

Selbststudium braucht Selbstregulation! Fördermöglichkeiten in der Hochschullehre

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Überblick



Wie lernen Studierende?



Was ist selbstreguliertes Lernen?



Wie kann selbstreguliertes Lernen gefördert werden?

Überblick



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Zeitinvestment im Studium

Erwartetes Zeitinvestment im Studium:
40h/Woche (Europäische Union, 2015)

Was schätzen Sie?

Wie viel Stunden pro Woche investieren Studierende im Durchschnitt für ihr Studium (Präsenzveranstaltungen + Selbststudium)?

Zeitinvestment: Semesterverlauf

Liborius, Bellhäuser & Schmitz (2019)

Stichprobe: N=105

Geschlecht: 39 w, 66 m

Alter: M=22,3 Jahre (SD=2,8)

Semester: M= 4,4 (SD=2,7)

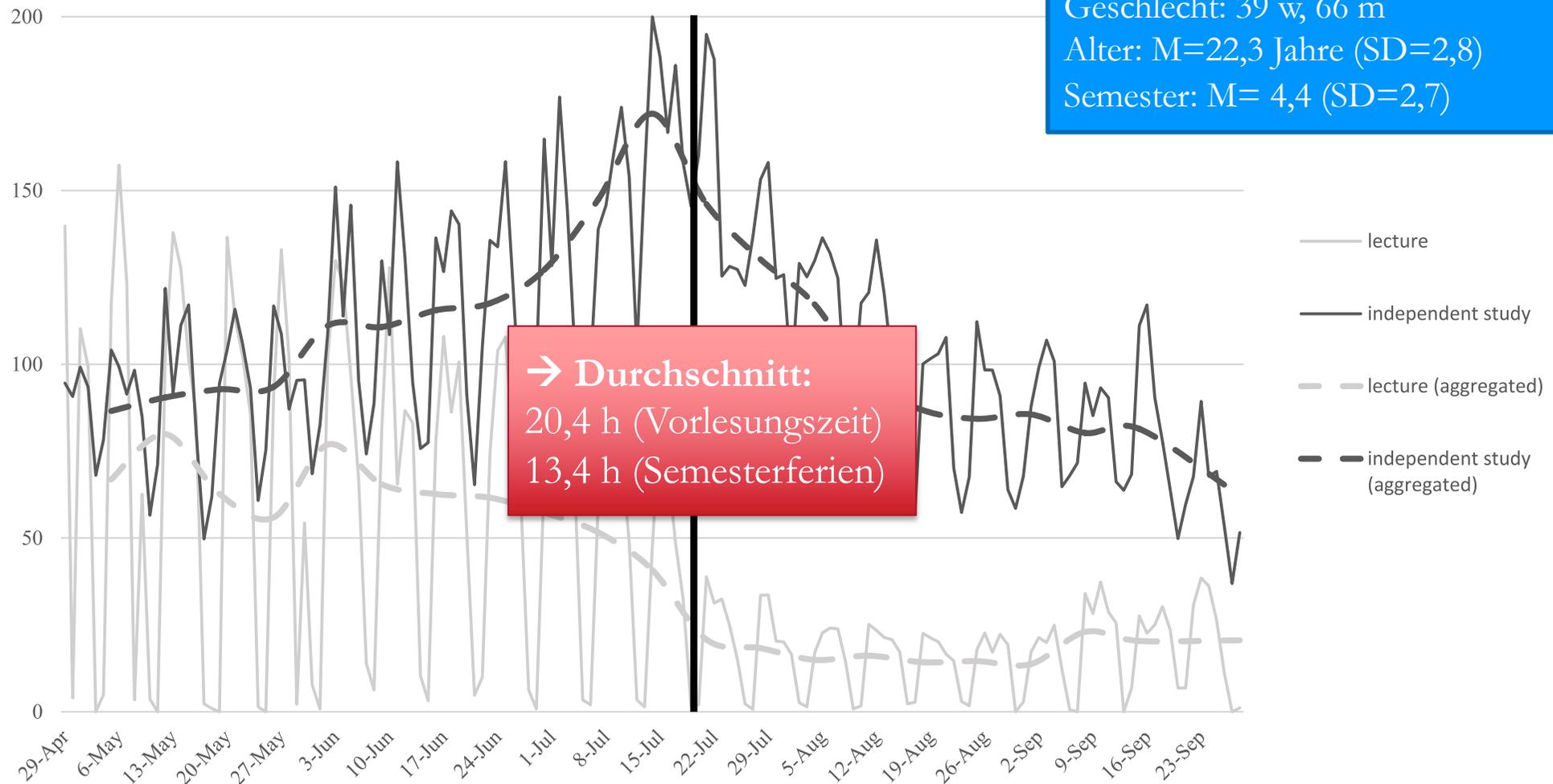


Fig. 3. Students lecture- and independent time investment (solid lines) and average lecture- and independent study time investment (dashed lines) aggregated for weeks 1 to 22 (in minutes). The plumb line indicates the begin of the exam period.

Zeitinvestment: Wochentage

Liborius, Bellhäuser & Schmitz (2019)

Stichprobe: N=105

Geschlecht: 39 w, 66 m

Alter: M=22,3 Jahre (SD=2,8)

Semester: M= 4,4 (SD=2,7)

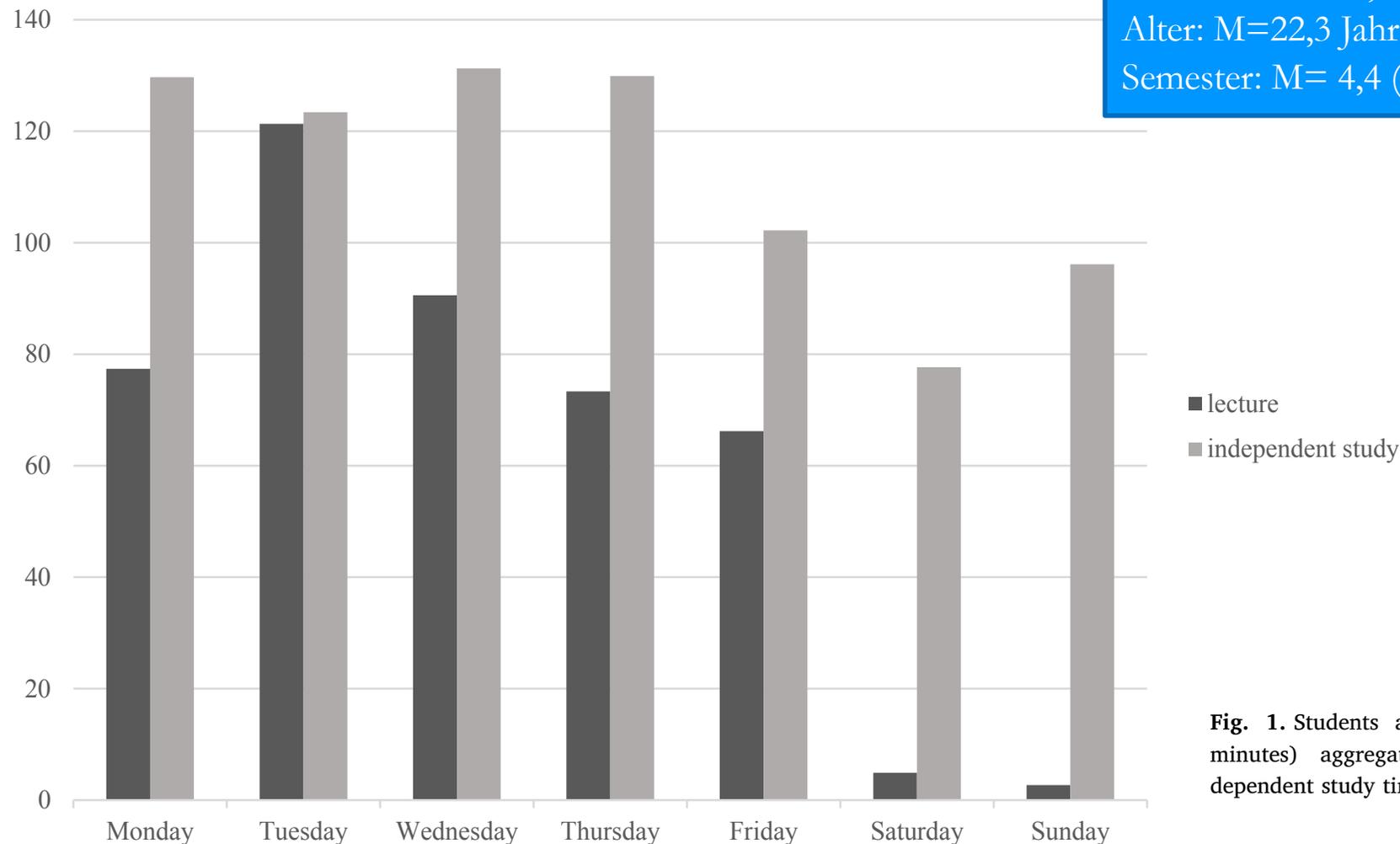


Fig. 1. Students average time investment (in minutes) aggregated over lecture- and independent study time within the lecture period.

Zeitinvestment und Studienleistung

- N=424 Studierende
- Logfiles von Lernplattform

Theobald, Bellhäuser & Imhof (2019)
Stichprobe: N=424
Geschlecht: 253 w, 171 m

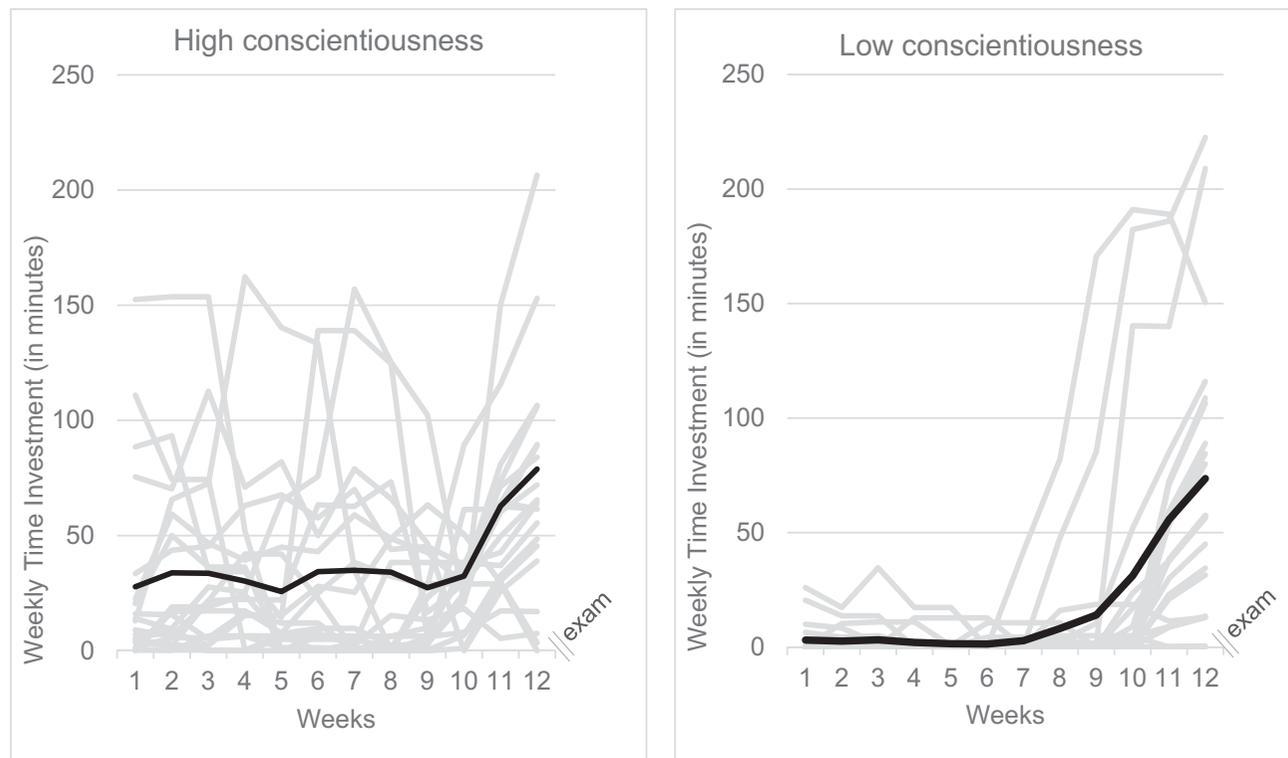


Fig. 3. Individual (grey) and average (black) weekly time investment in minutes for low ($n = 21$, 10th percentile) and high conscientious ($n = 21$, 90th percentile) students. *Note.* We computed moving averages of weekly time investment for every week t_w using the time investment in the respective preceding (t_{w-1}) and subsequent week (t_{w+1}).

Wie lernen Studierende?

Zeitinvestment

durchschnittlich 20,4h (Vorlesungszeit) bzw. 13,4h (Semesterferien)

dennoch: weitverbreitetes Gefühl der Überforderung

Besuch von Lehrveranstaltungen nimmt linear ab über die Vorlesungszeit

Selbststudium nimmt linear zu über die Vorlesungszeit

Studienleistung

Absolutes Zeitinvestment nicht unbedingt entscheidend für Leistung

Großer Einfluss von verteiltem Lernen auf Leistung

Überblick



Wie lernen Studierende?



Was ist selbstreguliertes Lernen?



Wie kann selbstreguliertes Lernen gefördert werden?



Definition: Selbstreguliertes Lernen (SRL)

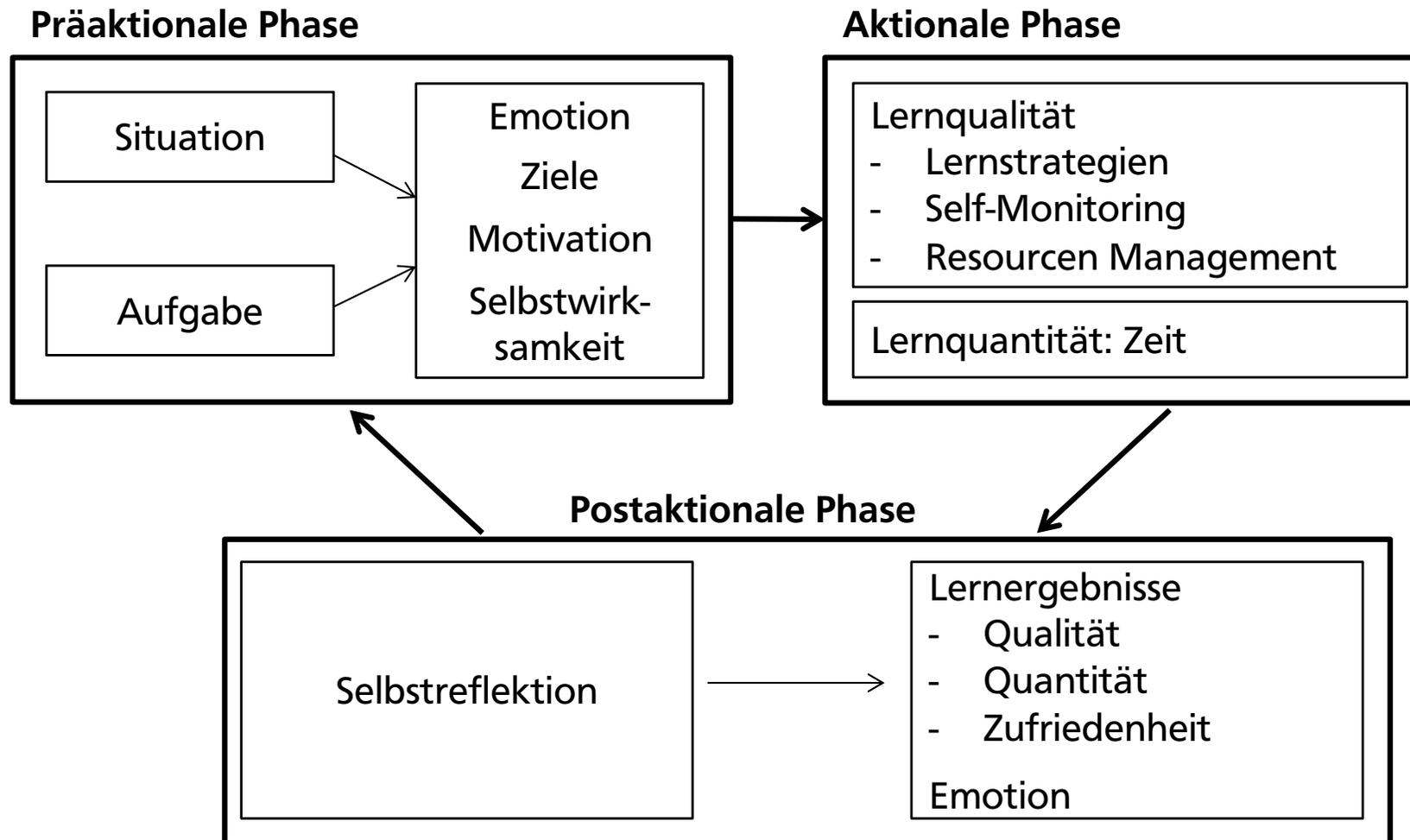


...processes whereby learners personally activate and sustain cognitions, affects, and behaviors that are systematically oriented toward the attainment of personal goals.

(Zimmerman & Schunk, 2011)

Prozessmodell des selbstregulierten Lernens

Schmitz & Wiese (2006)



Einfluss von SRL auf akademische Leistungen

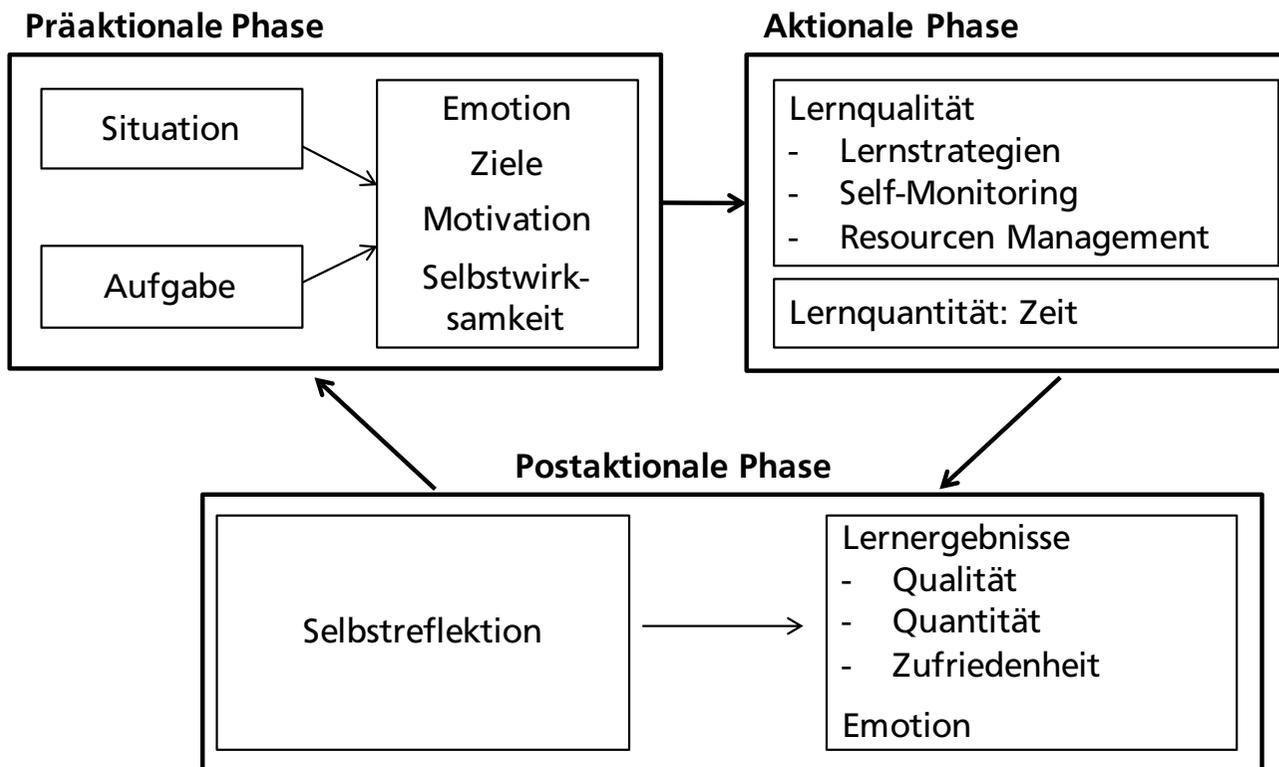
Metaanalyse

*Psychological Correlates
of University Students'
Academic Performance*

Richardson, Abraham &
Bond, 2012

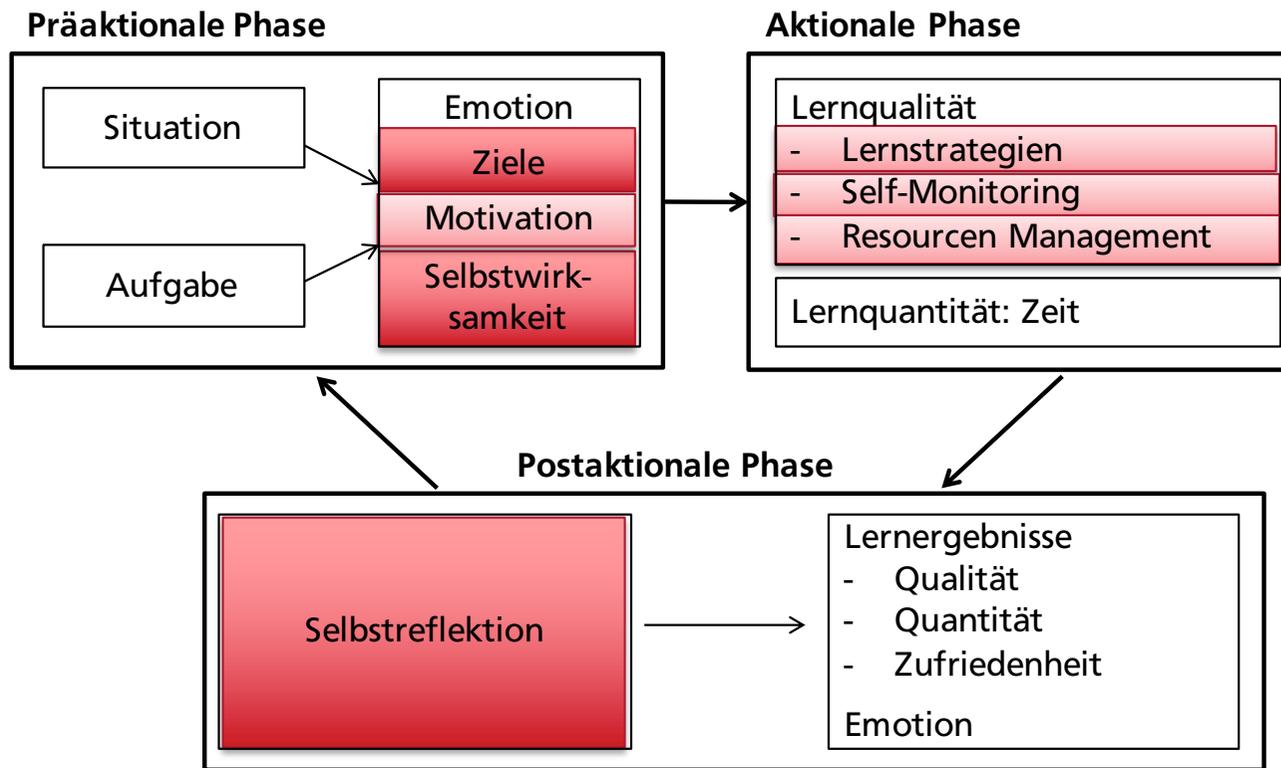
Maß	r	CI (95%)	N	k
Abschlussnote Schule	.40	[.35, .45]	34.724	46
Intelligenz	.20	[.16, .24]	7.820	35
Gewissenhaftigkeit	.19	[.17, .22]	27.875	69
Offenheit	.09	[.06, .12]	23.096	52
Neurotizismus	-.01	[-.04, .01]	23.659	58
Verträglichkeit	.07	[.04, .09]	21.734	47
Extraversion	-.04	[-.07, -.02]	23.730	58
Selbstwirksamkeitserwartung	.31	[.28, .34]	46.570	67
Intrinsische Motivation	.17	[.12, .23]	7.414	22
Zielsetzung	.35	[.28, .42]	2.670	13
Elaboration	.18	[.11, .24]	8.006	12
Metakognition	.18	[.10, .26]	6.205	9
Anstrengungsregulation	.32	[.29, .35]	8.862	19
Hilfesuchen	.15	[.08, .21]	2.057	8

Einfluss von SRL auf akademische Leistungen



Maß	r
Abschlussnote Schule	.40
Intelligenz	.20
Gewissenhaftigkeit	.19
Offenheit	.09
Neurotizismus	-.01
Verträglichkeit	.07
Extraversion	-.04
Selbstwirksamkeitserwartung	.31
Intrinsische Motivation	.17
Zielsetzung	.35
Elaboration	.18
Metakognition	.18
Anstrengungsregulation	.32
Hilfesuchen	.15

Einfluss von SRL auf akademische Leistungen



Maß	r	C
Abschlussnote Schule	.40	[
Intelligenz	.20	[
Gewissenhaftigkeit	.19	[
Offenheit	.09	[
Neurotizismus	-.01	[
Verträglichkeit	.07	[
Extraversion	-.04	[
Selbstwirksamkeitserwartung	.31	[
Intrinsische Motivation	.17	[
Zielsetzung	.35	[
Elaboration	.18	[
Metakognition	.18	[
Anstrengungsregulation	.32	[
Hilfesuchen	.15	[

Selbstreguliertes Lernen

Lernen wird als Prozess betrachtet, der auch Vor- und Nachbereitung umfasst.

Selbstregulierte Lerner sind erfolgreicher in der (Hoch-)Schule durch:

- Besseres Verständnis der Inhalte
- Effizienteres Lernverhalten
- systematisches, eigenverantwortliches und zielgerichtetes Lernen

Sie erreichen dadurch bessere Leistungen und sind zufriedener.

Selbstreguliertes Lernen ist die Voraussetzung für lebenslanges Lernen.

Überblick



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Wie kann selbstreguliertes Lernen gefördert werden?



Interventionen zur Förderung von SRL

Selbstreguliertes Lernen kann gefördert werden

(Benz, 2010; Dignath & Büttner, 2008)

- 1) Trainingsinterventionen (Schmitz & Wiese, 2006)
- 2) Web-basiertes Training (Bellhäuser et al., 2016)
- 3) Lerntagebücher (Theobald, Dignath & Bellhäuser, under review)
- 4) Learning Analytics & Prompting (Bannert & Reimann, 2011)
- 5) Einsatz digitaler Medien (Tamim et al., 2011)

1) Trainingsinterventionen

Ziele
setzen



Planen



Selbst-
motivation



Volition



Kognitive
Lern-
strategien



Reflexion



1) Trainingsinterventionen



- Eigene Zielesetzung vergegenwärtigen
 - Langfristige Ziele
 - Kurzfristige Ziele
- SMARTe Ziele
 - Spezifisch
 - Messbar
 - Anspruchsvoll
 - Realistisch
 - Terminiert

1) Trainingsinterventionen



- Überblick über Aufgaben verschaffen
- Prioritäten setzen
- Teilschritte planen
- Feste Zeiten definieren
- Verteiltes Lernen
- Pausen einplanen

1) Trainingsinterventionen



- Intrinsische vs. extrinsische Motivation
- Schlaf
- Körperliche Aktivität
- Soziale Kontakte
- Erfolgserlebnisse
- Interesse
- Einstellung

1) Trainingsinterventionen

Volition



- Störquellen vorab ausschalten
- Arbeitsmaterialien bereitlegen
- Gewohnheiten / Rituale
- Leicht anfangen
- Durchhaltewillen trainieren

1) Trainingsinterventionen

Kognitive
Lern-
strategien



- Strukturieren
- Elaborieren
- Zusammenfassen
- Wiederholen

1) Trainingsinterventionen

Reflexion



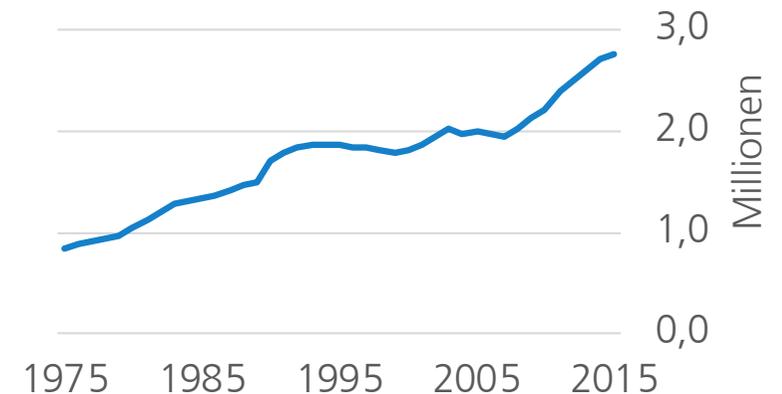
- Attribution / Ursachenzuschreibung
 - Internal vs. external
 - Stabil vs. variabel
- Bezugsnormorientierung
 - Soziale Bezugsnorm
 - Individuelle Bezugsnorm
 - Kriteriale Bezugsnorm

2) Web-basiertes Training (WBT)

Effektivität vs. Effizienz

Zunehmende Studierendenzahlen

Studierende in Deutschland
(Quelle: DESTATIS)



Hypermediale Lernumgebung im World Wide Web

Metaanalytischer Vergleich mit Classroom Instruction (CI):

(Sitzman, Kraiger, Steward & Wisher, 2006)

- WBT effektiver für deklaratives Wissen
- WBT und CI gleichermaßen effektiv für prozedurales Wissen



2) Web-basiertes Training (WBT)

Kurs: Studie zum Online-Lernverhalten

http://fb04267.mathematik.tu-darmstadt.de/lehveranstaltungen/course/view.php?id=179&sesskey=i70Xm9p2CF&switchrole=

Google TU Darmstadt Spiegel online Hilfreich Psychologie Apple Entertainment Literaturrecherche Mathe-Vorkurs Konferenzen

Sie sind angemeldet als Henrik Bellhäuser: Teilnehmer/in (Zu meiner Ausgangsrolle zurückkehren)

Home > StudieO

Themen dieses Kurses

SELBST-REGULIERTES LERNEN

Wie werden Ziele SMART formuliert?

S Das Ziel sollte **anspruchsvoll** sein, damit wir uns nicht unterfordern.

M

ANSPRUCHSVOLL

R „Ich will jeden Tag drei Kapitel im Vorkurs bearbeiten!“

T

Thema	Beginnt mit	Gruppe	Antworten	Letzter Beitrag
Schlafen ist einfach zu schön!	Domenic Stern	Studie	3	26.10.2010, 09:08
Zeitdieb Telefon	Clara B. Böck	Studie	3	26.10.2010, 08:07
Immer einen Link weiter	Thomas Böhm	Studie	2	26.10.2010, 07:07
Zeitdieb Internet	Andreas Seitz	Studie	19	26.10.2010, 07:00
Zeitdieb - Hobby am falschen Ort	Olivier Miaszewicz	Studie	0	26.10.2010, 06:07
Zeitdieb langsames Internet (384kbits/sek) in Verbindung mit dieser Studie / Zeitdieb lange Fahrzeiten	Luca Grünwald	Studie	3	26.10.2010, 07:58
Zeitdieb "der innere Schweinehund"	Henrik Bellhäuser	Studie	4	25.10.2010, 18:02

Neueste Nachrichten

27. Aug, 10:58
Henrik Bellhäuser
Teilnahmebestätigung mehr...
Ältere Beiträge ...

Bald aktuell ...

Lektion 1 - Vor dem Lernen
Donnerstag, 16. September, 06:00

Lernens
Donnerstag, 23. September, 06:00
Freitag, 24. September, 21:00

Neueste Aktivitäten

Aktivität seit Freitag, 3. September 2010, 18:43
Alle Aktivitäten der letzten Zeit
Nichts Neues seit Ihrem letzten Login

2) Web-basiertes Training (WBT)

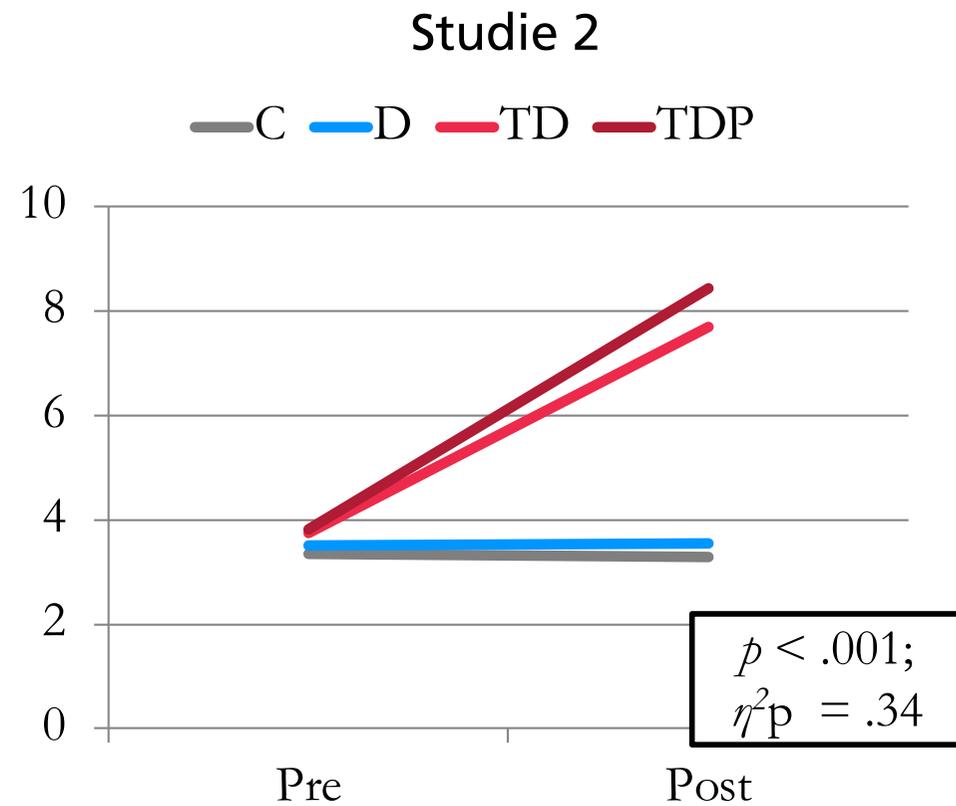
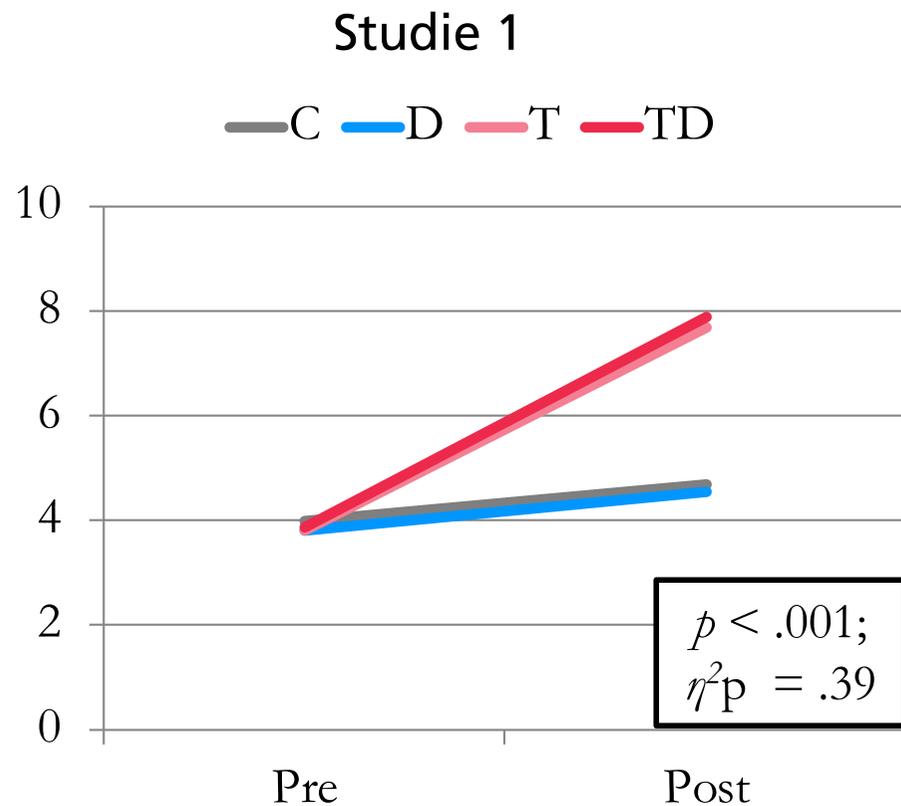
Ursprüngliches Einsatz-Szenario:
Vorkurs Mathematik (TU Darmstadt)

- Vorbereitung auf mathematikhaltiges Studium (Maschinenbau, Informatik, Bauingenieurwesen & Mathematik)
- ca. 50 Kapitel
- 4 Wochen vor Vorlesungsbeginn
- Online-Kurs (Plattform: Moodle)

The screenshot shows the VEMINT (Virtuelles Eingangstutorium Mathematik) interface. The main content area displays 'Interaktion 6.1.1-14' with a 3D diagram of a vector \vec{v} originating from the origin O of a coordinate system. Below this is 'Definition 6.1.1-15' which defines the vector \vec{PQ} between points $P(p_1; p_2; p_3)$ and $Q(q_1; q_2; q_3)$ as
$$\vec{PQ} = \begin{pmatrix} q_1 - p_1 \\ q_2 - p_2 \\ q_3 - p_3 \end{pmatrix}$$
 Below the definition is 'Beispiel 6.1.1-16' which states that the coordinates of point $Q(q_1; q_2; q_3)$ can be seen as the result of a translation. The interface includes a navigation sidebar on the left with options like 'Meine Startseite', 'Mein Profil', and 'Kurse'. The top right has navigation buttons for 'ZURÜCK' and 'WEITER'.

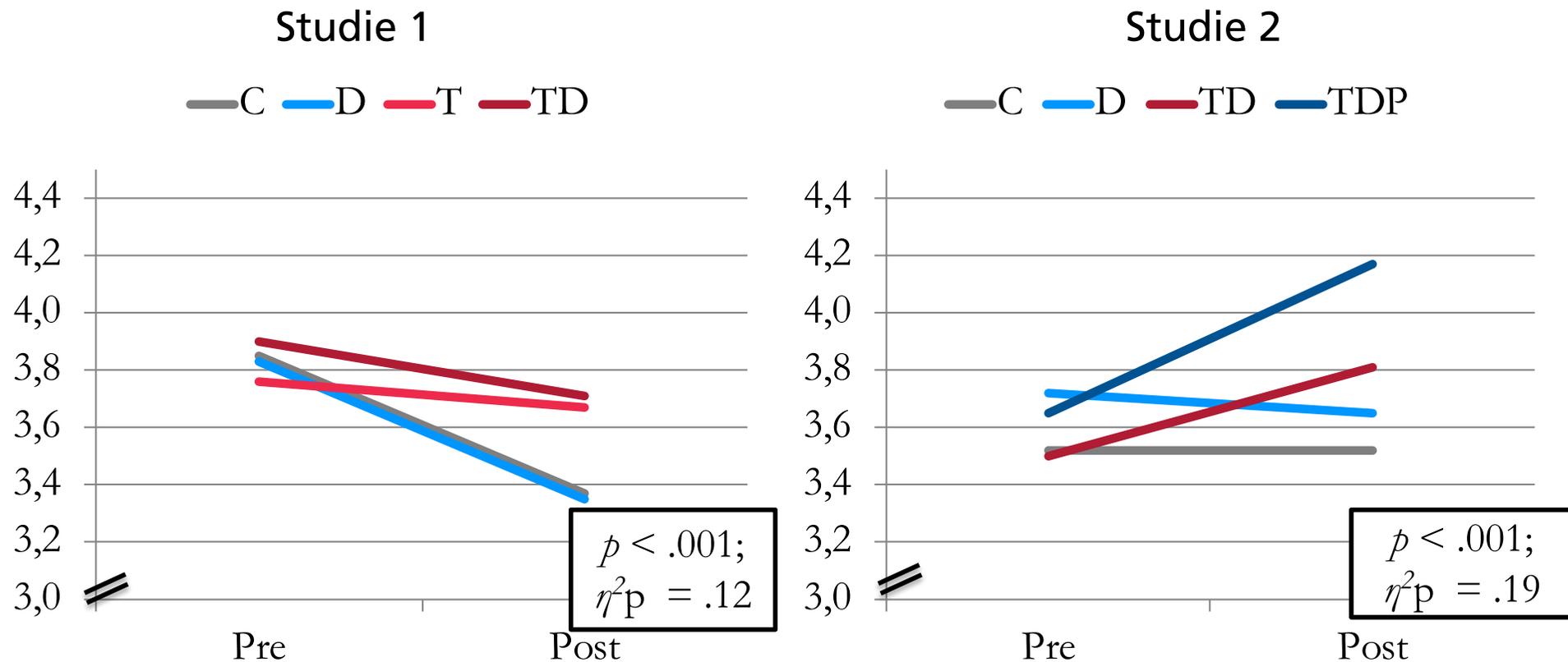
2) Web-basiertes Training (WBT)

WBT auf SRL-Wissen: Starke empirische Evidenz



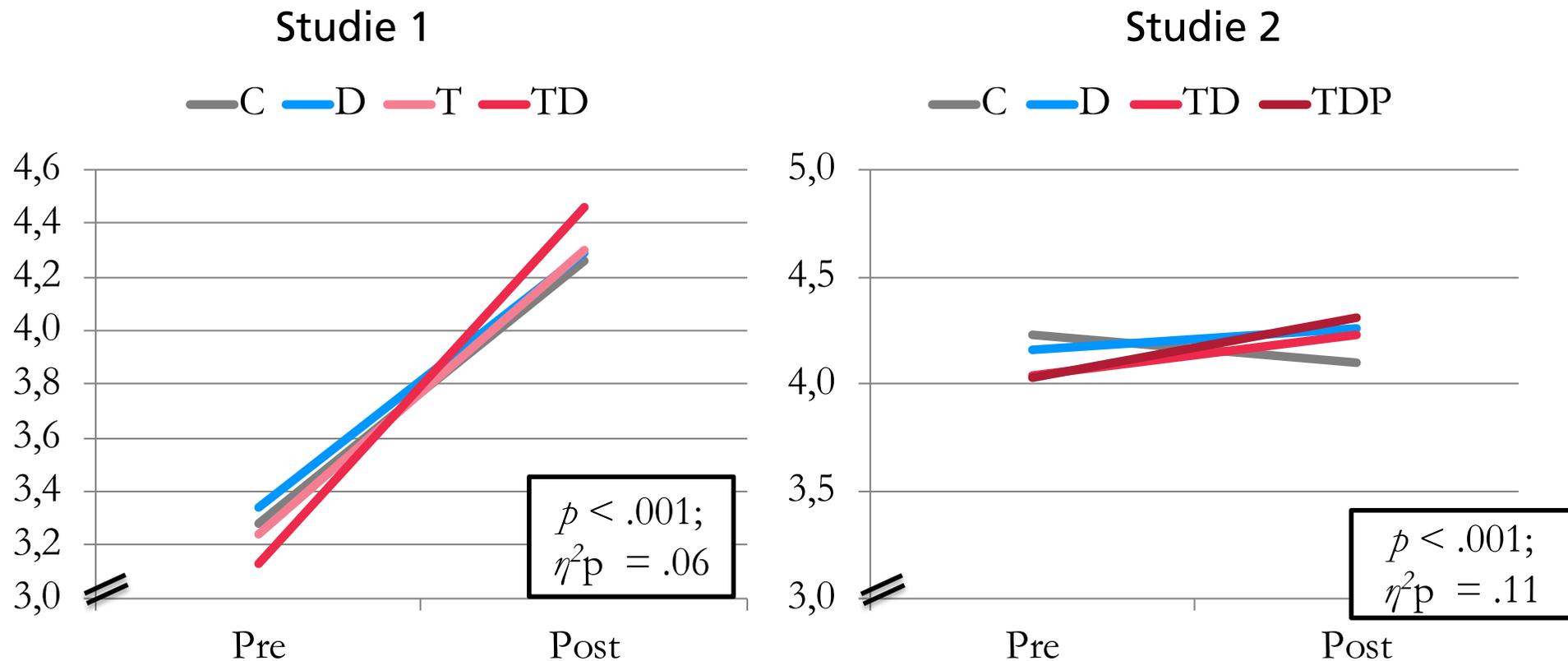
2) Web-basiertes Training (WBT)

WBT auf SRL-Verhalten: Starke empirische Evidenz



2) Web-basiertes Training (WBT)

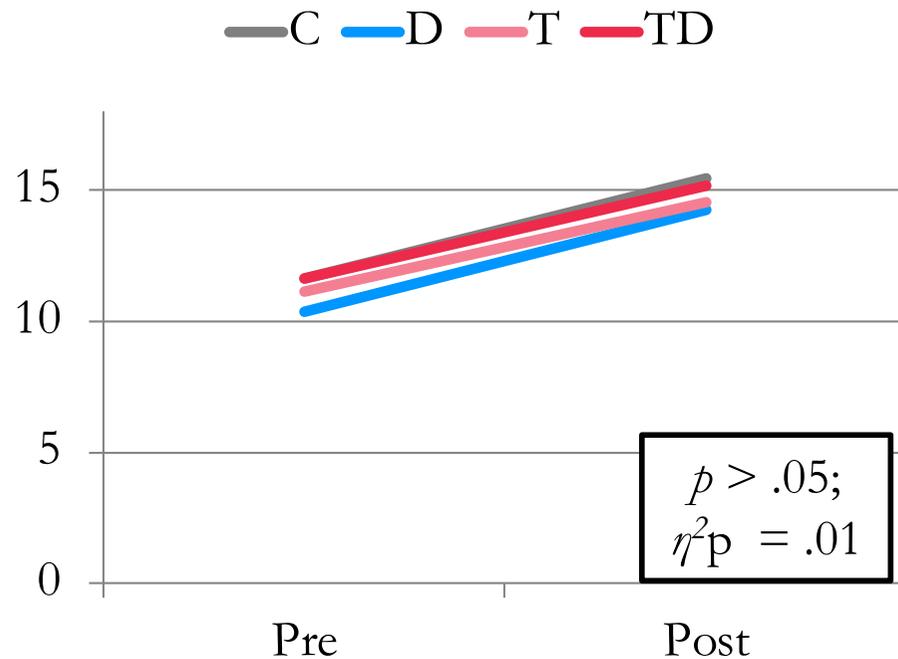
WBT auf Selbstwirksamkeit: Starke empirische Evidenz



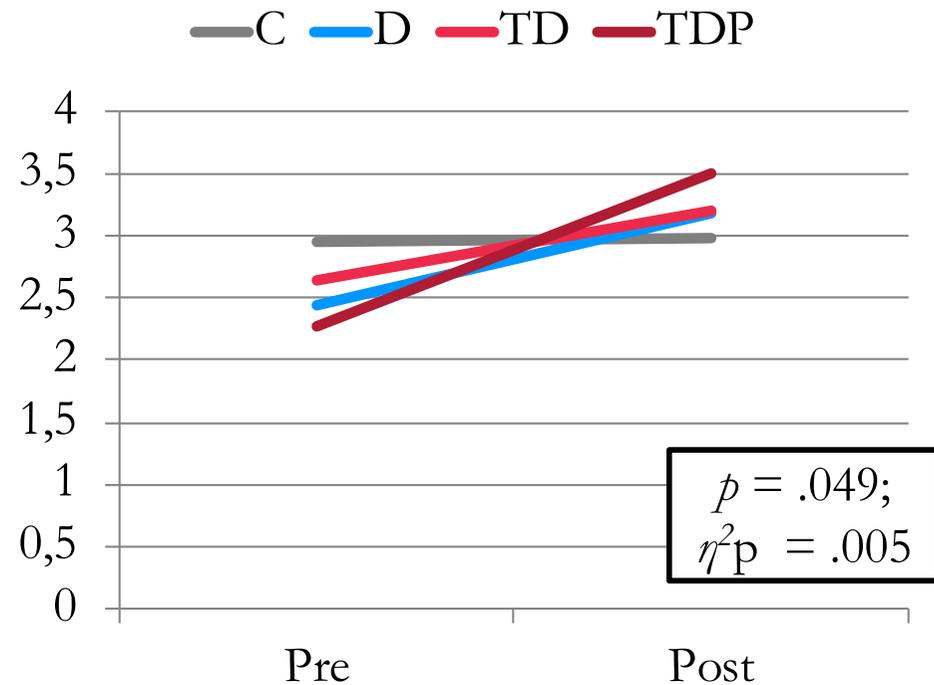
2) Web-basiertes Training (WBT)

WBT auf Leistung: bislang schwache Evidenz

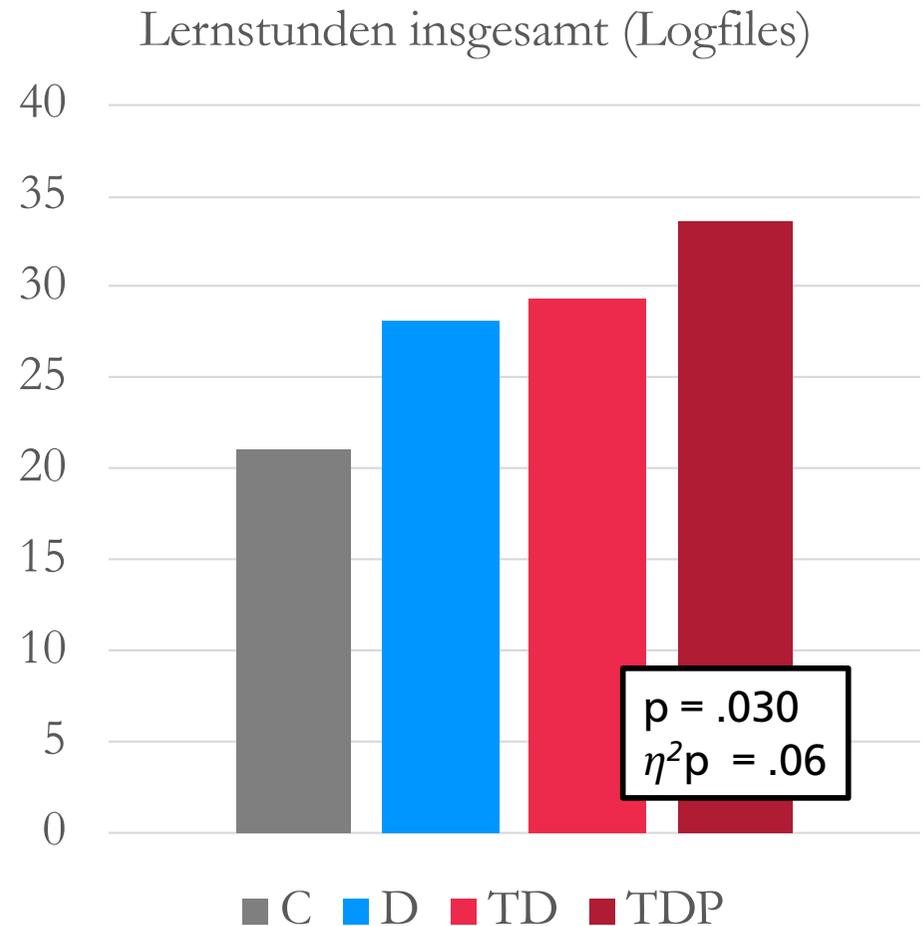
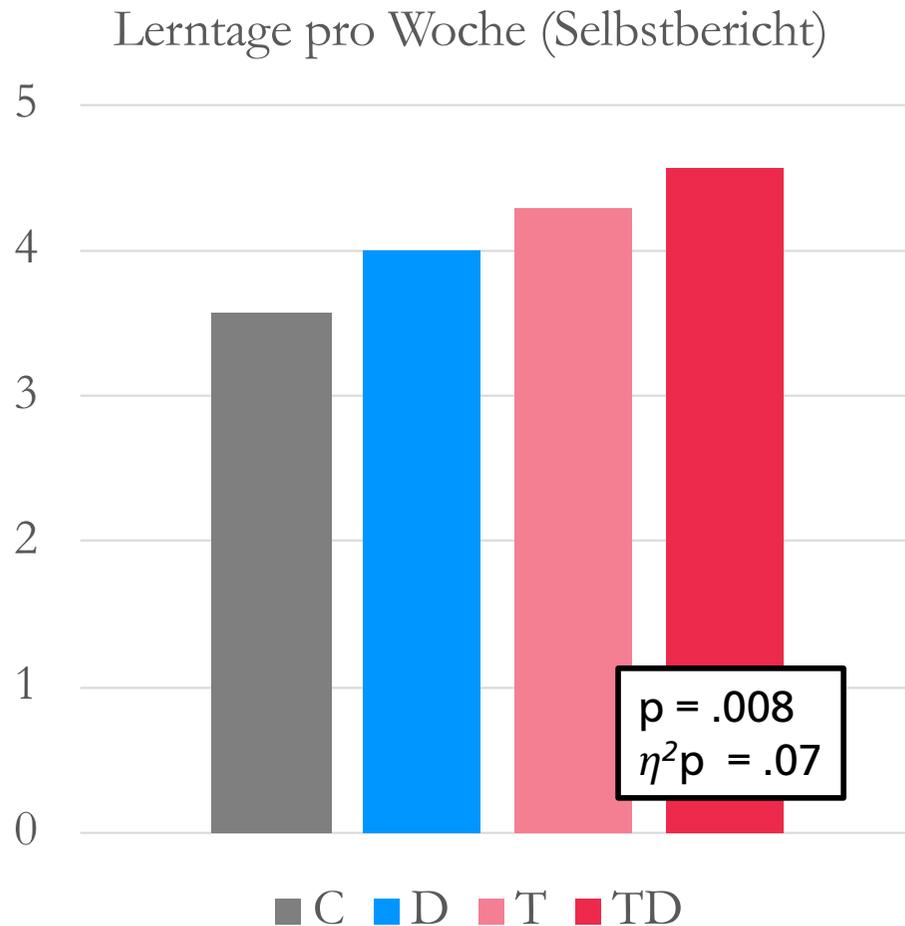
Studie 1



Studie 2



2) Web-basiertes Training (WBT)



3) Lerntagebücher

Standardisierte tägliche Kurzfragebögen

- Messmethode
- Intervention

Theobald, Dignath & Bellhäuser (under review)

N=194 Studierende

Tägliche Tagebucheinträge über 5 Wochen

Morgens: Planung; Abends: Reflexion

Experimentelles Design:

- Experimentalgruppe (tägliches Feedback)
- Kontrollgruppe (nur Tagebuch)

3) Lerntagebücher

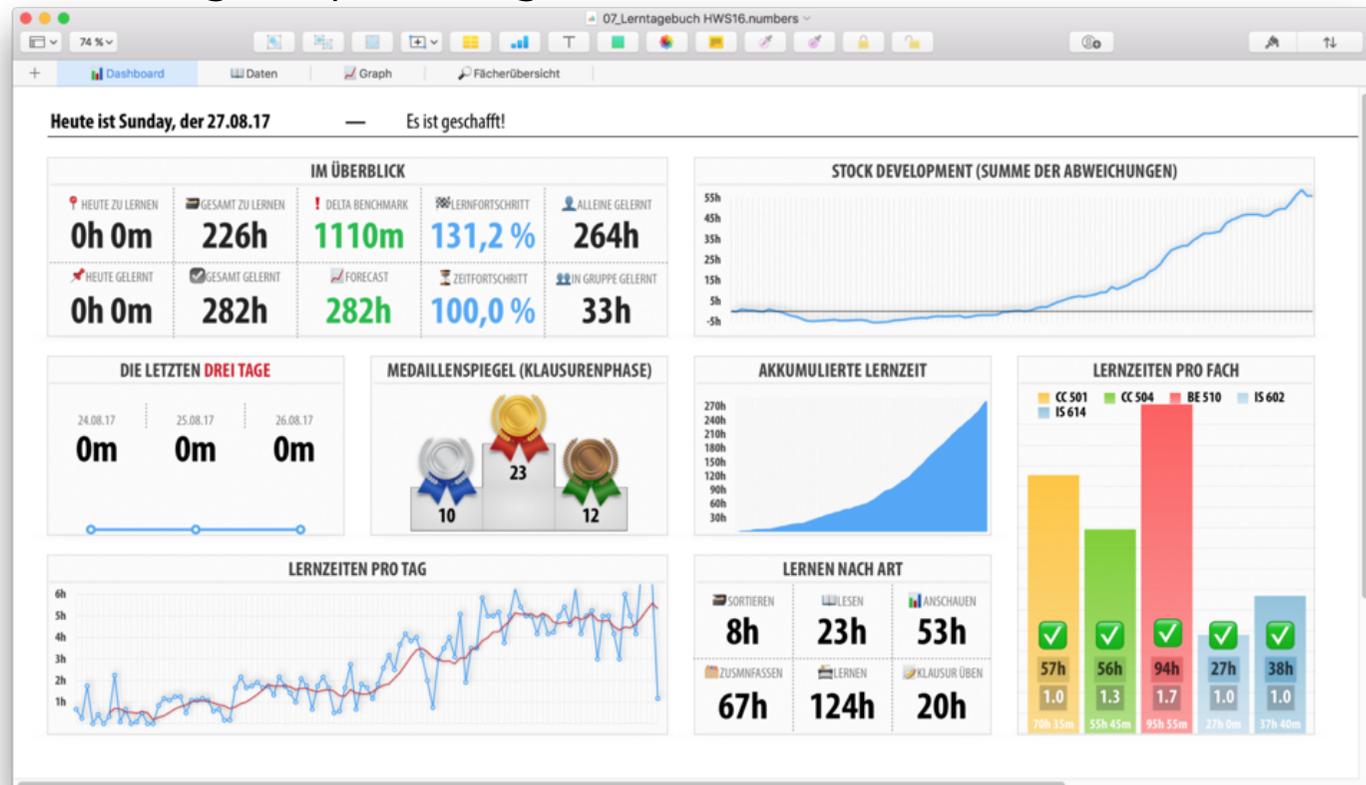
<p>Morgens</p> <p>...</p> <p>Mein heutiger Zeitplan:</p> <div data-bbox="134 879 600 1082"><p>8.30h Lernbeginn 11.30h Pause 15.30h Lernzeit Ende</p></div> <p>Zeitinvestment geplant:</p> <div data-bbox="134 1177 600 1262"><p>6 Stunden</p></div> <p>...</p>	<p>Abends</p> <p>...</p> <p>Mein heutiger Zeitplan:</p> <div data-bbox="770 879 1236 1082"><p>9.30h Lernbeginn 10.30h Pause 13.30h Lernzeit Ende</p></div> <p>Zeitinvestment real:</p> <div data-bbox="770 1177 1236 1262"><p>3 Stunden</p></div> <p>...</p>	<p>Feedback (nur EG)</p> <p>...</p> <div data-bbox="1328 879 1794 1262"><p>Sie haben sich heute nicht gut an Ihren Zeitplan gehalten. Versuchen Sie morgen realistischer zu planen.</p></div> <p>...</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

3) Lerntagebücher



4) Learning Analytics & Prompting

- Automatische Erfassung von Daten über das Lernverhalten
- Rückmeldung an Dozierende und Studierende
- Prompting: konkrete Handlungsempfehlungen



4) Learning Analytics & Prompting

The screenshot displays the MetaTutor (version 1.4.0) interface. At the top left, a 'Time Left' indicator shows 30:00. Below it is a 'Table of Contents' with a tree view including 'Introduction', 'Components', 'Heart', 'Systems of Circulation', 'Other Aspects of CS', and 'CS in Non-Humans'. The 'Systems of Circulation' section is expanded to show 'Systemic Circulation' and 'Pulmonary Circulation'. The main content area is titled 'Learning Goal and Subgoals' and contains the following text:

Learning Goal and Subgoals
Your goal is to learn all you can about the Circulatory System. Specifically, be sure to learn about all the different organs and other components of the circulatory system, and their purpose within the system, how they work both individually and together, and how they support the healthy functioning of the body.

Your current subgoals are
Path of blood flow
Malfunctions of the circulatory system

Systems of Circulation: Systemic Circulation
During systemic circulation, the heart pumps oxygenated blood from the left ventricle into the aorta; the aorta branches into smaller arteries, which eventually become capillaries that feed tissues with oxygen and nutrients. The first arteries to branch from the aorta are the coronary arteries that feed the heart itself.

Capillaries have thin walls to allow for oxygen and nutrients to diffuse, that is to move across, the plasma membranes at the surface of muscles and organs. Carbon dioxide and waste products can also diffuse or be transported into blood, where it is carried away for disposal in the lungs and other organs such as the kidneys and liver.

The capillaries turn into veins as blood returns to the heart. These eventually converge into the inferior or superior vena cava (for lower and upper body, respectively), which feed blood to the right atrium. When blood enters the right ventricle, pulmonary circulation begins.

The diagram, titled 'Pulmonary Circulation and systemic circulation', shows the heart and lungs. It labels the 'Pulmonary circuit' (right atrium, right ventricle, pulmonary arteries, pulmonary veins) and the 'Systemic circuit' (left atrium, left ventricle, aorta to systemic arteries, systemic veins). A legend indicates: red for 'Vessels transporting oxygenated blood', blue for 'Vessels transporting deoxygenated blood', and purple for 'Vessels involved in gas exchange'. The diagram also shows 'Capillaries' in the lungs and body.

On the right side of the interface, there is a 'Gavin the Guide' avatar and a sidebar with the following sections:

- I would like to:**
 - Plan my learning by...
 - Telling what I already know about this
- Monitor my learning by...**
 - Assessing how well I understand this
 - Evaluating how well I already know this content
 - Evaluating how well this content matches my current subgoal
- Apply a learning strategy:**
 - Take notes
 - Make an inference
 - Summarize
- Take Survey Now

MetaTutor

Azevedo et al. (2010)

4) Learning Analytics & Prompting

Systemic Circulation See Contents in Full View

Systems of Circulation: Systemic Circulation

During systemic circulation, the heart pumps oxygenated blood from the left ventricle into the aorta; the aorta branches into smaller arteries, which eventually become capillaries that feed tissues with oxygen and nutrients. The first arteries to branch from the aorta are the coronary arteries that feed the heart itself.

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Pulmonary Circulation and systemic circulation

■ Vessels transporting oxygenated blood
■ Vessels transporting deoxygenated blood
■ Vessels involved in gas exchange

MetaTutor

Azevedo et al. (2010)

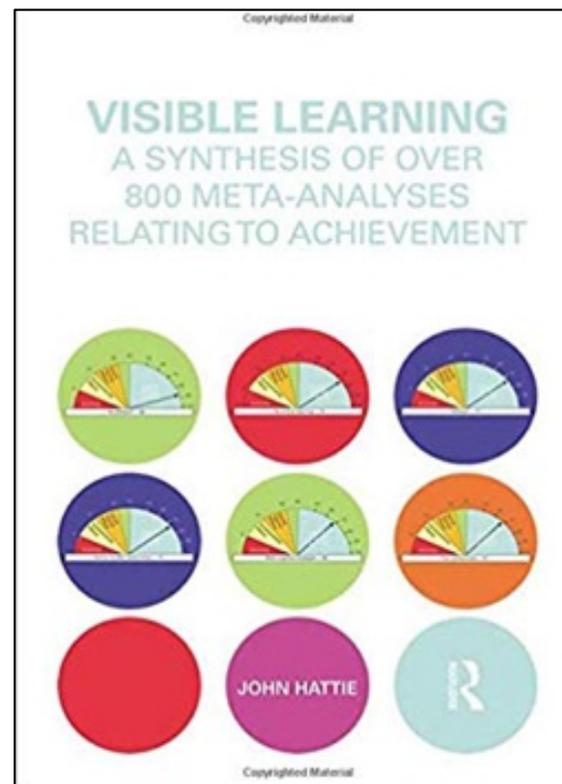
4) Learning Analytics & Prompting

The screenshot displays the MetaTutor (version 1.4.0) interface. On the left, a 'Table of Contents' lists topics like 'Introduction', 'Components', 'Heart', and 'Systems of Circulation'. The main content area is titled 'Learning Goal and Subgoals' and 'Your current subgoals are', with 'Path of blood flow' selected. Below this, the 'Systemic Circulation' section includes text explaining the process and a diagram of the heart and blood vessels. The diagram is labeled 'Pulmonary Circulation and systemic c' and includes a legend for 'Vessels transporting oxygenated blood', 'Vessels transporting deoxygenated blood', and 'Vessels involved in gas exchange'. On the right side of the interface, a virtual guide named 'Gavin the Guide' is visible. Below the guide, there are several learning prompts: 'I would like to: Plan my learning by...', 'Telling what I already know about this', 'Monitor my learning by...', 'Assessing how well I understand this', 'Evaluating how well I already know this content', 'Evaluating how well this content matches my current subgoal', and 'Apply a learning strategy: Take notes, Make an inference, Summarize'.

MetaTutor
Azevedo et al. (2010)

5) Einsatz digitaler Medien

- Ca. 4.000 empirische Studien
- Ca. 150 Meta-Analysen
- Zwei second-order Meta-Analysen (Hattie, 2009; Tamim et al., 2011)



Exkurs: Meta-Analysen

Varshney et al. *Journal of Otolaryngology - Head and Neck Surgery* 2014, 43:40
<http://www.journalotohns.com/content/43/1/40>



ORIGINAL RESEARCH ARTICLE Open Access

The McGill simulator for endoscopic sinus surgery (MSESS): a validation study

Rickul Varshney^{1,2*}, Saul Frenkel¹, Lily HP Nguyen^{1,2}, Meredith Young^{2,3}, Rolando Del Maestro⁴, Anthony Zeitouni¹, Elias Saad⁵, W Robert J Funnell^{1,5}, National Research Council Canada⁶ and Marc A Tewfik¹

Abstract
Background: Endoscopic sinus surgery (ESS) is a technically challenging procedure, associated with a significant risk of complications. Virtual reality simulation has demonstrated benefit in many disciplines as an important educational tool. The validity of virtual reality simulation as an educational tool for ESS is not clear. The purpose of this study was to evaluate the acceptability of the McGill simulator for endoscopic sinus surgery (MSESS) among medical students and residents, and to determine if it could differentiate between residents and medical students.
Methods: 10 residents and 10 medical students performed ESS on a virtual reality simulator. Performance metrics related to time, accuracy, and safety were recorded. The results were compared between the two groups.
Results: The mean time to complete the simulation was 7.97 ± 0.29 and 8.57 ± 0.69, respectively. The accuracy was 0.69 and 0.79, respectively. The number of complications was 0 and 1, respectively.
Conclusion: The McGill simulator may be a potential resource to help fill the void in endoscopic sinus surgery training.
Keywords: Rhinology, Endoscopic sinus surgery, Training, Education, Simulation, Virtual reality, Resident, Minimally invasive surgery, Haptic, Technical abilities, Performance metrics, Nasal model

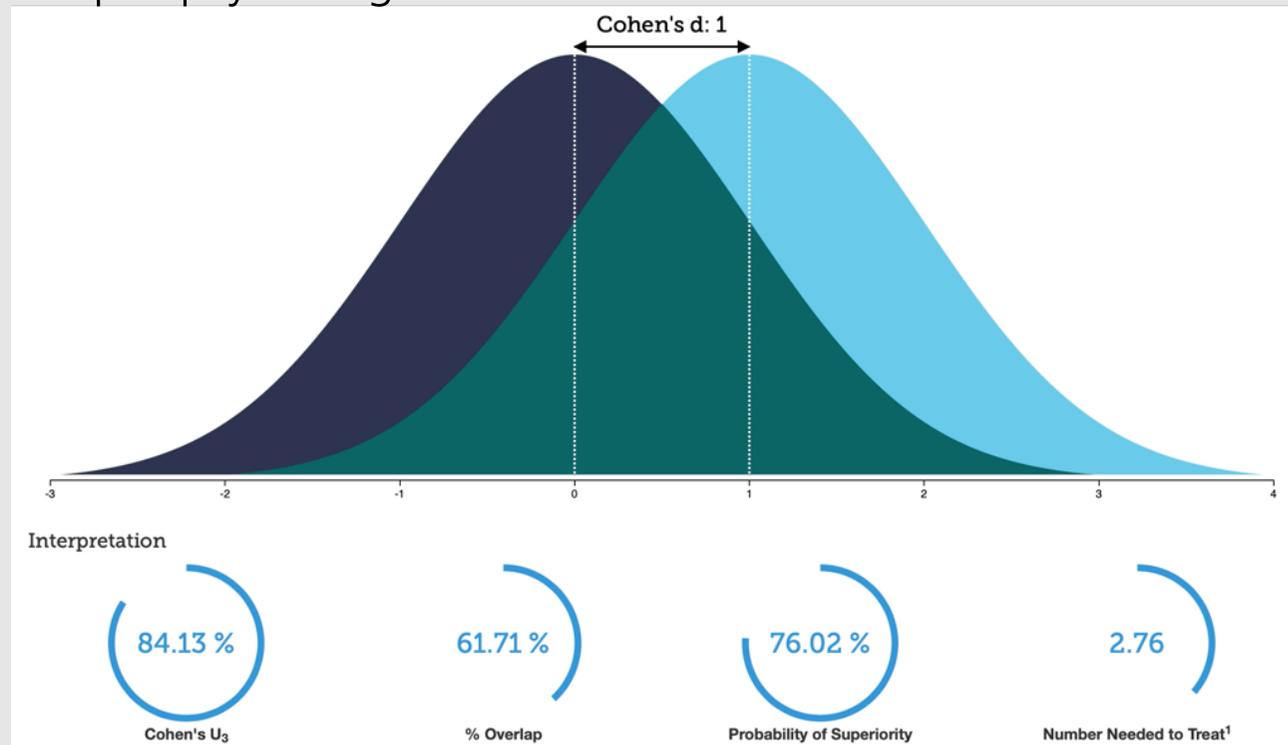
d = .30

Introduction
 Endoscopic sinus surgery (ESS) requires specialized technical skills involving complex spatial, perceptual and psychomotor performances [1]. Expertise in this minimally invasive surgery necessitates bimanual dexterity within a small 3-dimensional space [1], avoidance of key vital structures (i.e. orbits, brain and carotid artery), thorough applied knowledge of the intricate anatomy, and proficiency in maneuvering with the indirect visual aid of a 2-dimensional monitor [2]. Given the proximity of the paranasal sinuses to critical structures such as the orbits and skull base, it can be understood why ESS is the most frequent reason for otolaryngic surgical litigation in the United States [3], and why the rate of complications during ESS is higher in trainees when compared to attending physicians [4].
 Those teaching ESS have found alternative modalities to the traditional apprenticeship training model such as cadaveric dissections and 3D silicone models [1]. However, the latter have substantial limitations with regards to the complex needs of ESS training, such as the lack of tissue

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 Full list of author information is available at the end of the article

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<http://rpsychologist.com/d3/cohend/>



Exkurs: Meta-Analysen

d=.05

d=.15

d=.30

d=.35

d=.50

d=.60

d=.80

Check for updates

Varshney et al. *Journal of Otolaryngology - Head and Neck Surgery* 2014, 43:40
<http://www.journalotohns.com/content/43/1/40>



ORIGINAL RESEARCH ARTICLE Open Access

The McGill simulator for endoscopic sinus surgery (MSESS): a validation study

Rickul Varshney^{1,7*}, Saul Frenkiel¹, Lily HP Nguyen^{1,2}, Meredith Young^{3,3}, Rolando Del Maestro⁴, Anthony Zeitouni¹, Elias Saad⁵, W Robert J Funnell^{1,5}, National Research Council Canada⁶ and Marc A Tewfik¹

Abstract
Background: Endoscopic sinus surgery (ESS) is a technically challenging procedure, associated with a significant risk of complications. Virtual reality simulation has demonstrated benefit in many disciplines as an important educational tool for surgical training. Within the field of rhinology, there is a lack of ESS simulators with appropriate validity evidence supporting their integration into residency education. The objectives of this study are to evaluate the acceptability, perceived realism and benefit of the McGill Simulator for Endoscopic Sinus Surgery (MSESS) among medical students, otolaryngology residents and faculty, and to present evidence supporting its ability to differentiate users based on their level of training through the performance metrics.
Methods: 10 medical students, 10 junior residents, 10 senior residents and 3 expert sinus surgeons performed anterior ethmoidectomies, posterior ethmoidectomies and wide sphenoidotomies on the MSESS. Performance metrics related to quality (e.g. percentage of tissue removed), efficiency (e.g. time, path length, bimanual dexterity, etc.) and safety (e.g. contact with no-go zones, maximum applied force, etc.) were calculated. All users completed a post-simulation questionnaire related to realism, usefulness and perceived benefits of training on the MSESS.
Results: The MSESS was found to be realistic and useful for training surgical skills with scores of 7.97 ± 0.29 and 8.57 ± 0.69 , respectively on a 10-point rating scale. Most students and residents (29/30) believed that it should be incorporated into their curriculum. There were significant differences between novice surgeons (10 medical students and 10 junior residents) and senior surgeons (10 senior residents and 3 sinus surgeons) in performance metrics related to quality ($p < 0.05$), efficiency ($p < 0.01$) and safety ($p < 0.05$).
Conclusion: The MSESS demonstrated initial evidence supporting its use for residency education. This simulator may be a potential resource to help fill the void in endoscopic sinus surgery training.
Keywords: Rhinology, Endoscopic sinus surgery, Training, Education, Simulation, Virtual reality, Resident, Minimally invasive surgery, Haptic, Technical abilities, Performance metrics, Nasal model

Introduction
Endoscopic sinus surgery (ESS) requires specialized technical skills involving complex spatial, perceptual and psychomotor performances [1]. Expertise in this minimally invasive surgery necessitates bimanual dexterity within a small 3-dimensional space [1], avoidance of key vital structures (i.e. orbits, brain and carotid artery), thorough applied knowledge of the intricate anatomy,

and proficiency in maneuvering with the indirect visual aid of a 2-dimensional monitor [2]. Given the proximity of the paranasal sinuses to critical structures such as the orbits and skull base, it can be understood why ESS is the most frequent reason for otolaryngic surgical litigation in the United States [3], and why the rate of complications during ESS is higher in trainees when compared to attending physicians [4].

Those teaching ESS have found alternative modalities to the traditional apprenticeship training model such as cadaveric dissections and 3D silicone models [1]. However, the latter have substantial limitations with regards to the complex needs of ESS training, such as the lack of tissue

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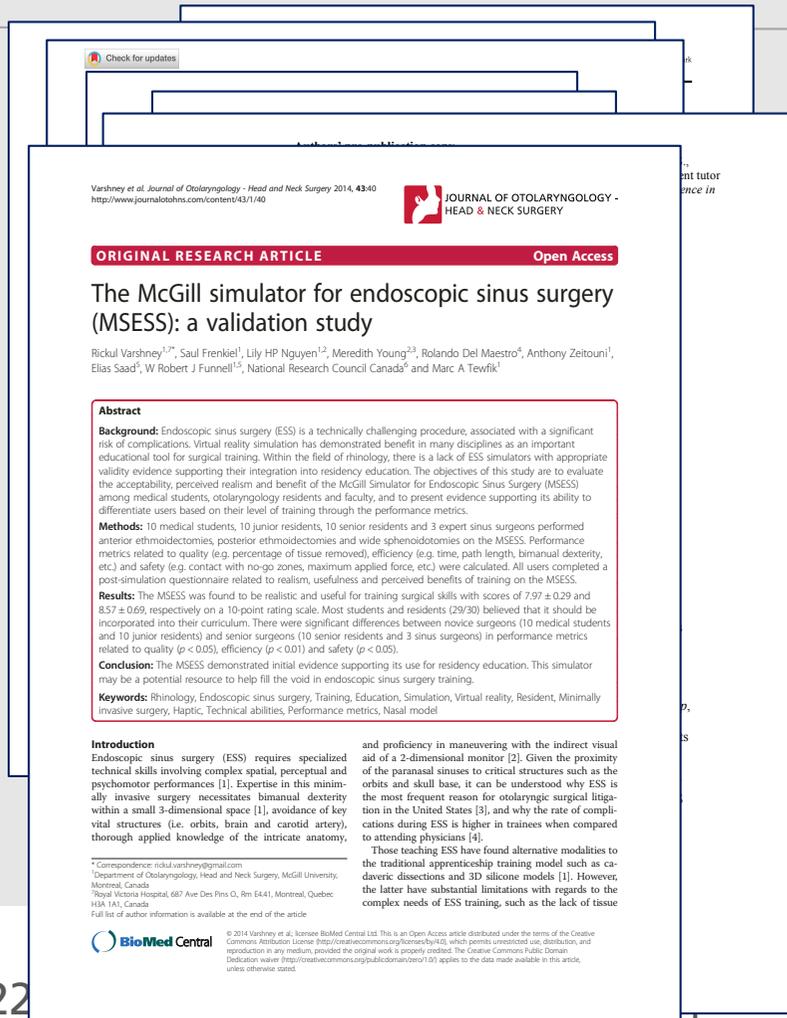
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Exkurs: Meta-Analysen

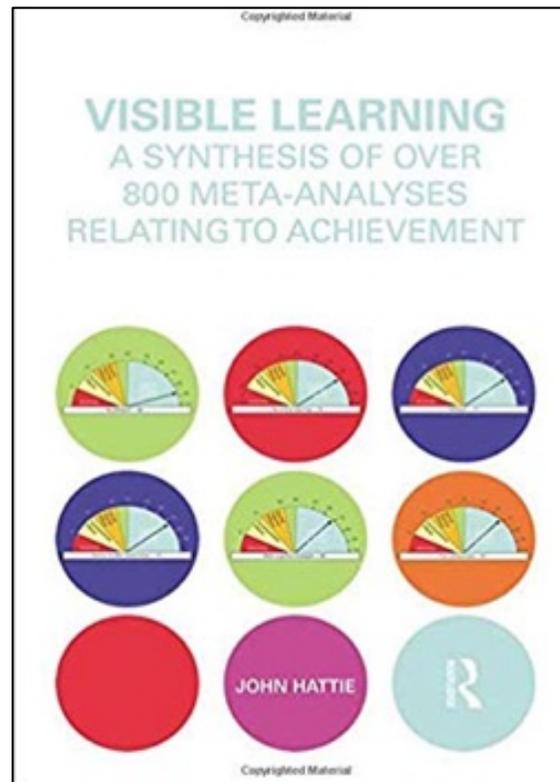


$$d = .39$$

- + Überblick über Literatur
- + belastbarer als Einzelstudien
- + Moderatoranalysen
- Äpfel-Birnen-Problem
- Garbage-in → Garbage-out

5) Einsatz digitaler Medien

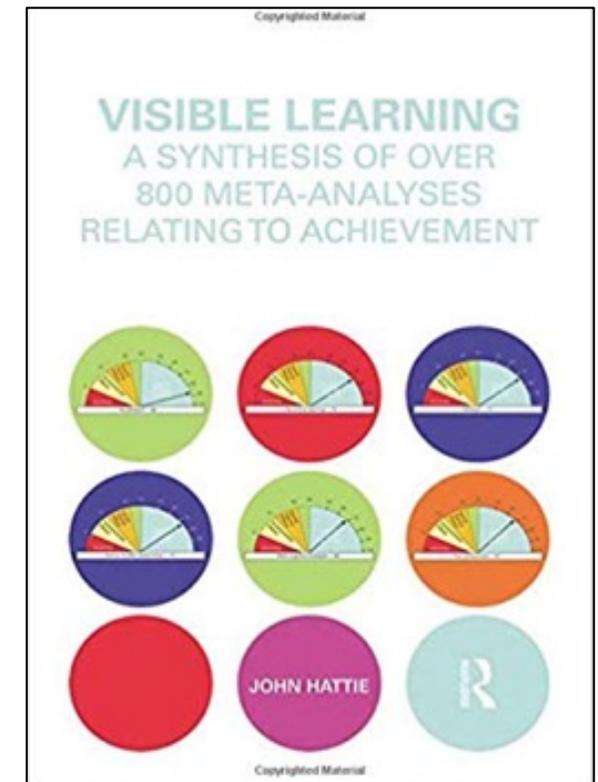
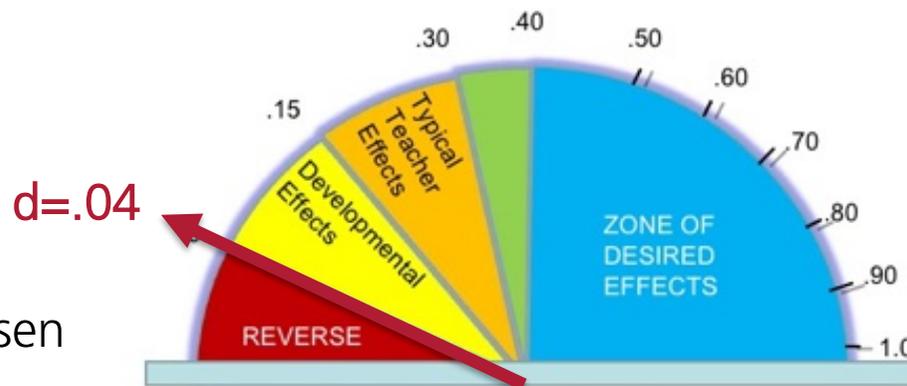
- Ca. 4.000 empirische Studien
- Ca. 150 Meta-Analysen
- Zwei second-order Meta-Analysen (Hattie, 2009; Tamim et al., 2011)



Wirkung digitaler Medien auf das Lernen

- Ca. 4.000 empirische Studien
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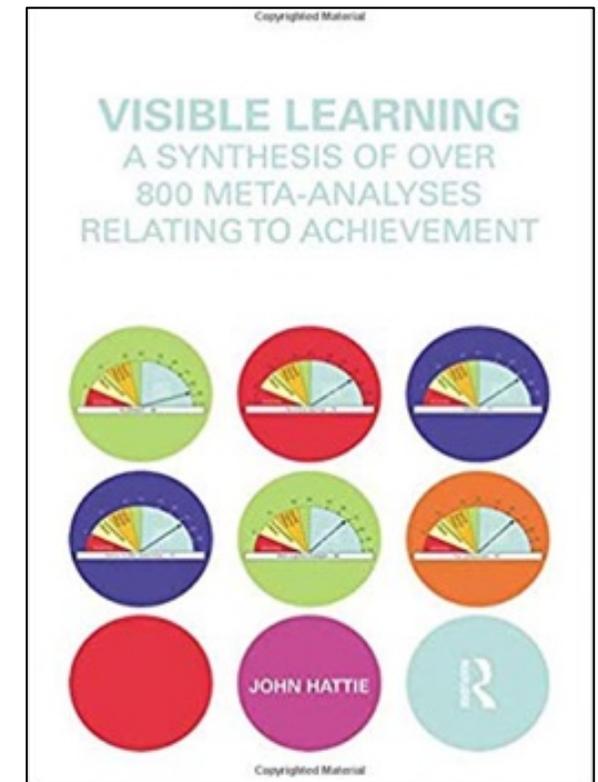
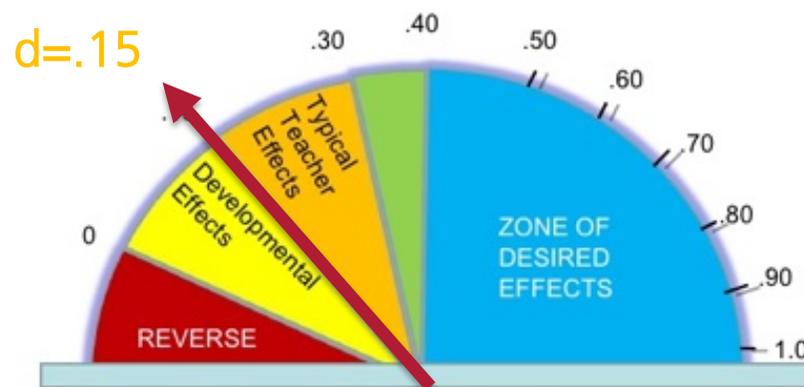
z.B. Jahrgangs-
übergreifende Klassen



Wirkung digitaler Medien auf das Lernen

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z.B. Problem-
basiertes Lernen

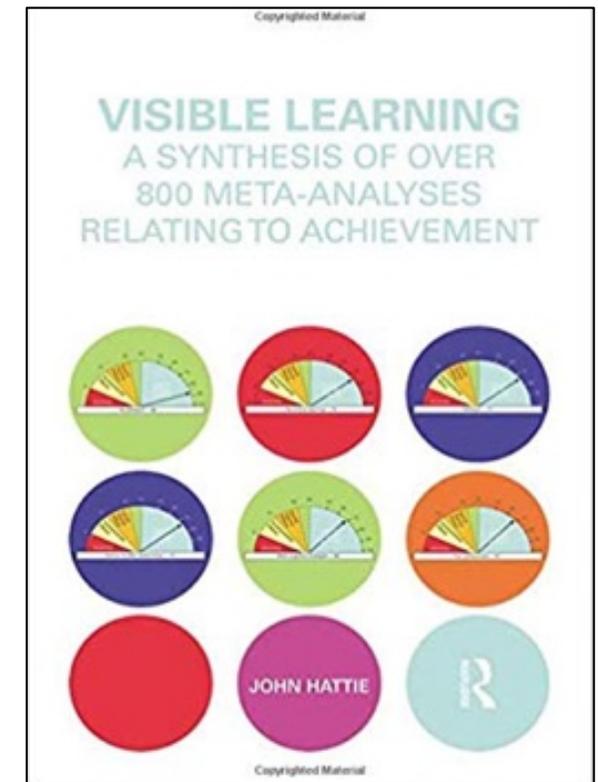
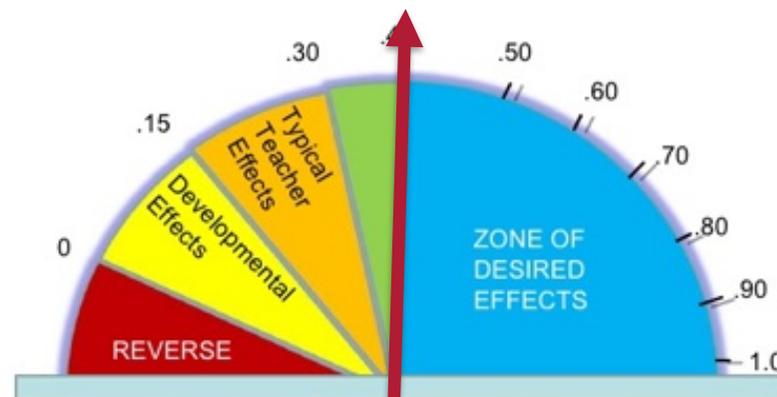


Wirkung digitaler Medien auf das Lernen

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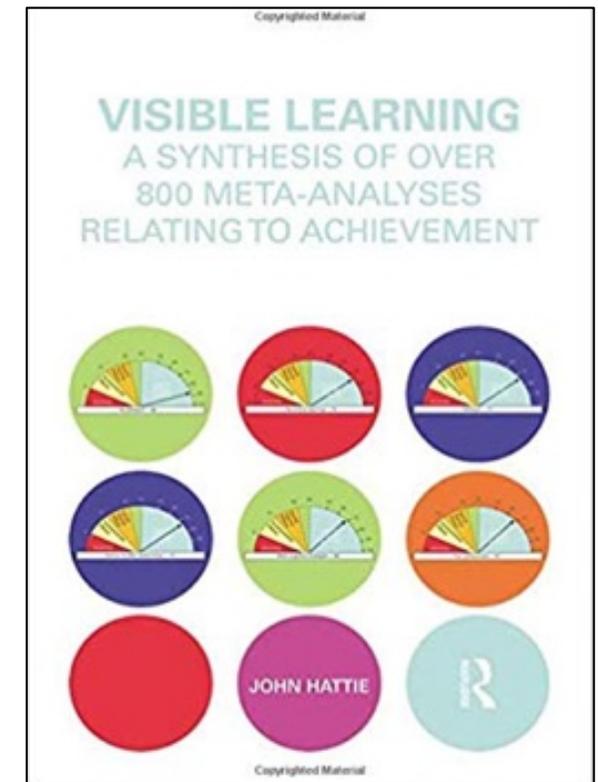
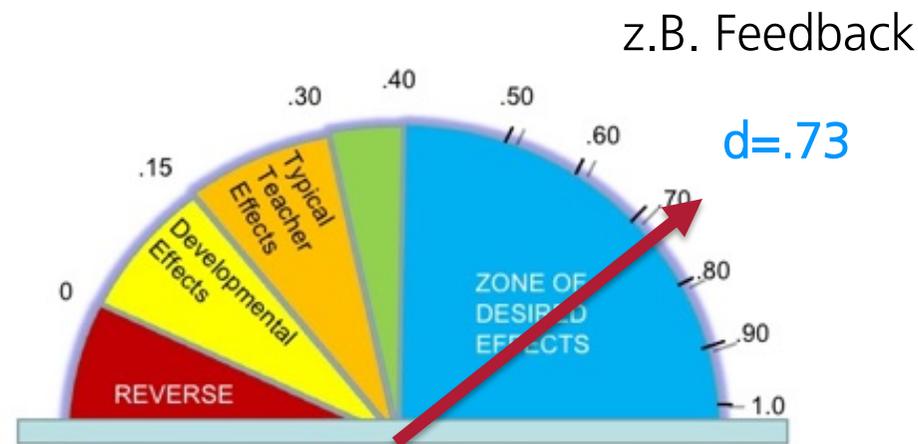
z.B. Kooperatives
Lernen

$d = .41$



Wirkung digitaler Medien auf das Lernen

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- Ca. 150 Meta-Analysen
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Wie groß ist der Effekt? Competition

Get ready to compete!

Wie groß ist der Effekt?

Lernen von Vokabeln am Computer (Chiu, 2013)

= *Bereitstellung von Übungen + Feedback*



kein Effekt ($d=.03$)

kleiner Effekt ($d=.24$)

mittlerer Effekt ($d=.75$)

großer Effekt ($d>.91$)

Total Results: 0

Wie groß ist der Effekt?

Game-based Learning (Wouters et al., 2013)

= *in Spiel eingebettetes Lernen; Wettbewerbscharakter (Punktzahl, Konkurrenz)*



kein Effekt ($d=.08$)

kleiner Effekt ($d=.22$)

mittlerer Effekt ($d=.62$)

großer Effekt ($d>.95$)

Total Results: 0

Wie groß ist der Effekt?

Simulationsbasiertes Lernen mit virtuellen Patienten (Consorti et al., 2012)

= authentische Problemsituationen mit Zeitraffer, Zeitlupe, Wiederholbarkeit, Individualisierung, Risikovermeidung



kein Effekt ($d=.07$)

kleiner Effekt ($d=.32$)

mittlerer Effekt ($d=.71$)

sehr großer Effekt ($d=2.19$)

Total Results: 0

Wie groß ist der Effekt?

Intelligente Tutorielle Systeme (Ma et al., 2014)

= *adaptive Instruktion mit individuellem Feedback*

The screenshot shows a web-based tutoring interface. At the top left, there's a 'Time Left' indicator showing 30:00. Below it is a 'Table of Contents' with sections like 'Introduction', 'Components', 'Heart', 'Systems of Circulation', and 'Other Aspects of CS'. The main content area is titled 'Systems of Circulation: Systemic Circulation' and contains text explaining the process of systemic circulation, including the role of the heart, arteries, capillaries, and veins. A diagram illustrates the circulatory system with labels for the heart, lungs, and various blood vessels. The diagram is titled 'Pulmonary Circulation and systemic circulation'. The interface also includes a 'Learning Goal and Subjects' section, a 'Your current subjects are' section, and a 'Table of Contents' section.

kein Effekt ($d=.12$)

kleiner Effekt ($d=.34$)

mittlerer Effekt ($d=.49$)

sehr großer Effekt ($d=1.67$)

Total Results: 0

5) Einsatz digitaler Medien

Warum ist Lernen mit digitalen Medien wirksam?

- **Motivation** (Deci & Ryan, 2000): Autonomie, Kompetenzerleben, Anschluss
- **Kognitive Aktivierung** (Klieme, 2006)
- **Feedback** (Hattie & Timperley, 2007)
- **Problemlösen** (Vygotsky, 1978): Zone der proximalen Entwicklung

Take-home messages

Studierende brauchen Unterstützung beim selbstregulierten Lernen.

Seien Sie ein positives Rollenvorbild:

Kommunizieren Sie klare Ziele für Ihre Lehrveranstaltungen!

Zeigen Sie regelmäßig die Gliederung Ihrer Veranstaltung auf!

Bieten Sie Raum für unterschiedliche Lernwege!

Sprechen Sie über geeignete Lernstrategien!

Schaffen Sie eine positive Fehlerkultur!

Setzen Sie nicht ausschließlich auf die soziale Bezugsnorm!

Wecken Sie die intrinsische Motivation der Studierenden!

Besprechen Sie mit Ihren Studierenden die Evaluationsergebnisse!

Ich wünsche Ihnen eine erfolgreiche und inspirierende Konferenz!

Dr. Henrik Bellhäuser

bellhaeuser@uni-mainz.de