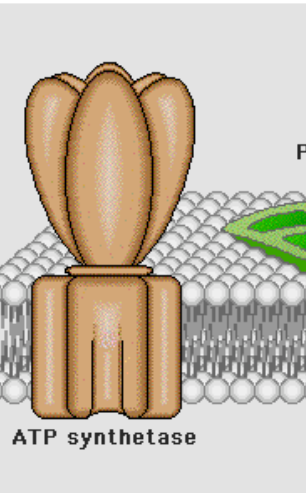
where I is the current, X_C and X_L are the capacitive and inductive reactances, respectively, and Z is obtain for Z:

$$\begin{aligned}
 Z &= \frac{V}{I} \\
 &= \sqrt{R^2 + (X_C - X_L)^2} \\
 &= \sqrt{R^2 + (X_C - X_L)^2}
 \end{aligned}$$

Z is dependent on the frequency and has its m

the frequency of oscillation of the pure LC cir
frequency dependence of the impedance and o

In summary, reactances in series have to be ad
impedance, which is the AC equivalent of the ;



Thylakoid Lumen



Animation speed:

- faster
- medium
- slower

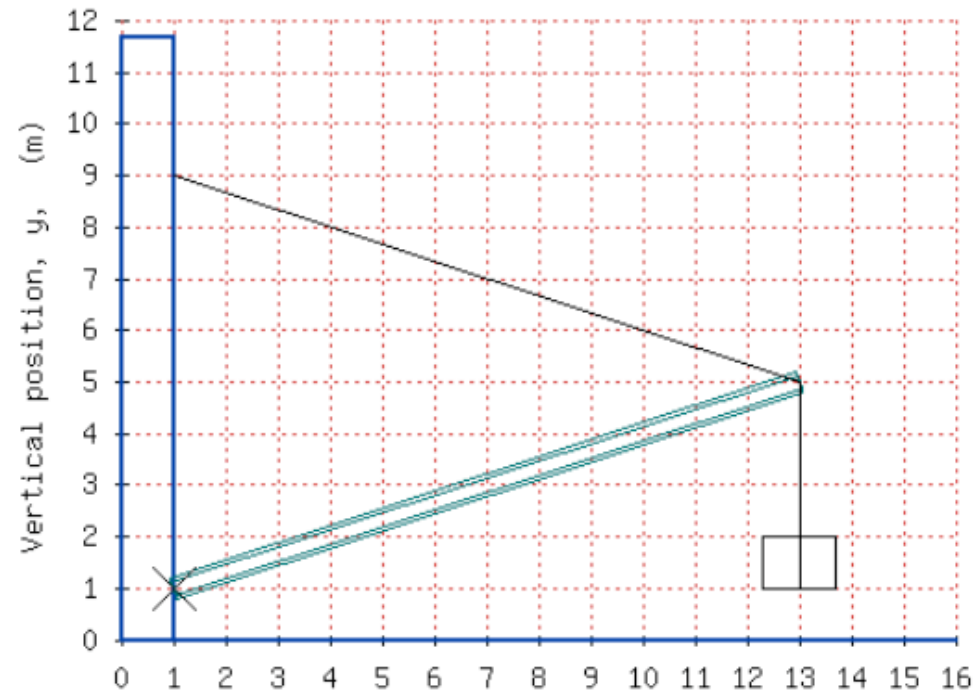
Play animation number:

1 2 3 4 5 6 7 8 9

Verteilte Inhaltsbibliothek

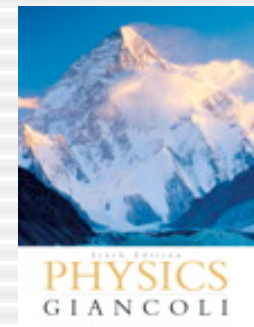
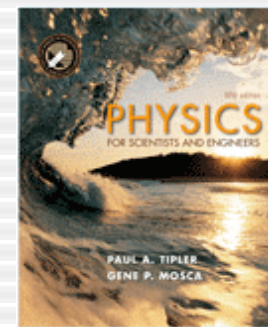
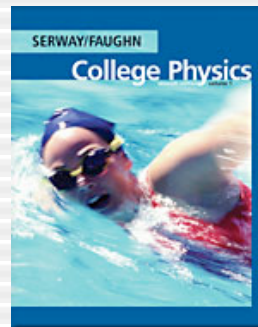
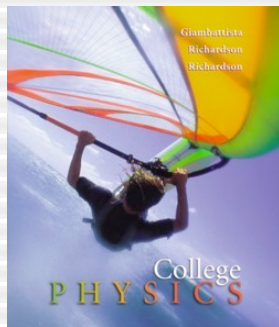
- Hausübungs- und Klausurprobleme
- Jeder Studierende hat eine andere Version
- Verschiedene Optionen, Bilder, Nummern, Graphen, etc
- Mehr dazu später

A crate with a mass of 155.5 kg is suspended from the end of a uniform boom with mass of 89.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



Verteilte Inhaltsbibliothek

- Mehrheit der Materialien von Lehrenden erstellt
- Jedoch auch: Aufgabensammlungen zu Vorlesungstexten
- Verlage beauftragen Firmen, die Aufgaben in LON-CAPA Format bereitzustellen
- Bibliotheken werden freigeschaltet für Kurse, die diese Texte benutzen
- Keine zusätzlichen Kosten, stattdessen Anreiz für Lehrende, dieses Buch auszuwählen



Verteilte Inhaltsbibliothek

LON-CAPA Inhaltsbibliothek August 2006	Verfügbar	Aktiv genutzt	Über Institutions- grenzen hinaus aktiv genutzt
Bilder	88079	18262	9629
Übungsaufgaben	80009	57979	23816
Webseiten	57972	5888	2949
Wiederverwendbare Inhaltszusammen- stellungen	7405	3184	1299
Animationen und Simulationen	1575	507	338
Filme und Soundfiles	742	326	105
Andere (MS Office, etc)	11302	2484	674
Gesamt	247084	88630	38810

Hintergrund



Kursverwaltungssystem

Campus A

Inhalts
-zusammenstellungs
-werkzeuge



Kursverwaltungssystem

Campus B

Inhalts
-zusammenstellungs
-werkzeuge

Verteilte Inhaltsbibliothek
über Campusgrenzen hinaus

Inhaltszusammenstellung

- Einkaufswagen

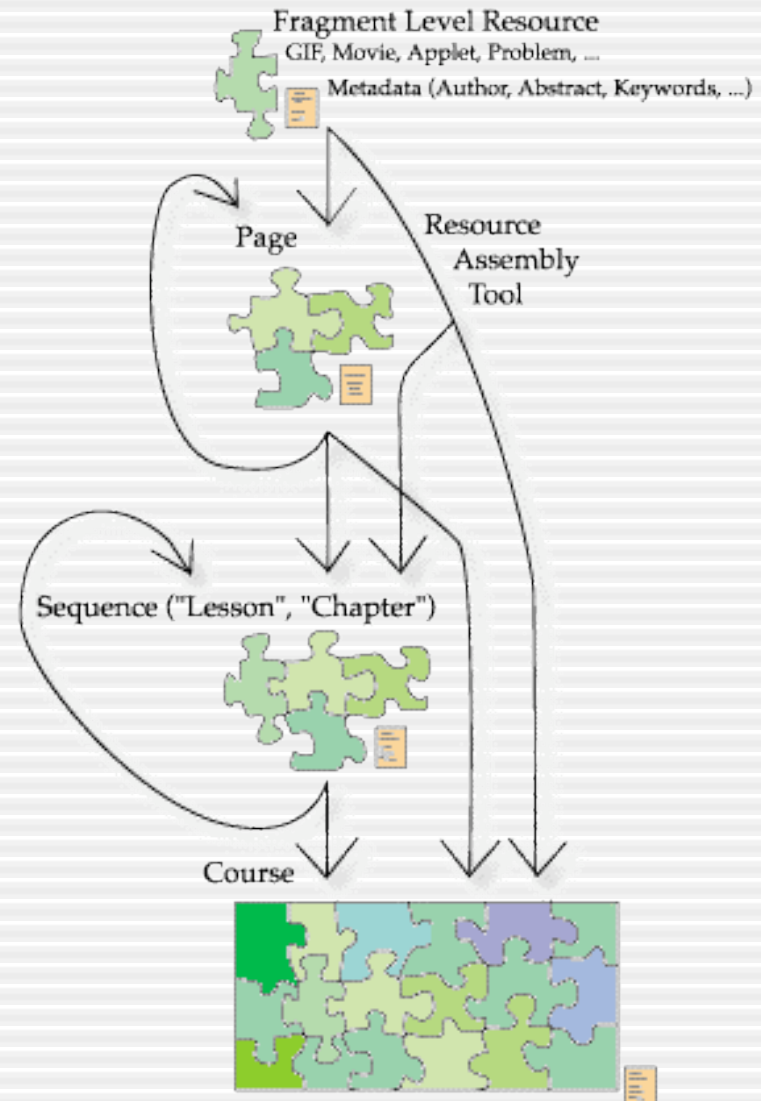


“Supermarkt”

▶	Domain - sc (University of South Carolina)
▼	Domain - sfu (Simon Fraser University)
▶	batchelo
▶	chem281
▶	exafs
▶	hanlan
▶	mxchen
▶	slavieri
▶	vjungic
▶	Domain - sunysb (SUNY Stony Brook)
▼	Domain - tmcc (Truckee Meadows Community College)
▶	jensen
▶	mbauer
▼	souza
▶	Greenberg
	default.sequence (metadata)
▶	samples
▶	testuser1
▶	Domain - ucf (University of Central Florida)

Inhaltszusammenstellung

- Verschachtelte Struktur
- Keine festgelegten Granularitäten
- Leute können sich darauf nicht einigen
- Lernobjekte existieren auf jeder Stufe und können auf jeder Stufe wiederverwendet werden



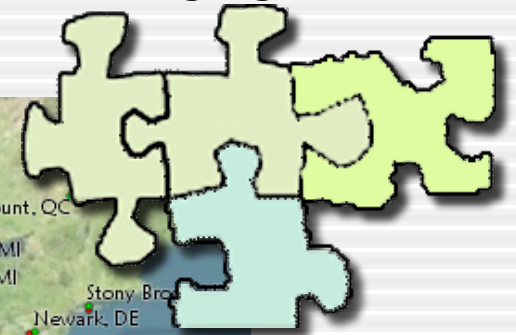
Inhaltszusammenstellung



Schreibt Modul über
Energieerhaltung



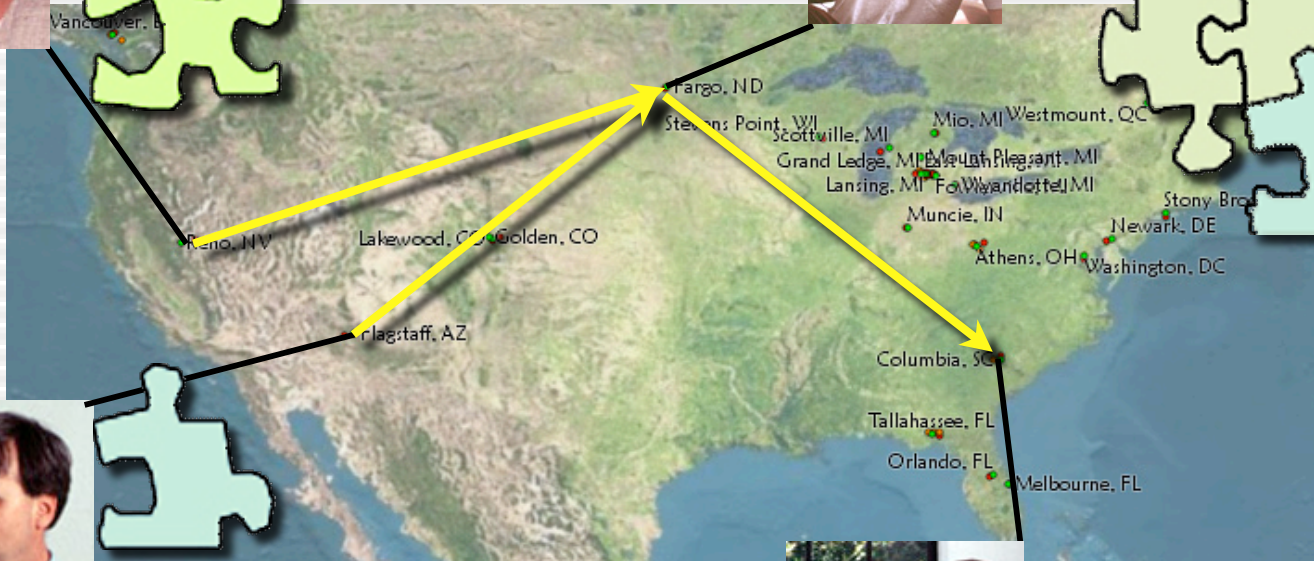
Schreibt Modul über
Erhaltungsgrößen



Schreibt Modul über
Impulserhaltung



Benutzt dies in
seinem Kurs



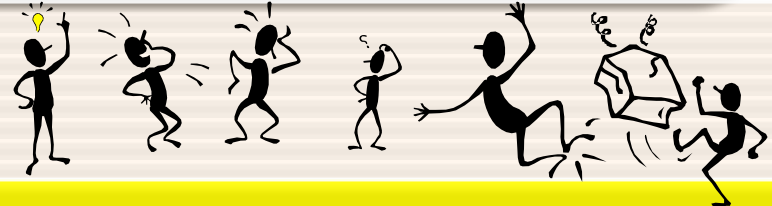
Logischer Aufbau



Kursverwaltungssystem

Campus A

Inhalts
-zusammenstellungs
-werkzeuge



Kursverwaltungssystem

Campus B

Inhalts
-zusammenstellungs
-werkzeuge

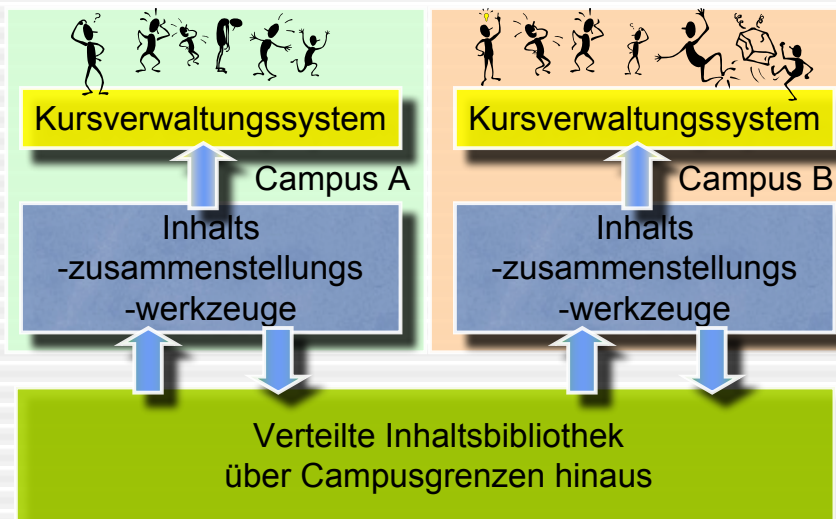
Verteilte Inhaltsbibliothek
über Campusgrenzen hinaus

Kursverwaltung

- Standardwerkzeuge
 - Kommunikation
 - Benotung
 - Syllabus, Kalender
 - Navigation
 - Portfolios
 - RSS Feeds, etc

Kursverwaltung

- Mittlere Ebene war Inhaltzusammenstellung
- Kursmanagementebene: Navigation wird dynamisch daraus erzeugt



Main Menu Return to Last Location Navigate Contents Course Documents

Navigate Course Contents

? ? Select Action Go Sort by: Default

- Syllabus
- Calendar Overview
- Electrostatics
- Electric Field
- Capacitors
 - Capacitors
 - Capacitors Materials
 - Capacitors Homework
 - Force Answer available
 - Spherical Capacitor Answer available
 - Separation Answer available
 - Dielectric Constant Answer available
 - Energy Stored Answer available
 - Dielectric constant 2 Answer available
 - Energy Density Answer available
 - Capacitance Answer available
 - Capacitance 2 Answer available

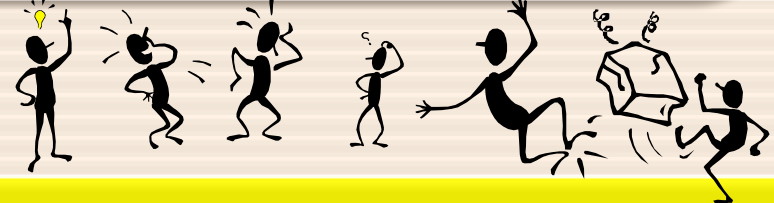
Dynamische Metadaten



Kursverwaltungssystem

Campus A

Inhalts
-zusammenstellungs
-werkzeuge



Kursverwaltungssystem

Campus B

Inhalts
-zusammenstellungs
-werkzeuge

Verteilte Inhaltsbibliothek
über Campusgrenzen hinaus

A green puzzle piece on the left and a light blue puzzle piece on the right, representing a distributed content library.


Dynamische Metadaten

- Dynamische Metadaten: Verwendungsdaten
- Helfen bei der Auswahl („amazon.com“)
- Qualitätskontrolle

Access and Usage Statistics

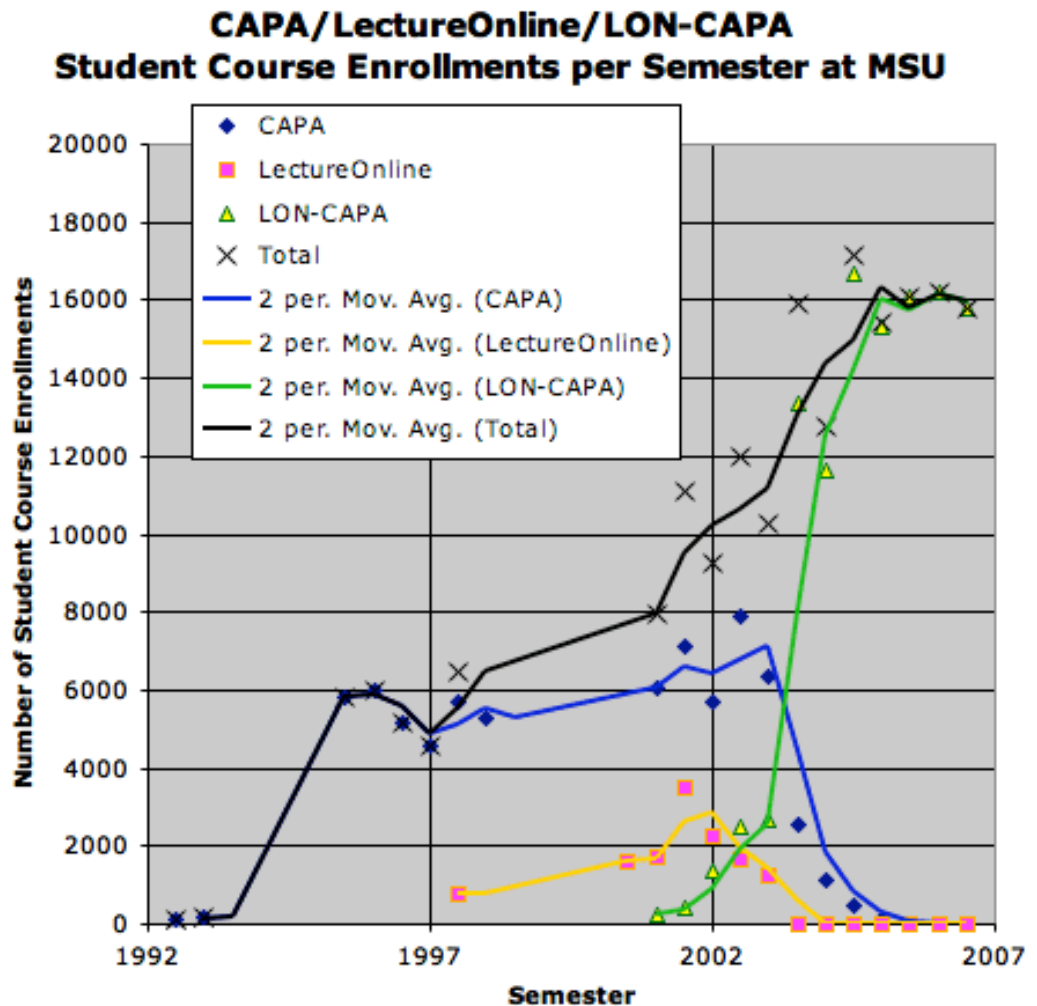
Network-wide number of accesses (hits)	890
Number of resources using or importing resource	1 <ul style="list-style-type: none"> • Eukaryotic Gene Control [msu/bio/Gene_Expr/111f03GeneCntrl.sequence]
Number of resources that lead up to this resource in maps	1 <ul style="list-style-type: none"> • Back to the Original Question [msu/bio/Gene_Expr/problems/originalquestion.problem]
Number of resources that follow this resource in maps	1 <ul style="list-style-type: none"> • Eukaryotic vs Prokaryotic Gene Expression II [msu/bio/Gene_Expr/problems/eukvsprokII.problem]
Network-wide number of courses using resource	3 <ul style="list-style-type: none"> • LBS 145 - Spring 2004 • ZOL 341 - Fall 2003 • BS 111 - Fall 2003

Assessment Statistical Data

Total number of students who have worked on this problem	291
Average number of tries till solved	1.37
Degree of difficulty	 (0.36)

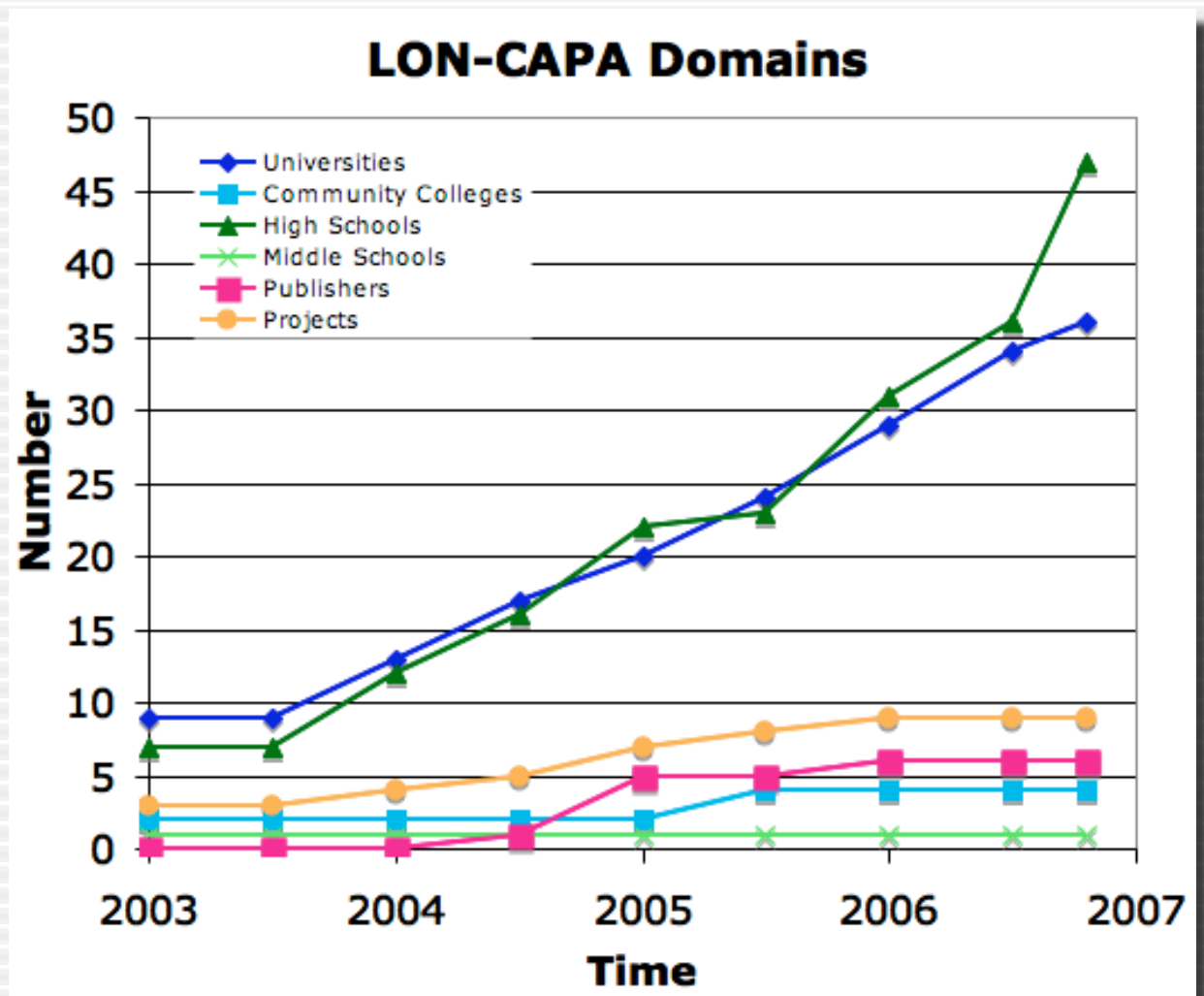
Wachstum an MSU

- Wachstum an Michigan State University
- 16.000 Einschreibungen pro Semester
- 12.000 individuelle Nutzer pro Semester



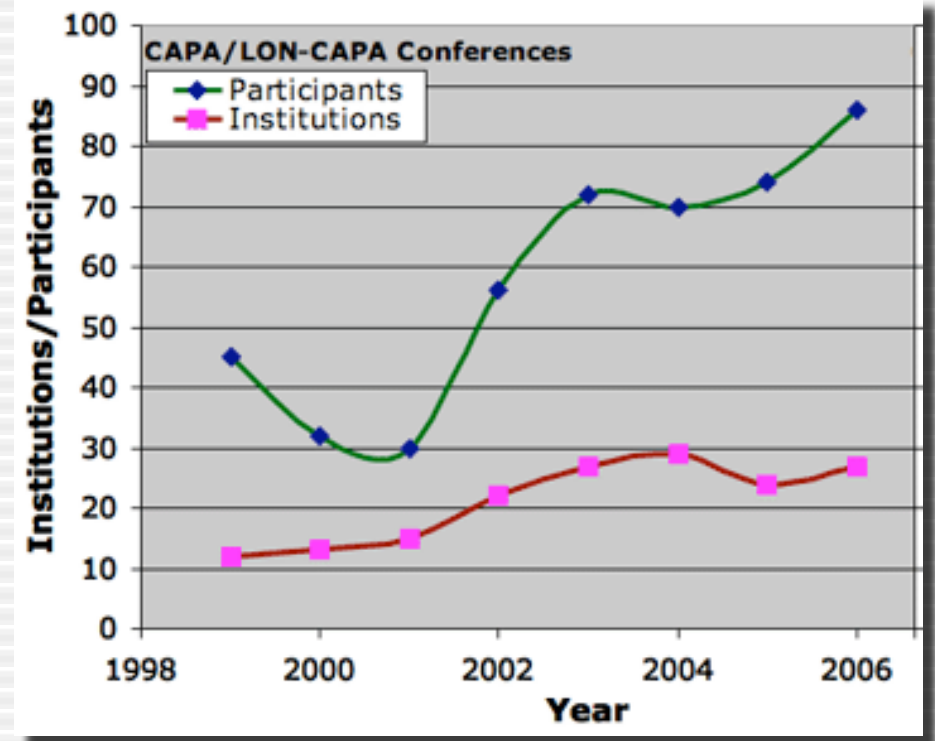
Nutzerinstitutionen

- Wachsende Zahl von Nutzerinstitutionen
- Unerwartete Popularität an Schulen



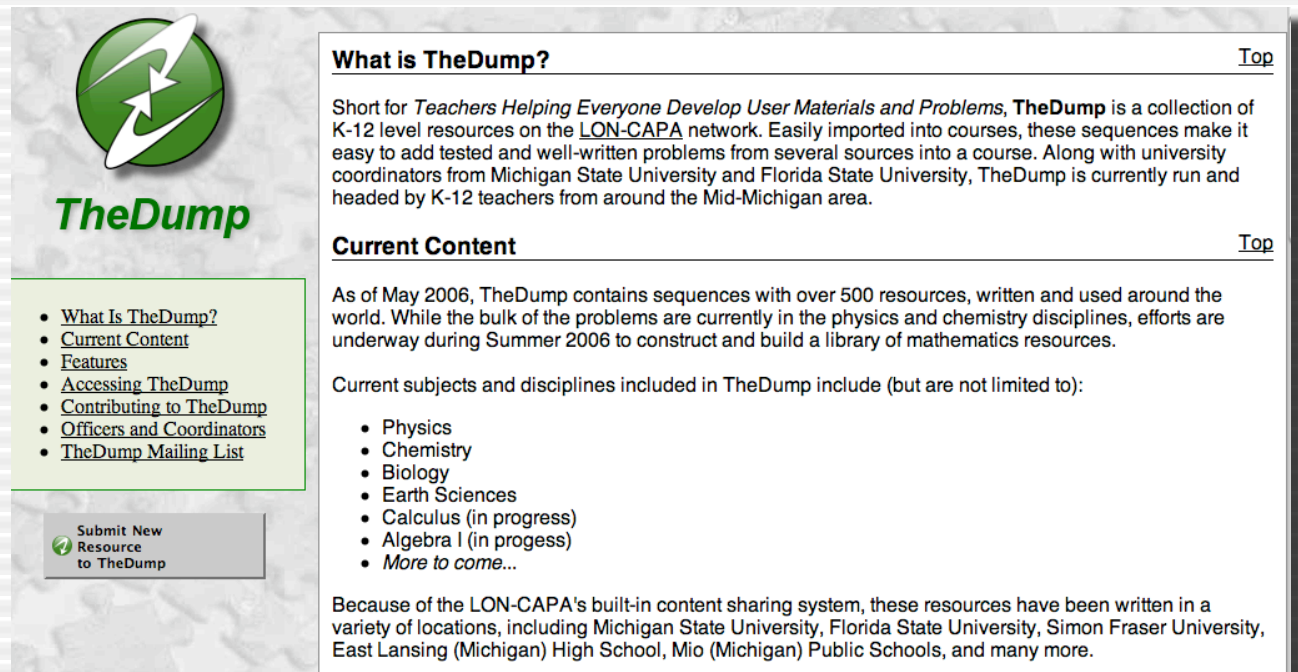
Aktivitäten

- Jährliche Nutzerkonferenzen
- Mehrfach im Jahr Workshops
- Jährliche NSF Research Experience for Teachers (RET): Internships für Science Teachers
- Teil der Masters Kurse für In-Service Teachers an MSU



Aktivitäten

- Initiative: THEDUMP („Teachers Helping Everyone Develop User Materials and Problems“)
- Zusammenstellung von Materialien aus Bibliothek entsprechend High School Curriculum-Einheiten
- Einschließlich Universitätsmaterialien



The screenshot shows the homepage of TheDump. On the left, there is a green circular logo with a white lightning bolt and the text 'TheDump' below it. Below the logo is a navigation menu with links: 'What Is TheDump?', 'Current Content', 'Features', 'Accessing TheDump', 'Contributing to TheDump', 'Officers and Coordinators', and 'TheDump Mailing List'. At the bottom left, there is a button that says 'Submit New Resource to TheDump' with a green checkmark icon. On the right, there are two main sections: 'What is TheDump?' and 'Current Content'. The 'What is TheDump?' section includes a 'Top' link and a paragraph describing the site as a collection of K-12 level resources on the LON-CAPA network. The 'Current Content' section includes another 'Top' link, a paragraph stating that as of May 2006, there are over 500 resources, and a list of current subjects and disciplines: Physics, Chemistry, Biology, Earth Sciences, Calculus (in progress), Algebra I (in progress), and 'More to come...'. At the bottom of the right section, there is a paragraph explaining that resources are written in a variety of locations, including Michigan State University, Florida State University, Simon Fraser University, East Lansing (Michigan) High School, Mio (Michigan) Public Schools, and many more.

What is TheDump? [Top](#)

Short for *Teachers Helping Everyone Develop User Materials and Problems*, **TheDump** is a collection of K-12 level resources on the [LON-CAPA](#) network. Easily imported into courses, these sequences make it easy to add tested and well-written problems from several sources into a course. Along with university coordinators from Michigan State University and Florida State University, TheDump is currently run and headed by K-12 teachers from around the Mid-Michigan area.

Current Content [Top](#)

As of May 2006, TheDump contains sequences with over 500 resources, written and used around the world. While the bulk of the problems are currently in the physics and chemistry disciplines, efforts are underway during Summer 2006 to construct and build a library of mathematics resources.

Current subjects and disciplines included in TheDump include (but are not limited to):

- Physics
- Chemistry
- Biology
- Earth Sciences
- Calculus (in progress)
- Algebra I (in progress)
- *More to come...*

Because of the LON-CAPA's built-in content sharing system, these resources have been written in a variety of locations, including Michigan State University, Florida State University, Simon Fraser University, East Lansing (Michigan) High School, Mio (Michigan) Public Schools, and many more.

Aktivitäten

- Mehrsprachige Benutzerschnittstelle

Change Your Language Preferences

Preferred language:

[メインメニュー](#) [最後に戻る](#) [コンテンツをナビゲートする](#) [リモコンパネルを使う](#) **LON-CAPA**

[The LearningOnline ...](#) [Welcome Set-Up Page](#)

メインメニュー

ROLES	他の役割に切り替える
DOCS	このコースに含まれているドク
NAV	コースの目次をナビゲートする
SPRS	コースの成績を計算する(スプレ
CHRT	成績の伸長グラフを見る
STAT	コースのテストの統計を見る
ENRL	コースに / から学生を追加 / 削
CUSR	ユーザを追加、役割・権限を 変
PARM	締め切りを設定し、その他の試
RES	公開されたリソースを見る

Importieren eines veröffentlichten Dokumentes

Spezielle Dokumente

-
-
-
-
-
-
-
-
-

lo Curso

ntar para o cu

/se...

ий до

Nachhaltigkeit

- Nachhaltigkeit erreicht durch
 - Kommerzielle Ausgründung
 - Gemeinnütziges LON-CAPA Academic Consortium

Ausgründung

- eduCog, LLC
- Gegründet 2005
- Stellt heute LON-CAPA bereit für
 - 2 Hochschulen
 - 32 Schulen
 - 6 Verlage



Academic Consortium

- Gründungsmitglieder:
Michigan State University
und University of Illinois at
Urbana-Champaign
- Associate Member: Simon
Fraser University
- Verpflichtungen in Höhe
von \$2,15 Millionen über
die nächsten fünf Jahre



The logo for Michigan State University. It consists of the words 'MICHIGAN STATE' stacked above 'UNIVERSITY' in a black, sans-serif font. A horizontal line separates the two lines of text.



The logo for Simon Fraser University. It features the words 'SIMON FRASER UNIVERSITY' in a white, sans-serif font, stacked vertically on a dark grey rectangular background.

Teil 2

- Teil 2: Übungs- und Prüfungsaufgaben

Übungs- und Prüfungsaufgaben

- Verschiedene Studierende bekommen verschiedene Versionen der gleichen Aufgabe
 - Studierende können Aufgaben miteinander diskutieren
 - Zusammenarbeiten
 - Aber: nicht einfach Lösungen austauschen
- Weniger Selbstbetrug
- Authentischeres Feedback an Lehrende

Übungs- und Prüfungsaufgaben

- Natürlich das Übliche:
 - Mehrfachauswahlen
 - Klicke-auf-Bild
 - Zuordnungsaufgaben
 - Rankordnungsaufgaben
- Alle Typen können mit Medien angereichert werden
- Sofortige Rückmeldung bzgl. Richtigkeit (abschaltbar vom Lehrenden)
- Mehrere Versuche (konfiguriert vom Lehrenden)
- Besondere Stärken in den Naturwissenschaften und Mathematik

Mathematische Aufgaben

- Auswertung symbolischer Ausdrücke

Example:

$$\frac{d}{dt} \begin{pmatrix} 3at \\ 2t^2 \\ 5 \end{pmatrix} = \begin{pmatrix} 3a \\ 4t \\ 0 \end{pmatrix}$$

Exercise: What is the derivative of the vector

$$\begin{pmatrix} c \sin(at) \\ c \exp(kt) \\ bt^3 \end{pmatrix}$$

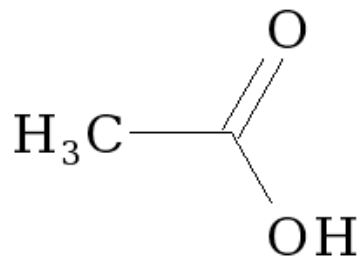
with respect to t ? Enter the components separated by commas, with exponents denoted by \wedge and explicit multiplication using $*$, e.g., $7*b*t^2+a, 5a, a+b*t$.

Submit Answer Tries 0/99

Aufgaben für die Chemie

- Chemische Formeln und Strukturen

The image below is $C_2H_4O_2$

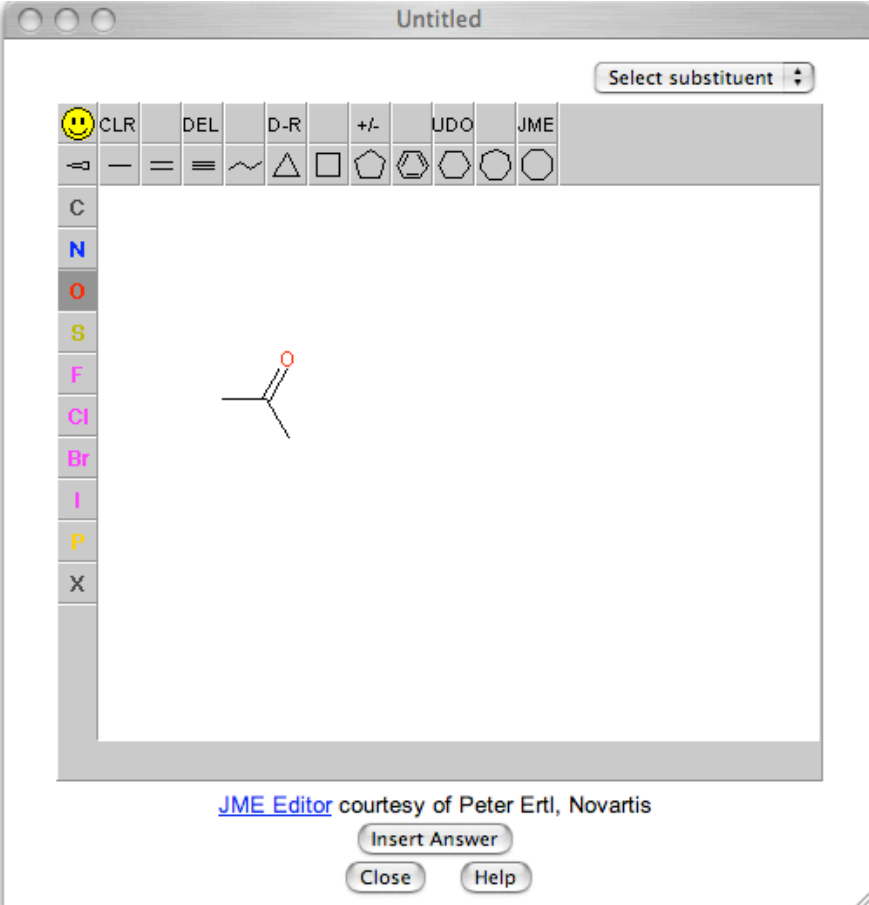


Draw acetic acid.

Draw Molecule

Submit Answer Tries 0/99

[Post Discussion](#)



The screenshot shows the JME Editor interface. The window title is "Untitled". The toolbar includes buttons for CLR, DEL, D-R, +/-, UDO, and JME. A "Select substituent" dropdown menu is visible. The main drawing area shows the chemical structure of acetic acid (CH₃COOH) being drawn. The JME Editor is courtesy of Peter Ertl, Novartis. At the bottom, there are buttons for "Insert Answer", "Close", and "Help".

Aufgaben für die Physik

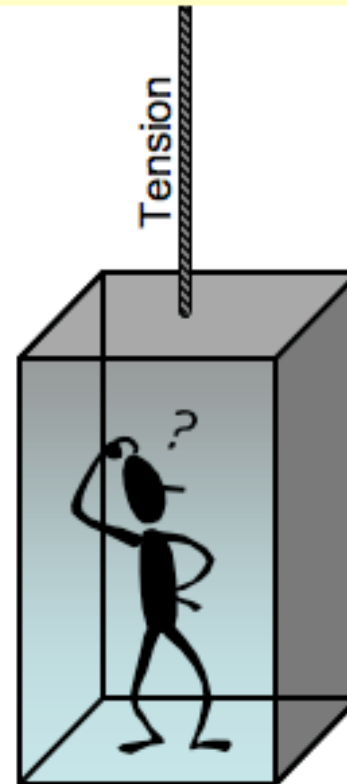
- Unterstützung physikalischer Einheiten

Elevator Problem

Due never

An elevator (cabin mass 500 kg) is designed for a maximum load of 2600 kg, and to reach a velocity of 3 m/s in 5 s. For this scenario, what is the tension the elevator rope has to withstand?

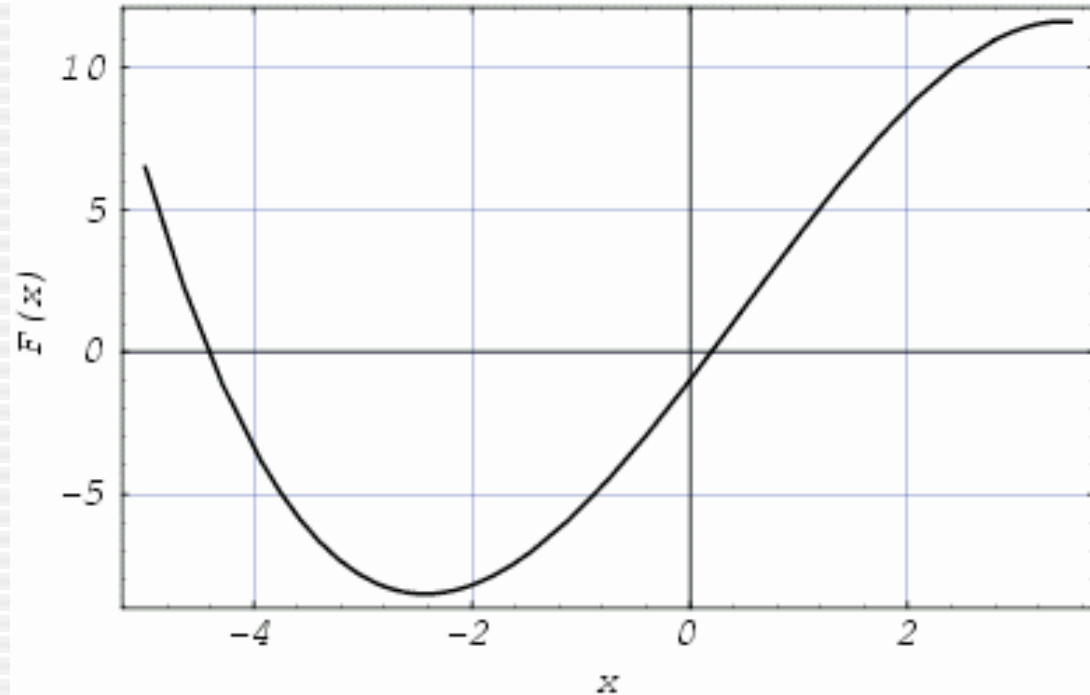
Submit Answer Tries 0/99



Graphen

- Dynamische Erzeugung von Graphen

Using graphical methods, determine at 2.0 the value of the derivative of function $F(x)$ plotted in the graph below.

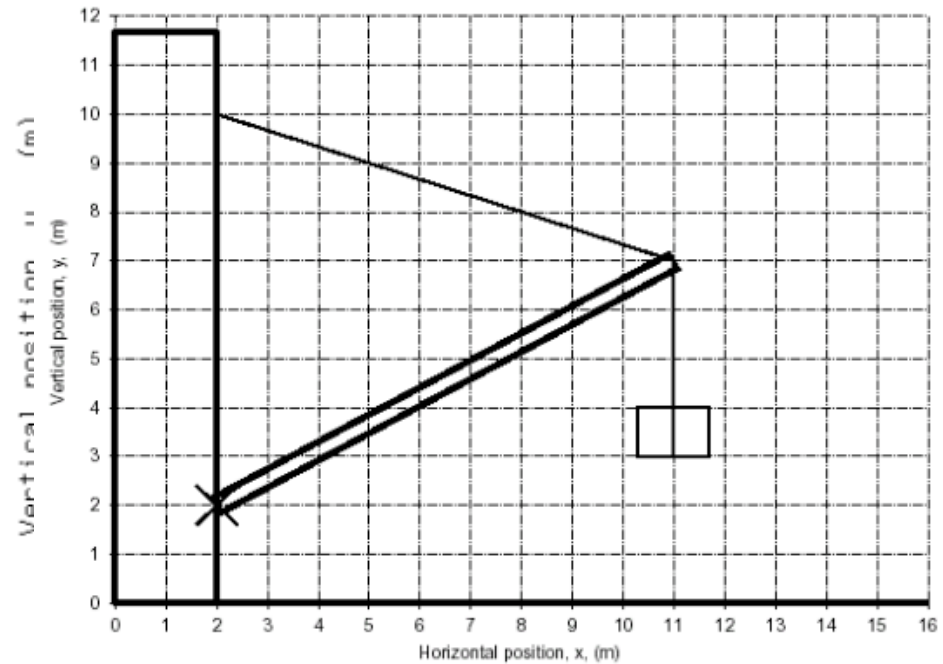


Submit All Answers

Klausuraufgaben

A crate with a mass of 177.5 kg is suspended from the end of a uniform boom with mass of 88.5 kg. The

upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



(in N)

22. A 2.58×10^3 B 2.92×10^3 C 3.29×10^3
 D 3.72×10^3 E 4.21×10^3 F 4.75×10^3
 G 5.37×10^3 H 6.07×10^3

Directions for Marking

- Use number 2 pencil only.
- Make dark marks that fill the circle completely.
- Erase cleanly any mark you wish to change.
- Make no stray marks.

Example: A B C D E F G H I J

PRINT AND MARK YOUR NAME

YOUR LAST NAME: _____ FL: _____ A: _____ PID: _____

SECTION: _____ CODE: _____

PLEASE WRITE YOUR SIGNATURE WITHIN THIS BOX

FORM

0-21677

Teil 3

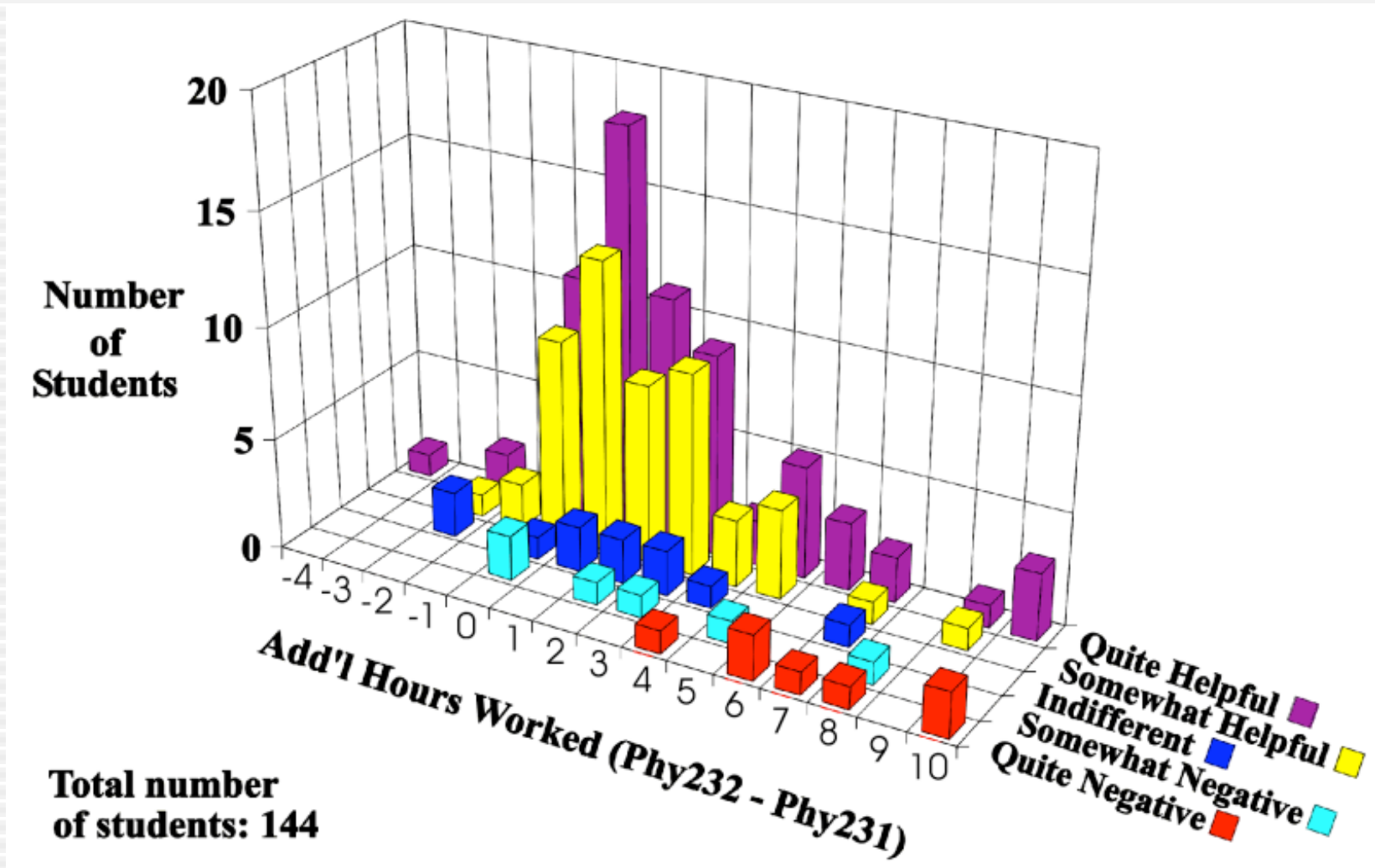
- Teil 3: Ergebnisse und Erfahrungen

Disclaimer

- Disclaimer:
 - LON-CAPA ist ein Werkzeug
 - Erfahrungen und Ergebnisse hängen davon ab, wie man es einsetzt
- Insgesamt:
 - Weniger als ein Prozent komplett virtuelle Kurse
 - In den meisten Kursen wird LON-CAPA vorlesungsbegleitend eingesetzt
 - Hausübungen und Klausuren
 - Zusätzlich in einigen Kursen: Materialien
 - Mit oder ohne traditionelles „Textbook“

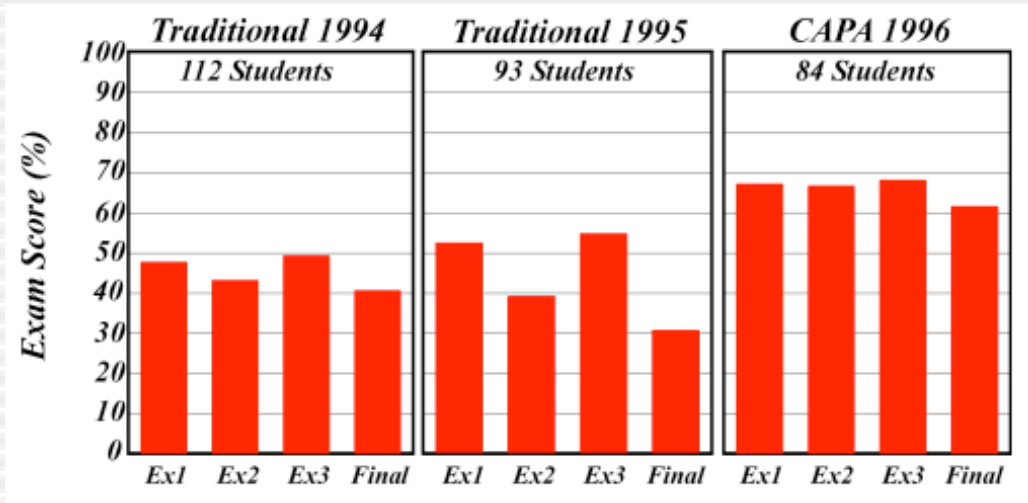
Subjektiv, Studierende

Zweisemestriger Kurs: CAPA eingeführt zwischen Semestern

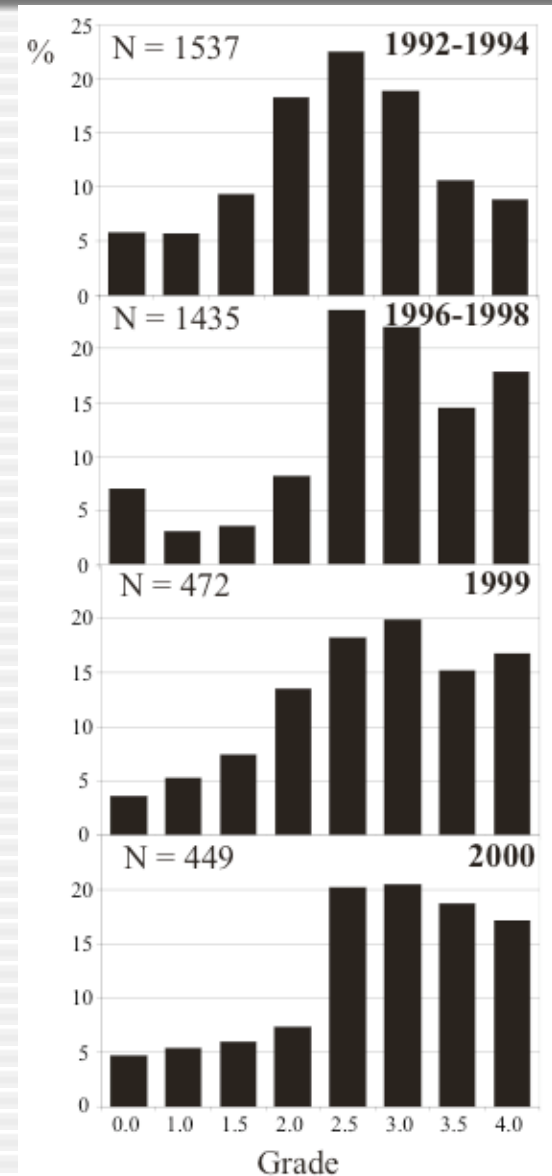


Objektiv: Prüfungs- und Kursnoten

Vorher/Nachher



- Klausuren waren nicht CAPA in diesem Kurs
- Hausübungen nur geringer Teil der Note



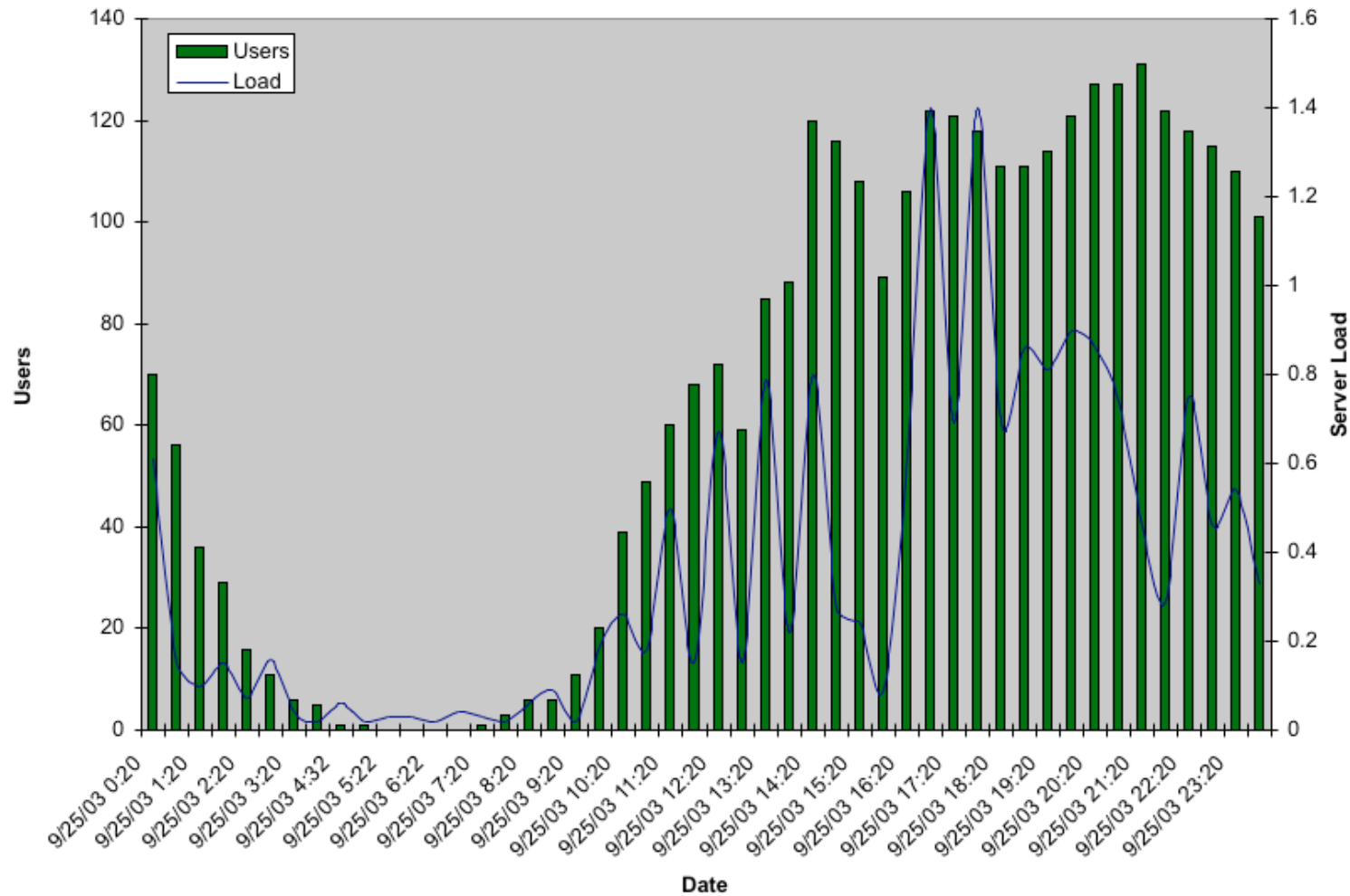
Ergebnisse und Erfahrungen

- Wundermittel?
- “Übung macht den Meister”
- “Time on Task”
- Feedback on Lehrende und Lernende

Zeit mit dem Material

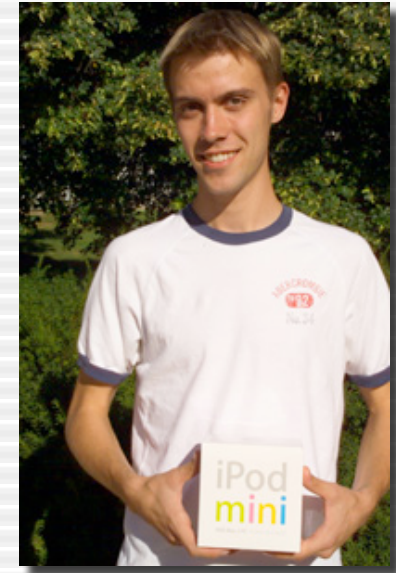
x5

Active Users and Server Load, msua1



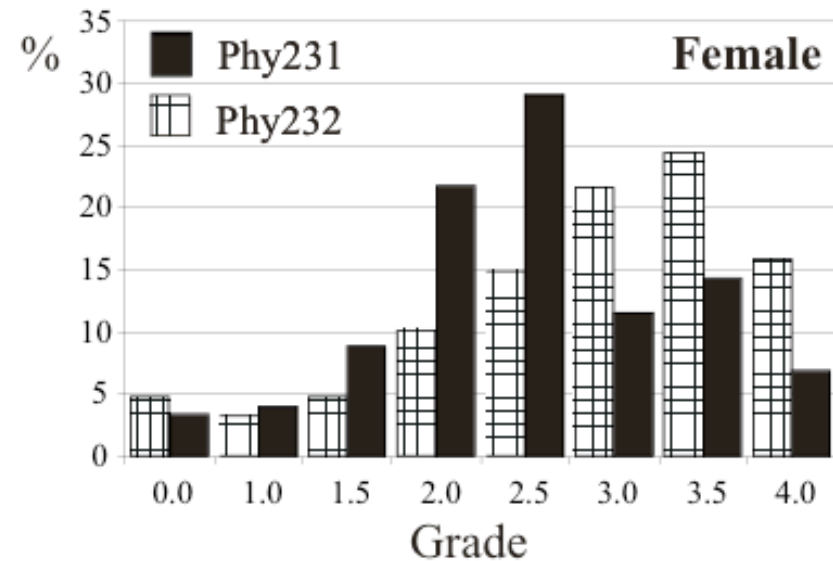
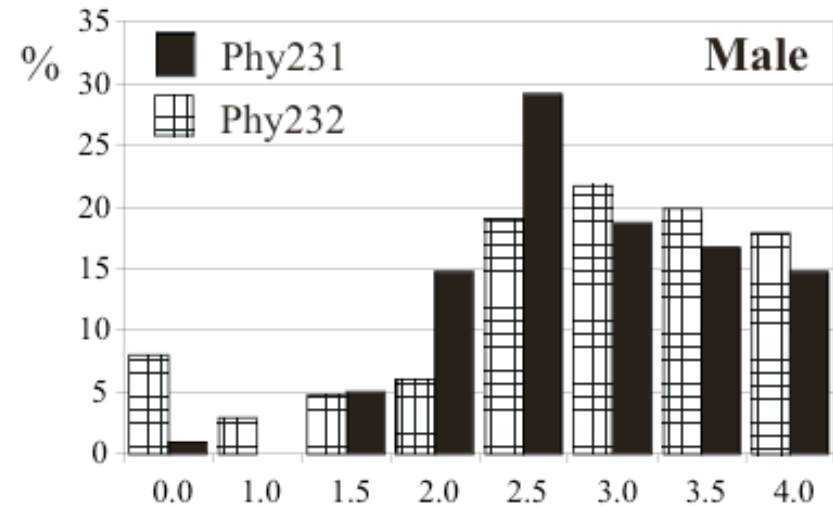
Zeit mit dem Material

- Akademisches Jahr 2004/2005
- Circa 12.600 (Herbst) and 10.800 (Frühling) Studierende an der MSU
- 100.000 Logins in den ersten 16 Tagen des Semesters
- 1.000.000 Logins im März, sieben Monate später



Gender Differential

- phy231: ohne CAPA
- phy232: mit CAPA
- Geschlechter-
unterschied



Prüfungsaufgaben

A capacitor is completely charged with 650 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

- 7.A 1.49×10^{-9} B 1.86×10^{-9} C 2.32×10^{-9}
D 2.90×10^{-9} E 3.63×10^{-9} F 4.53×10^{-9}
G 5.67×10^{-9} H 7.08×10^{-9}

1 pt Now the plates of the charged capacitor are pushed together with the voltage source already disconnected.

8. A The charge on the plates increases.
B The energy stored in the capacitor remains the same.
C The capacitance increases.
D The voltage drop between the plates increases.
E The energy stored in the capacitor increases.

1 pt The initial air gap was 8 mm. What is the stored energy if the air gap is now 6 mm? (in J)

- 9.A 0.00 B 8.53×10^{-5} C 1.14×10^{-4}
D 1.30×10^{-4} E 1.52×10^{-4} F 3.41×10^{-4}
G 3.44×10^{-4} H 4.87×10^{-4}

A capacitor is completely charged with 670 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

- 7.A 1.91×10^{-9} B 2.39×10^{-9} C 2.99×10^{-9}
D 3.74×10^{-9} E 4.67×10^{-9} F 5.84×10^{-9}
G 7.30×10^{-9} H 9.13×10^{-9}

1 pt Now the plates of the charged capacitor are pulled apart with the voltage source already disconnected.

8. A The voltage drop between the plates increases.
B The energy stored in the capacitor remains the same.
C The charge on the plates increases.
D The capacitance increases.
E None of the above.

1 pt The initial air gap was 6 mm. What is the stored energy if the air gap is now 11 mm? (in J)

- 9.A 0.00 B 6.40×10^{-5} C 1.17×10^{-4}
D 2.15×10^{-4} E 2.91×10^{-4} F 3.63×10^{-4}
G 4.39×10^{-4} H 5.42×10^{-4}

Prüfungsaufgaben zur Nachbereitung

A capacitor is completely charged with 650 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

7. A 1.49×10^{-9} B 1.86×10^{-9} C 2.32
 D 2.90×10^{-9} E 3.63×10^{-9} F 4.53
 G 5.67×10^{-9} H 7.08×10^{-9}

1 pt Now the plates of the charged capacitor are together with the voltage source already disconnected.

8. A The charge on the plates increases.
 B The energy stored in the capacitor remains the same.
 C The capacitance increases.
 D The voltage drop between the plates increases.
 E The energy stored in the capacitor increases.

1 pt The initial air gap was 8 mm. What is the stored energy if the air gap is now 6 mm? (in J)

9. A 0.00 B 8.53×10^{-5} C 1.14×10^{-4}
 D 1.30×10^{-4} E 1.52×10^{-4} F 3.41×10^{-4}
 G 3.44×10^{-4} H 4.87×10^{-4}

A capacitor is completely charged with 670 nC by a voltage source that had 350 V.

Problem 6

Due on Tuesday, Feb 22 at 10:00 am

A capacitor is completely charged with 640 nC by a voltage source that has 375 V.

What is its capacitance?

Tries 0/3

Now the plates of the charged capacitor are pulled apart with the voltage source still connected.

- The capacitance increases.
 The voltage drop between the plates increases.
 The energy stored in the capacitor increases.
 The energy stored in the capacitor remains the same.
 None of the above.

Tries 0/2

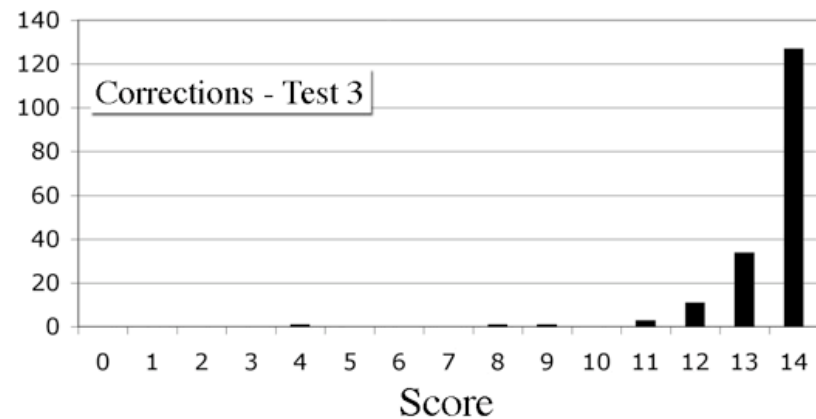
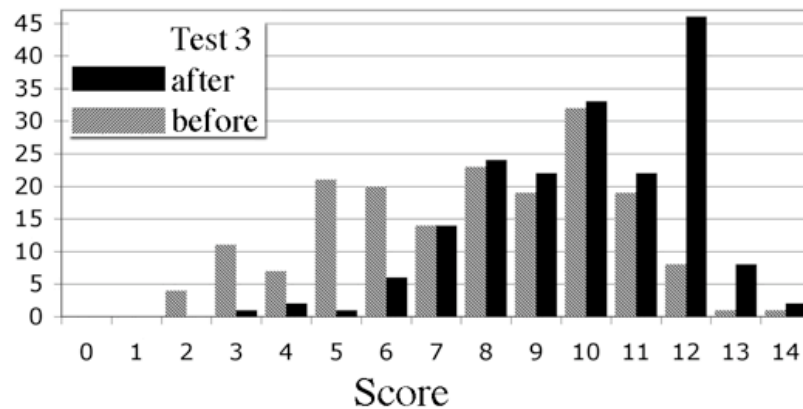
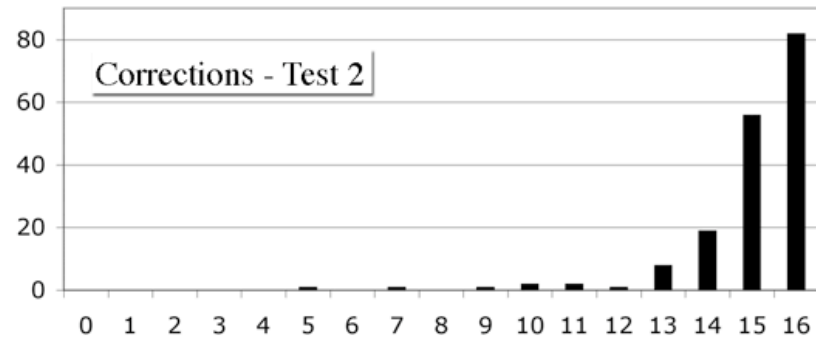
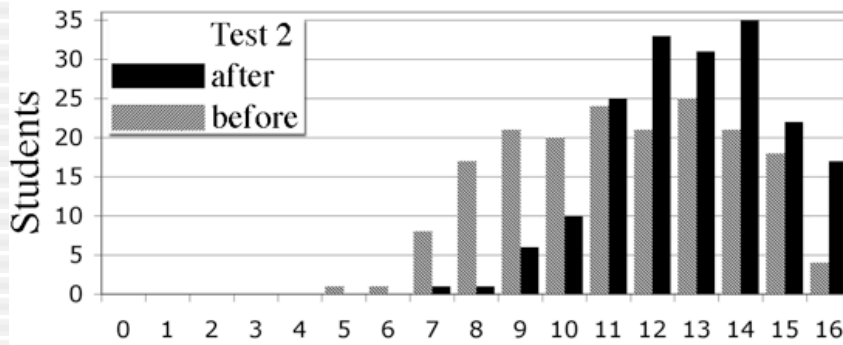
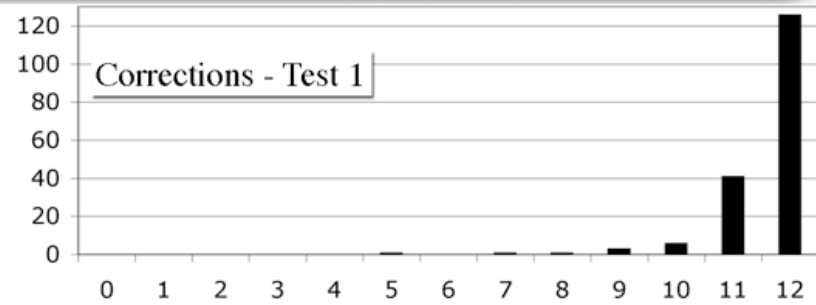
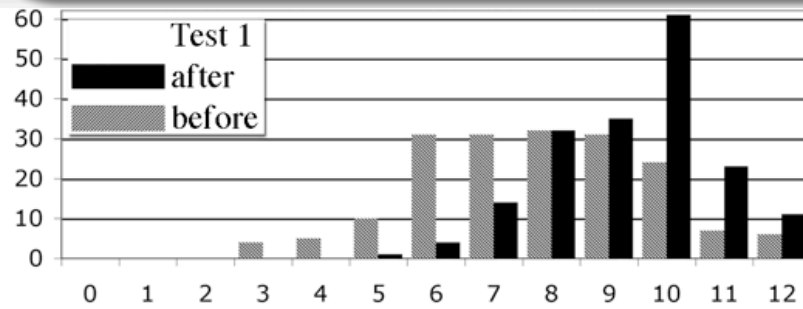
The initial air gap was 5 mm. What is the stored energy if the air gap is now 10 mm?

Tries 0/3

9. A 0.00 B 6.40×10^{-4} C 1.17×10^{-4}
 D 2.15×10^{-4} E 2.91×10^{-4} F 3.63×10^{-4}
 G 4.39×10^{-4} H 5.42×10^{-4}

In den letzten zwei Jahren eingeführt

Prüfungsaufgaben zur Nachbereitung



Feedback

- Feedback an den Studierenden
 - “mache ich ausreichend Fortschritte?”
 - “was wird erwartet?”
- Feedback an den Lehrenden
 - “wie kommen meine Studierenden voran?”
 - “worauf muss ich in der Vorlesung näher eingehen und worauf nicht?”
 - Just-In-Time Teaching
(Probleme fällig *vor* der Vorlesung)

Feedback an den Lehrenden

Course Action Items

Gerd Kortemeyer
Course Coordinator
LBS 272 - Spring 2006

? LBS 272 - Spring 2006 -> Display Action Items

What's New?

[Go to first resource](#)

Page set to be displayed after you have selected a role in this course? Currently: *What's New? page (user preference)* **Change** for just [this course](#) or for all your courses.

[Hide all](#) [Show all](#)

Problems requiring handgrading		Hide
Problem Name	Number ungraded	
Electric Field	4	

Problems with errors		Hide
<i>No problems with errors</i>		

Problems with av. attempts ≥ 3 or deg. difficulty ≥ 0.8 and total number of students with submissions ≥ 4							Hide
							Change thresholds?
Resource	Part	Num. students	Av. Attempts	Deg. Diff	Last Reset	Reset Count?	
Field Lines	single part	24	2.12	0.84		<input type="checkbox"/>	
Net Force	single part	53	2.49	0.80		<input type="checkbox"/>	
Pith Balls	single part	52	4.12	0.90		<input type="checkbox"/>	

[Reset counters to 0](#)

Resources in course with version changes since last week				Hide
				Change interval?
Resource	Last revised	New version	Version used	
Applet: Electron Orbit	Fri Jan 13 10:18:52 2006 (EST)	10	10	
Capacitance of a Sphere	Mon Jan 16 12:03:13 2006	8	8	

Unread course discussion posts				Hide
				Change options?
Location	Type	Time of last post	Number of new posts	
Coulomb	Resource	last Monday, Jan 16 at 04:55 pm (EST)	1	
Distance Change	Resource	last Monday, Jan 16 at 07:00 pm (EST)	1	
Field Lines	Resource	last Monday, Jan 16 at 07:49 pm (EST)	1	
Force	Resource	on Wednesday, Jan 11 at 07:01 pm (EST)	3	
Net Force	Resource	23 hours, 19 minutes ago	5	
Pith Balls	Resource	last Monday, Jan 16 at 09:21 pm (EST)	6	
Point P	Resource	last Friday, Jan 13 at 02:34 pm (EST)	5	
Potential	Resource	last Sunday, Jan 15 at 03:15 pm (EST)	1	
Two Charges	Resource	last Sunday, Jan 15 at 03:26 pm (EST)	1	
Vector	Resource	last Saturday, Jan 14 at 01:32 am (EST)	1	
Vectors	Resource	last Saturday, Jan 14 at 12:09 pm (EST)	2	

New course messages				Hide
Number	Subject	Sender	Date/Time	
1.	Feedback [msu/mmp/kap18/problems/cd460.problem]	@msu	Sat Jan 14 10:45:02 2006 (EST)	

New critical messages in course		Hide
<i>No unread critical messages in course</i>		

Feedback an den Lehrenden

Resource: Two Charges

View of the problem - [Sign out](#) [Sign in](#)

Two opposite charges are placed some distance apart in a vacuum.

What will happen if ...?

One forth the force: The distance between the charges is doubled.

Double the force: The magnitude of one of the two charges is doubled.

Four times the force: The magnitude of both charges is doubled.

Four times the force: The distance between the two charges is cut in half.

Half the force: The charges are placed in a medium with a factor two higher permittivity.

You are correct.

Your receipt is 498-1666 ?

Correct answer:

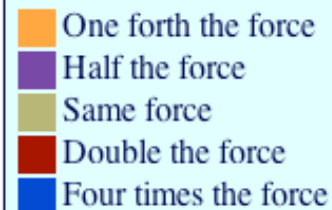
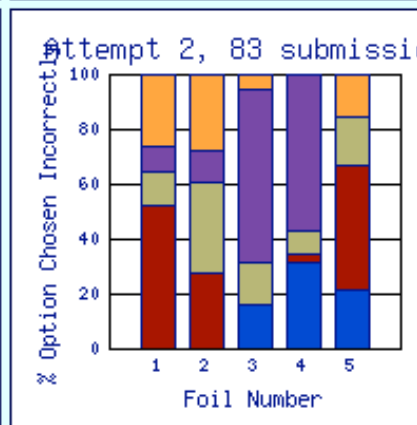
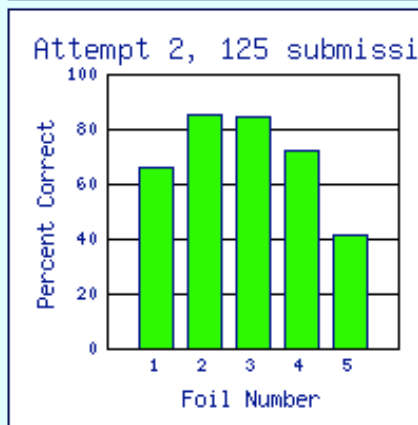
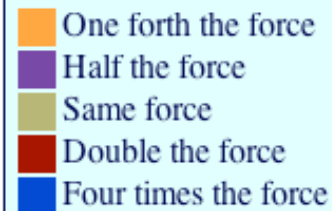
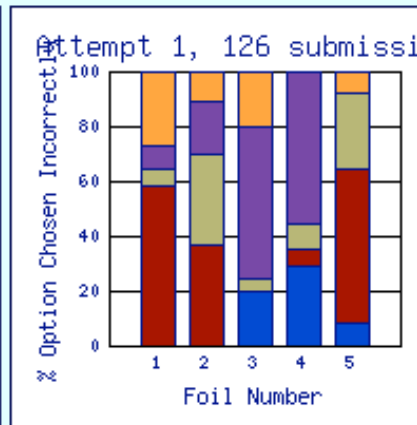
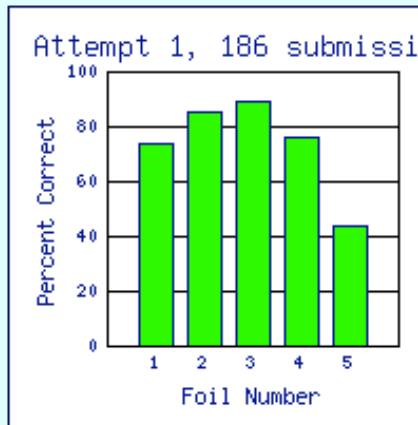
Answer for Part:0 One forth the force Double the force Four times the force Four times the force Half the force

Fullname: [Sign out](#) [Sign in](#)

Date/Time	Submission	Status												
Mon Jan 19 20:15:19 2004	Part 0 (ID 11) Trial 1 <table border="1"> <thead> <tr> <th>Answer</th> <th>One forth the force</th> <th>Double the force</th> <th>Four times the force</th> <th>Four times the force</th> <th>Double the force</th> </tr> </thead> <tbody> <tr> <td>Option ID</td> <td>1_6_1_4_2</td> <td>1_6_1_3_2</td> <td>1_6_1_2_2</td> <td>1_6_1_1_2</td> <td>1_6_1_5_2</td> </tr> </tbody> </table>	Answer	One forth the force	Double the force	Four times the force	Four times the force	Double the force	Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2	Part 0 incorrect
Answer	One forth the force	Double the force	Four times the force	Four times the force	Double the force									
Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2									
Mon Jan 19 20:15:29 2004	Part 0 (ID 11) Trial 2 <table border="1"> <thead> <tr> <th>Answer</th> <th>One forth the force</th> <th>Double the force</th> <th>Four times the force</th> <th>Four times the force</th> <th>Four times the force</th> </tr> </thead> <tbody> <tr> <td>Option ID</td> <td>1_6_1_4_2</td> <td>1_6_1_3_2</td> <td>1_6_1_2_2</td> <td>1_6_1_1_2</td> <td>1_6_1_5_2</td> </tr> </tbody> </table>	Answer	One forth the force	Double the force	Four times the force	Four times the force	Four times the force	Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2	Part 0 incorrect
Answer	One forth the force	Double the force	Four times the force	Four times the force	Four times the force									
Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2									

Feedback an den Lehrenden

Foil Number	Foil Name	Foil Text	Correct Value
1	1_6_1_1_2	The distance between the two charges is cut in half.	Four times the force
2	1_6_1_2_2	The magnitude of both charges is doubled.	Four times the force
3	1_6_1_3_2	The magnitude of one of the two charges is doubled.	Double the force
4	1_6_1_4_2	The distance between the charges is doubled.	One forth the force
5	1_6_1_5_2	The charges are placed in a medium with a factor two higher permittivity.	Half the force



Feedback an den Lehrenden

Course Action Items

Gerd Kortemeyer
Course Coordinator
LBS 272 - Spring 2006

? LBS 272 - Spring 2006 -> Display Action Items

[What's New?](#)

[Go to first resource](#)

Page set to be displayed after you have selected a role in this course? Currently: *What's New?* page (user preference) **Change** for just [this course](#) or for all your courses.

[Hide all](#) [Show all](#)

Problems requiring handgrading		Hide
Problem Name	Number ungraded	
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Problems with errors		Hide
<i>No problems with errors</i>		

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[Reset counters to 0](#)

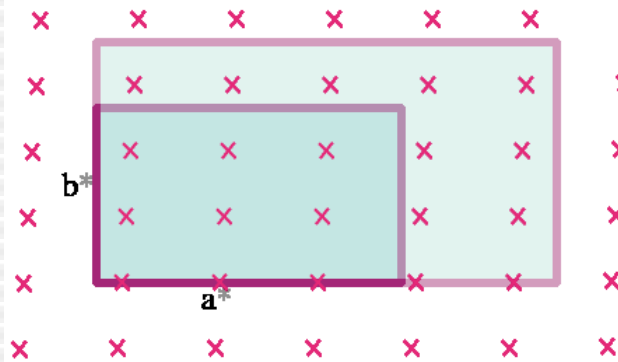
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Number	Subject	Sender	Date/Time	
1.	Feedback [msu/mmp/kap18/problems/cd460_problem]	@msu	Sat Jan 14 10:45:02 2006 (EST)	

New critical messages in course		Hide
<i>No unread critical messages in course</i>		

Feedback an den Lehrenden



You are looking down on a single coil in a constant magnetic field $B = 0.8 \text{ T}$ which points directly into of the screen. The dimensions the coil go from $a = 13 \text{ cm}$ and $b = 15 \text{ cm}$, to $a^* = 23 \text{ cm}$ and $b^* = 22 \text{ cm}$ in $t = 0.038 \text{ seconds}$. If the coil has resistance that remains constant at 1.7 ohms . What would be the magnitude of the induced current in amperes?

$I = 0.39 \text{ Amperes}$

Computer's answer now shown above. Tries 0/12

[Threaded View](#) [Chronological View](#) [Sorting/Filtering options](#) [Export?](#)

[anonymous] [Hide Delete Submissions](#) (Sat Feb 19 16:21:53 2005)

I tried using Faraday's Law for a changing area and then using Ohm's Law to find the current, but without success. Does anyone know how to do this one?

Re: [anonymous] [Hide Delete Submissions](#) (Sun Feb 20 17:15:48 2005)

for your first equation use:

$$V = NB \cos(\theta) \frac{dA}{dt}$$

dA/dt is just your change in area (make sure that you convert to meters correctly) over the time that is given to you.

Solve for V and then plug V into the equation for Ohm's law:

$$I = V/R$$

Re: Re: [anonymous] [Hide Delete Submissions](#) (Sun Feb 20 19:25:04 2005)

what is N ?

Quick question [anonymous] [Hide Delete Submissions](#) (Sun Feb 20 20:46:39 2005)

Mehr dazu in Teil 4

Teil 4

- Teil 4: Diskussionsanalyse als ein spezielles Forschungsgebiet

Forschungsumgebung

- Alle Studierenden haben eine andere Aufgabe, sodass sie nicht einfach die Lösung austauschen können
- Alle Diskussionen sind automatisch im Kontext einer bestimmten Aufgabe
- Studierende dokumentieren ihre eigenen Diskussionen - vergleiche mit Aufwand, mündliche Diskussionen zu dokumentieren
- Die Diskussionen sind authentisch: die Studierenden versuchen, die Aufgaben so schnell und effizient wie möglich zu lösen

Beispiel

- Einführender Physikkurs für Mediziner
(nicht Physiker!)
- CAPA vorlesungsbegleitend
- Jedoch alle Materialien online
- 200 Studierende

Aufgabe

- Eine Version der Aufgabe:
- A bug that has a mass $m_b=4\text{g}$ walks from the center to the edge of a disk that is freely turning at 32rpm. The disk has a mass of $m_d=11\text{g}$. If the radius of the disk is $R=29\text{cm}$, what is the new rate of spinning in rpm?



“Experten“-Lösung

- Kein externes Drehmoment, also Drehimpuls erhalten
- Fliege klein im Vergleich zur Scheibe, kann als Punktmasse angenähert werden

$$\left(\frac{1}{2}m_d R^2 + m_b 0^2\right)\omega_0 = \left(\frac{1}{2}m_d R^2 + m_b R^2\right)\omega$$

$$\Rightarrow \omega = \frac{m_d}{m_d + 2m_b}\omega_0$$

Studierendendiskussion

- [...]
- *Student C:* What is T exactly? And do I have to do anything to it to get the final RPM?
- *Student B:* ok so T is the period... and apparently it works for some and not others.... try to cancel out some of the things that are found on both sides of the equation to get a better equation that has less numbers in it
- *Student D: what did I do wrong?*

This is what I did. initial inertia x initial angular velocity = final inertia x final angular velocity. $I = mr^2$, angular velocity = ω ... so my I initial was $(10g)(24 \text{ cm}^2)$ and $\omega = 28 \text{ rpm}$. The number calculated was $161280 \text{ g} \cdot \text{cm}^2$. Then I divided by final inertia to solve for the final angular speed. I found final Inertia by $(10g + 2g)(24 \text{ cm}^2) = 6912$. I then found the new angular speed to be 23.3 rpm . This was wrong...what did I do incorrectly?

Studierendendiskussion

[...]

- *Student H: :sigh: Wow. So, many, little things, can go wrong in calculating this.* Be careful.

[...]

- Keiner der Studierenden bemerkte:
 - Fliege als Punktmasse
 - Ergebnis unabhängig vom Radius
 - Keine Umwandlung von physikalischen Einheiten nötig
 - Viel Verwirrung um den “Radius der Fliege”
 - Niemand hat eine symbolische Antwort beigetragen (stattdessen, viele setzen sofort Nummern ein)
- Viel Einblick in das Verständnis der Studierenden
- Viel unnötige Arbeit und “Schmerz”

Abwägen

- Die meisten Studierenden bekommen am Ende die richtige Lösung
- Gefahr: Falsches Gefühl der Sicherheit für Studierende und Lehrende
- Jedoch: Begrenztes Personal und Zeit zur Korrektur
- Abwägen:
 - Häufige Übungen mit unmittelbarem Feedback
 - Seltene Übungen mit sorgfältiger Kritik des Lösungsweges

Quantitative Forschung

- Klassifikation von Studierendenbeiträgen:
- Types:
 - Emotional
 - Surface
 - Procedural
 - Conceptual
- Features:
 - Unrelated
 - Solution-Oriented
 - Mathematical
 - Physics

Quantitative Forschung

Diskussionen aus drei Physikkursen:

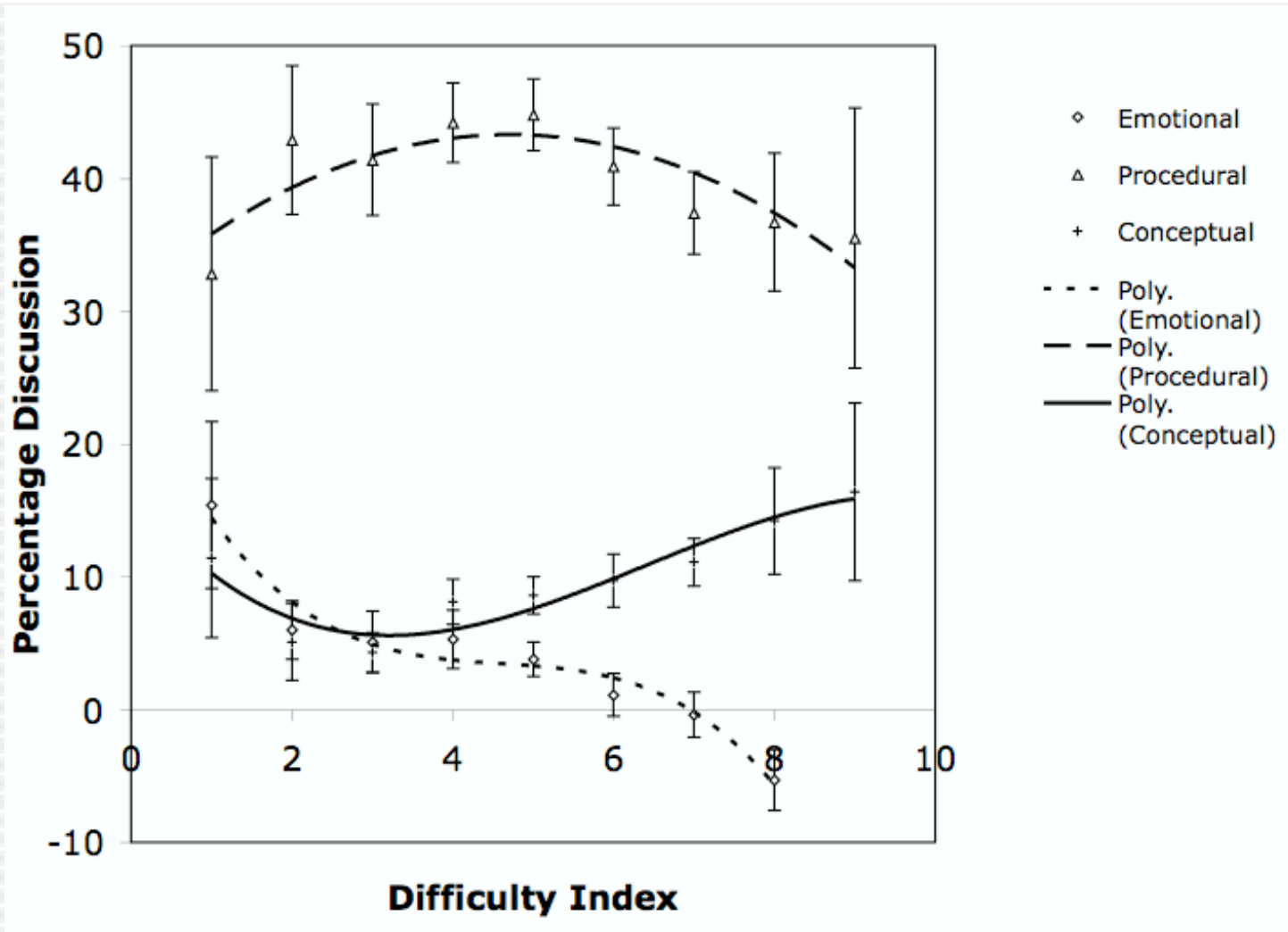
	Emotional		Surface		Procedural		Conceptual		
	Pos	Neg	Q	A	Q	A	Q	A	
Unrelated	71	54	10	1			1		137
Solution	279	185	601	341	353	456	12	3	2230
Math	1	6	49	36	73	87	3	6	261
Physics		14	85	81	170	190	100	126	766
	351	259	745	459	596	733	116	135	3394

Einfluss von Aufgabentypen

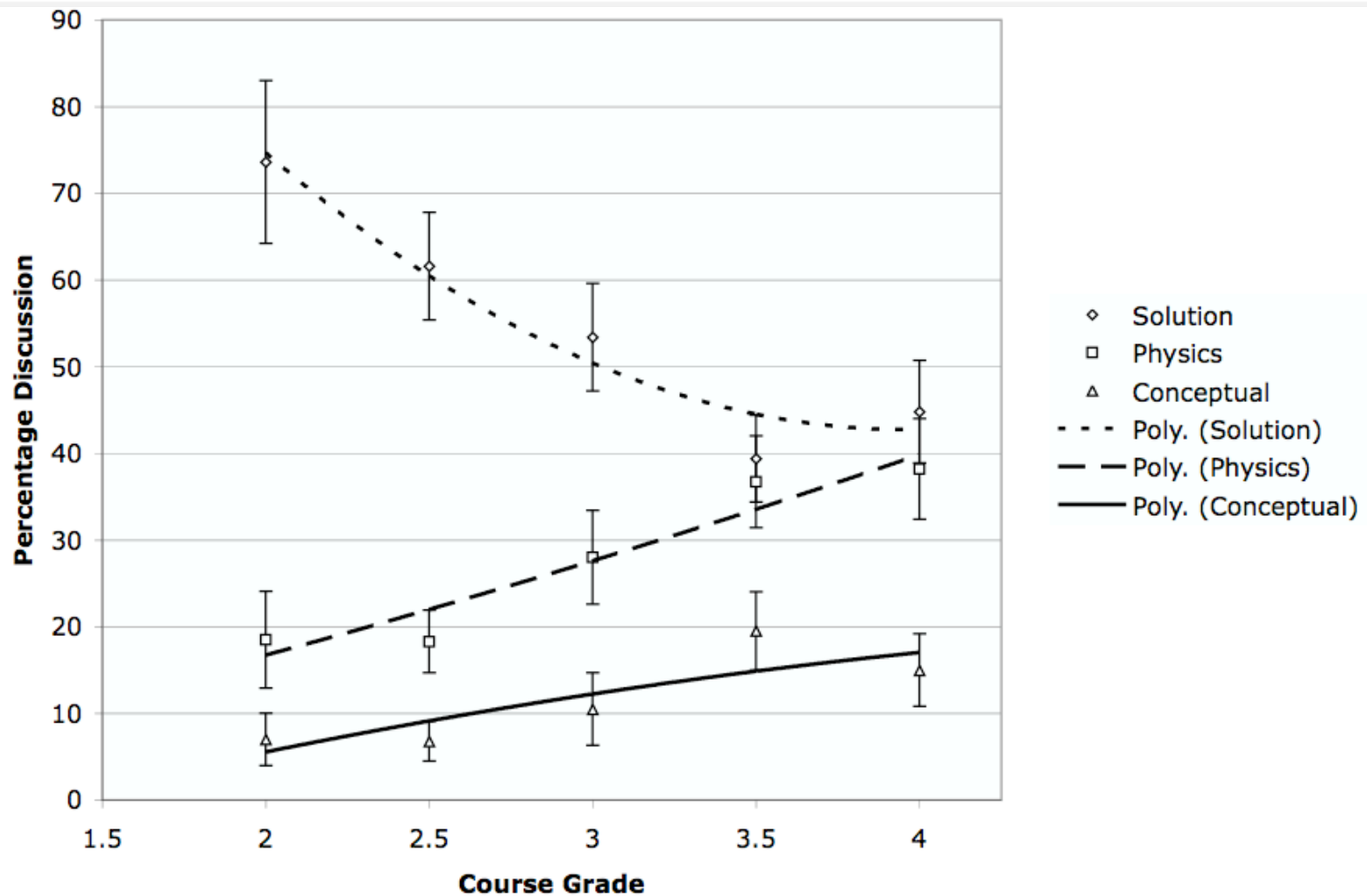
- Klassifikation der Aufgaben nach Typen
- Mehrfachauswahlen (incl. Mehrfachantworten)
 - höchste Rate von solution-oriented Diskussionsbeiträgen (“that one is right”)
 - geringste Rate von physics-related Beiträgen.
- Rankordnungs- and Click-auf-Bild-Aufgaben
 - Höchste Rate von physics-related Beiträgen
- Aufgaben mit Repräsentationswechsel (Interpretation von Graphen, etc)
 - etwas weniger procedural Beiträge
 - mehr negative emotionale Kommentare (Beschwerden, Nörgeln)

Einfluss der Problemschwierigkeit

- Schwieriger als 0,6: “more pain, no gain”

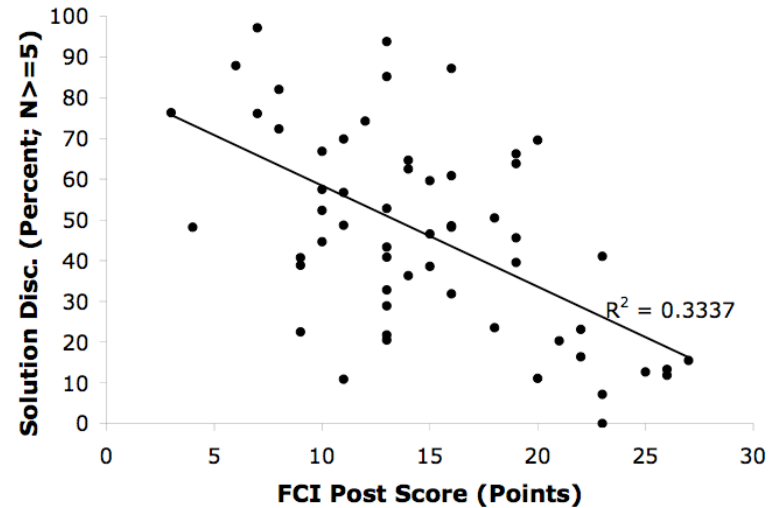
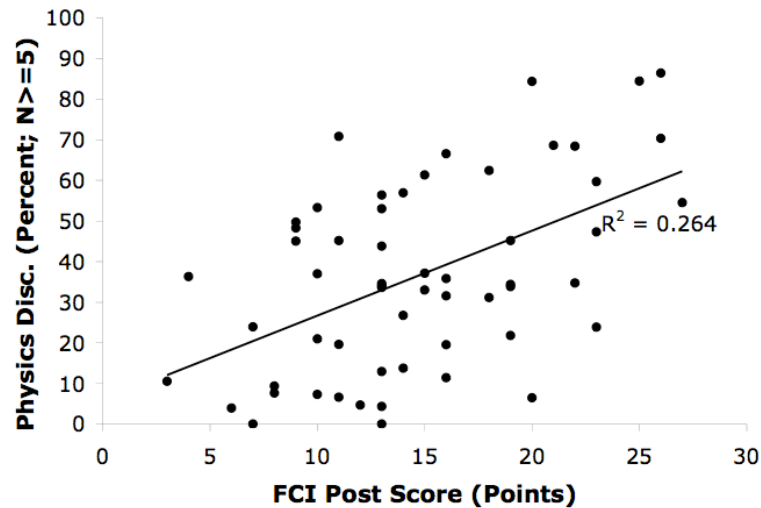


Diskutieren bessere Studierende besser?



Korrelationen

- Force Concept Inventory (FCI)
- Pre- und Post-Test



Regression

- $\text{PostFCI} = 5,486 + 0,922 \cdot \text{PreFCI} + 0,24 \cdot \text{ProzentPhysics}$
- $\text{PostFCI} = 7,606 + 0,857 \cdot \text{PreFCI} - 0.042 \cdot \text{ProzentSolution}$
- Wie zu verstehen?
- Wenn jemand 100% solution-oriented Diskussionen macht, hat er - nachdem Pre-Punkte schon eingerechnet sind - im Durchschnitt 4.2 Punkte weniger Post-Punkte

Teil 5

- Teil 5: Ausblick

Qualitative Forschung

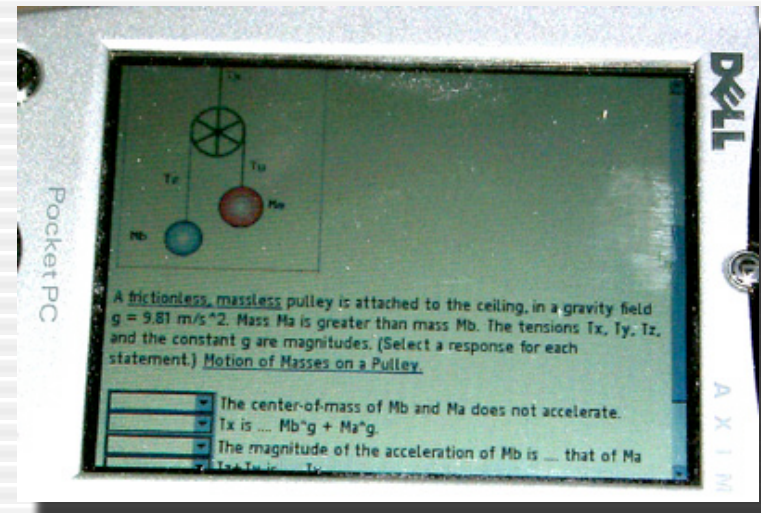
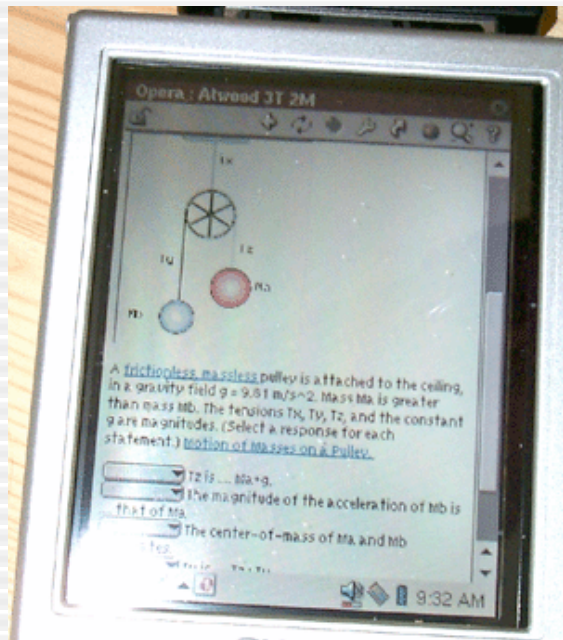
- Diskussionen:
 - Analysiere das Verständnis von Studierenden bezüglich bestimmter Konzepte (z.B. Drehimpulserhaltung)
 - Charakterisierung und Analyse von Problemlösungsstrategien
 - Evaluation von Materialien und Curricula

Übungen im Hörsaal

- Think-Pair-Share
- Peer-Teaching, sehr verbreitet in den US:
 - Studierende bekommen Aufgabe während Vorlesung
 - Stimmen über Lösungen ab („Clickers“)
 - Wenn Ergebnis schlecht ausfällt, lässt der Lehrende die Studierenden miteinander diskutieren
 - Stimmen erneut ab
- Unmittelbar: Verbesserte Abstimmungsergebnisse
- Auf lange Sicht: Erfolge auf Concept Inventories, etc.

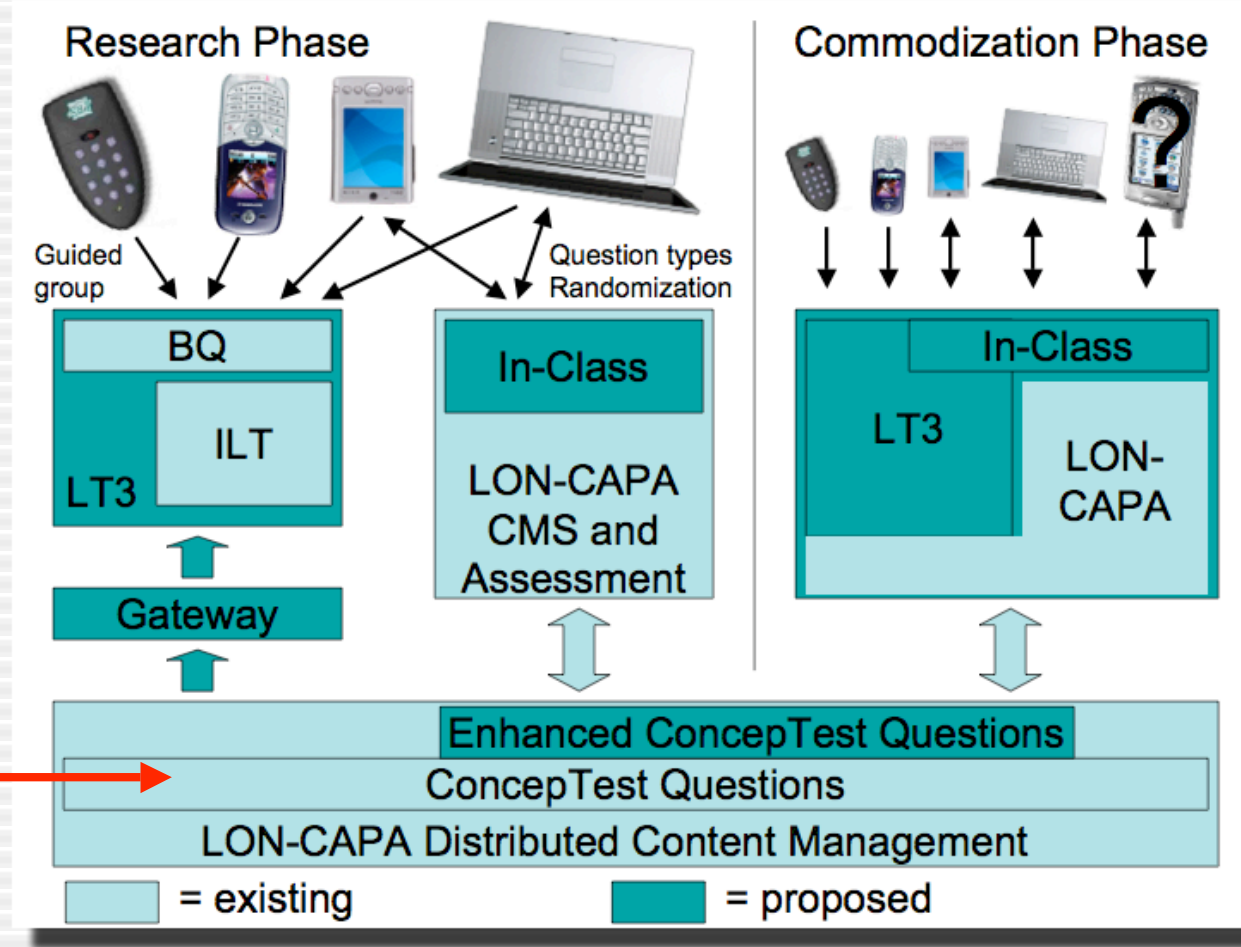
Übungen im Hörsaal

- Hörsaalnutzung von LON-CAPA
- “Next generation clickers”



Übungen im Hörsaal

- Zusammenarbeit mit Mazur Gruppe an Harvard und Bill Junkin an Erskine College



Übungen im Hörsaal

- Sind die Verbesserungen der Abstimmungsergebnisse nur dadurch bedingt, dass sich der „bessere“ Studierende durchsetzt?
- Haben die anderen Studierenden in der Gruppe die Aufgabe wirklich verstanden?
- Verschiedene Aufgabenversionen: authentischer
- Analyse der Diskussionen: bisher nicht geschehen!

The End

Vielen Dank!

<http://www.lon-capa.org/>