



KI und Bildung:

Können wir den Bildungs- und Fremdspracherwerb konkret voranbringen?

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basierend auf Teamarbeit mit

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Impulse Kontrovers – Podiumsgespräche 2021
Hospitalhof Stuttgart, 12. Oktober 2021



Digitalisierung, Künstliche Intelligenz und Bildung?

- Digitalisierung der Bildung wird seit Jahren viel diskutiert – allerdings stark fokussiert auf Infrastruktur & Medienbildung.
 - Künstliche Intelligenz ist dabei aktuell ein vielgenutztes Modewort – meist aber als eher diffuse Vision, illustriert mit Robotern.
- ⇒ Digitalisierung und KI sind kein Selbstwert an sich. Es ist essenziell zu überlegen
 - welche realen Desiderate der Schule sie lösen sollen,
 - basierend auf welchen Erkenntnissen zum Lehren und Lernen



Potential Digitaler Medien in der Bildung

KMK Strategiepapier “Bildung in der Digitalen Welt” (2017):

- *Digitale Medien halten ein großes Potential zur Gestaltung neuer Lehr- und Lernprozesse bereit, wenn wir allein an die Möglichkeiten zur **individuellen Förderung von Schülerinnen und Schülern** denken. (S. 3)*
- *Bei der Gestaltung von Lehr- und Lernprozessen werden digitale Lernumgebungen entsprechend **curricularer Vorgaben** dem **Primat des Pädagogischen** folgend systematisch eingesetzt. (S. 12)*



Was brauchen wir zum pädagogisch wohlmotivierten, individuellen Fordern und Fördern?

- I. **Interaktivität:** Schüler beim Lernen individuell unterstützen
 - Intelligentes Tutorsystem FEEDBOOK (<http://feedbook.schule>)
 - II. **Adaptivität:** Input & Aufgabenschwierigkeit an Lerner anpassen
 - Sprachaffine Suchmaschinen: <http://flair.schule>, <http://kansas-suche.de>
 - Sprachliche Komplexität explizit machen: <http://ctabweb.com>
- ⇒ Solche Individualisierung benötigt KI Methoden:
- Automatische Analyse von **Sprache** (→ Feedback)
 - Modellierung individueller **Lerner** (→ Learning Analytics)
 - Modellierung von **Aufgabenschwierigkeit** und ihre Sequenzierung für die laut Bildungsplan zu erwerbenden Kompetenzen
- Systeme können nur da erfolgreich sein, wo sie pädagogisch wohlmotiviert auf konkreten Erwerbsmechanismen aufbauen!



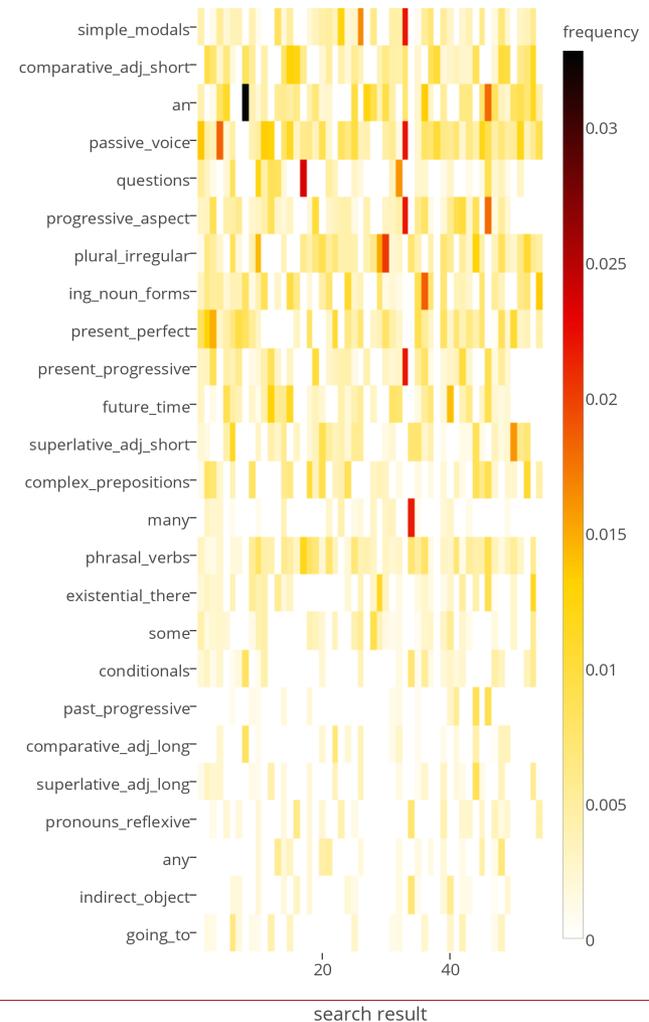
Input

- **Input Hypothesis** (Krashen 1985)
 - bedeutungstragender Input essenziell
 - $i+1$: Input etwas komplexer als Sprache des Lerners
 - **Teachability** (Pienemann 1989):
 - Lernen passiert in systematischen Erwerbsstufen
- ⇒ **FLAIR**, <http://flair.schule> (Chinkina & Meurers 2016; Chinkina, Oswal & Meurers 2018)
- Wie lässt sich individuell motivierender, verständlicher und sprachlich fördernder Input identifizieren?



Sprachlich informierte Websuche

- Startpunkt: Web bietet Vielfalt an interessanten Texten
 - Beispiel: 55 Texte der Websuche “US presidential elections”
 - Manche sprachliche Mittel sind hochfrequent (Artikel), andere selten (Fragen, Conditionals).
- ⇒ Automatische Inputanreicherung bei der Websuche durch Reranking





Sprachaffine Suchmaschine FLAIR (http://flair.schule)

← FLAIR
🕒
🌐

50 Results (0 Filtered)

VISUALIZE ↗

SHARE SEARCH SETUP ↩

Text Characteristics:

Length:

Prefer shorter texts.

Levels:

A1-A2 0 / 50

B1-B2 20 / 50

C1-C2 30 / 50

Constructions:

▼ Sentences ↶

▼ Parts of Speech ↶

▼ Verbs ↶

▼ Verb Forms ↶

'climate change site:reuters.com'

- 1** [A Cloudspotters' Guide to Climate Change - reuters.com](https://www.reuters.com/investigates/special-report/climate-change-britain-clouds)
https://www.reuters.com/investigates/special-report/climate-change-britain-clouds

He supports the climate-change equivalent of the Manhattan Project, a multinational effort championed by leading scientists in the European Union that pools computational resources to build higher ...
- 2** [Special Report: A Cloudspotter's Guide to Climate Change ...](https://www.reuters.com/article/us-climate-change-britain-clouds-special-idUSKCN1UK1GL)
https://www.reuters.com/article/us-climate-change-britain-clouds-special-idUSKCN1UK1GL

He supports the climate-change equivalent of the Manhattan Project, a multinational effort championed by leading scientists in the European Union that pools computational resources to build higher ...
- 3** [World march for climate change and the environment ...](https://www.reuters.com/news/picture/world-march-for-climate-change-and-the-e-idUSRTX6...)
https://www.reuters.com/news/picture/world-march-for-climate-change-and-the-e-idUSRTX6...

Demonstrators take part in the world march for climate change and the environment, called by the organization Fridays for Future at Angel de la Independencia monument in Mexico City, Mexico May 24.
- 4** [Climate change climbs up U.S. voters' list of concerns ...](https://www.reuters.com/article/us-usa-climate-voters-idUSKCN1SM2WW)
https://www.reuters.com/article/us-usa-climate-voters-idUSKCN1SM2WW

NEW YORK (Thomson Reuters Foundation) - Climate change is rising up the list of voter concerns in the United States with nearly 40% saying the issue will be crucial in how they cast their ballots ...
- 5** [High and dry: Alpine resorts grapple with climate change ...](https://www.reuters.com/article/us-climate-change-alps-insight-idUSKCN1UB0ED)
https://www.reuters.com/article/us-climate-change-alps-insight-idUSKCN1UB0ED

"The consequences of climate change will be felt across the travel and tourism

A Cloudspotters' Guide to Climate Change ...

B1-B2 289 Sentence(s) 5380 Word(s)

...tains of rain ... from a ... tower topped with the English flag, the coastline of Devon is faintly visible to the east, while the expanse of the Atlantic Ocean stretches west, the seas uninterrupted all the way to North America. Inside, a handful of visitors in windproof jackets lean forward on wooden benches to catch the Rev. Jane Skinner's words. "Majestic or wispy, solid yet ephemeral. Who could conceive of clouds?" Skinner asks, sturdy Teva sandals **peeking out** from underneath her white robes. "God has the whole spectrum in view, from the heavenly sphere to the atom, the clouds delivering dramatic forces of nature, shielding and obscuring light." As she speaks, workmen bustle about the nave **setting up** equipment for the days to come. It's no easy task, hosting a group on an off-grid island powered by a generator that **switches off** at midnight, and where the internet signal goes down in overloaded circuits whenever someone uses electricity to make tea. Cirrus and contrails compete in the sky above Lundy Island, with a lighthouse in view in the distance on this spit of land off England's southwest coast. A member of the Cloud Appreciation Society shows her love of

Construction	Count	Weight
Verbs > Phrasal > Phrasal...	35	(1)

ALL CONSTRUCTIONS



Sprachaffine Suchmaschine FLAIR

- FLAIR erlaubt Lehrern und Schülern, Texte zu finden, die
 - auf dem sprachlichen Level des Lernalters sind
 - ausgewählte Zielkonstruktionen möglichst reich repräsentieren
 - so aktuell und interessant sind wie das Internet
- FLAIR deckt 87 sprachliche Konstruktionen des Englisch Bildungsplans für Baden-Württemberg ab.
 - Auch eigene Texte können hochgeladen und analysiert werden.
- Weiterentwicklung für deutsche Grundbildung und Alphabetisierungskurse (Kooperation mit DIE):
<http://kansas-suche.de>



Focus on Form

- Input alleine führt nur zu **Basic Varieties** (Klein & Perdue 1997).
- Fremdsprachenlerner benötigen einen **Focus-on-Form**, um partielle oder fehlende Kompetenzen zu überwinden (Long 1991; Lightbown 1998)
- **Noticing Hypothesis** (Schmidt 1995)
 - Salienz erhöhen: **Input enhancement** (Sharwood Smith 1993)
- Digitalisierung kann automatisches Input Enhancement erzeugen:
 - Aktuelle Erweiterung von FLAIR um automatische Generierung von h5p Aktivitäten (*Bei Interesse bitte mir Email schicken!*)
 - WERTi (Working with English Real Texts interactively), VIEW (Visual Input Enhancement of the Web) (Meurers, Ziai, Amaral, Boyd, Dimitrov, Metcalf & Ott 2010)



Visual Input Enhancement: Präpositionen



Africa

Americas

Asia-Pacific

Europe

Middle East

South Asia

UK

England

Northern Ireland

Scotland

Wales

UK Politics

Education

Magazine

Business

Health

Science &
Environment

Technology

Entertainment

Also in the news

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Cows also 'have regional accents'

Cows have regional accents like humans, language specialists have suggested.

They decided to examine the issue **after** dairy farmers noticed their cows had slightly different moos, depending **on** which herd they came **from**.

John Wells, Professor **of** Phonetics **at** the University **of** London, said regional twangs had been seen before **in** birds.

The farmers **in** Somerset who noticed the phenomenon said it may have been the result **of** the close bond **between** them and their animals.

Farmer Lloyd Green, **from** Glastonbury, said: "I spend a lot **of** time **with** my ones and they definitely moo **with** a Somerset drawl.



Cows moo **with** a regional twang

[Listen](#) **Cow moo recordings**

SEE ALSO

- ▶ 'Accent' confirms unique species
15 Aug 06 | Highlands and Islands
- ▶ Brain bug changes woman's accent
10 Jul 06 | Staffordshire
- ▶ What makes you local?
18 Feb 05 | Magazine

RELATED INTERNET LINKS

- ▶ University **of** London phonetics department

The BBC is not responsible **for** the content **of** external internet sites

TOP UK STORIES

- ▶ Warnings **before** Potters Bar crash
- ▶ Gaza ship Britons 'to head home'
- ▶ Walcott left out **of** England squad

[RSS](#) | News feeds

MOST POPULAR STORIES NOW

[MOST SHARED](#) [MOST READ](#)

- 1 Doubt cast **on** Israel raid account

Source: <http://news.bbc.co.uk/2/hi/5277090.stm>



Üben, Interaction, Feedback

- **Skill Acquisition Theory** (DeKeyser 2005)
 - Deklaratives Wissen ist wichtiger Ausgangspunkt. Dann führt Üben zu flüssigem, prozeduraler Fähigkeit, das keine Aufmerksamkeit bindet.
- **Interaktion** zentral für sprachliche Entwicklung
 - Lernen resultiert aus Interaktion mit einem Lerner in seiner **Zone of Proximal Development (ZPD)** (Vygotsky 1986; Lantoff & Appel 1994)
 - Partner bietet Lerner Gerüst für die Entwicklung (**Scaffolding**)
 - **Feedback** einer der effektivsten Faktoren (Hattie & Timperley 2007)



Digitalisierung und interaktives Üben

- Wie können SchülerInnen individuell auf ihrem Niveau üben, um dann in der Klasse gemeinsam kommunizieren zu können?
 - Lernförderliche Aufgaben brauchen lernbegleitendes Feedback
 - Wie können SchülerInnen individuelles Feedback erhalten?
 - wenig Zeit mit LehrerInnen
 - Abhängigkeit vom Bildungsstand der Eltern (⚡ Bildungsgerechtigkeit)
- ⇒ Intelligente Tutorsysteme: FeedBook (Meurers et al. 2019a)



Wie sieht das konkret aus?

Grammar check: Problems

Everyone has got problems. What could these people do differently?

0. Gillian is sad. Her mother never has any time for her.

If Mrs Collins had more time for Gillian, Gillian wouldn't be so sad.

1. Mrs Collins feels bad. She should listen more to Gillian.

If she listens more to Gillian, she feels better

2. Gwynn is very disappointed. Gillian doesn't like Wilding

If Gillian like Wilding

**AUSGANGS-
PUNKT**

ZIEL

2

Welcome to Wales

CYP 2 Grammar check: Problems

Everyone has got problems. What could these people do differently? Use conditional clauses in your answers.

0. Gillian is sad. Her mother never has any time for her.

If Mrs. Collins had more time for Gillian, Gillian wouldn't be so sad. ✓ ?

1. Mrs Collins feels bad. She should listen more to Gillian.

If she listens more to Gillian, she feels better.

2. Gwynn is very disappointed. Gillian doesn't like Wilding

3. George and Rajiv feel bad because they don't have a pres

Feedback für "If she listens more to Gillian, she..."

With conditional clauses (type 2), we use the simple past in the if-clause, not the simple present.

Hilfreich?

Ja Nein

OK



B1 Off to Greece again

Mr Lambraki is checking flights to Greece. Read the information he has found on the two airlines and use the adjectives below to compare them.

• LiFBR: Comparison of adjectives

expensive (ticket) · early (departure) · attractive (shopping on board) · good (choice of food offered on board) · healthy (food and drinks) · suitable (airport) · cheap (tickets for shuttle bus) · friendly (service on board) · easy (online booking)

Midair	Air-Con
<ul style="list-style-type: none"> London – Athens from 39 pounds departure 7.00 am non-stop small choice of duty free articles for shopping on board low-calorie and vegetarian food available¹ from Gatwick only 28 miles from London tickets for shuttle bus are 10 euros 	<ul style="list-style-type: none"> London – Athens from 57 pounds departure 12.15 pm via Berlin all international brands for shopping on board snacks: crisps and chocolate bars from Stansted only 40 miles from London tickets for shuttle bus are 10 euros

1.

The tickets at Air-Con are expensiver than at Midair.



2.





B1 Off to Greece again

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Feedback für "The tickets at Air-Con are expensiv..."

When an adjective has three or more syllables, we form the comparative with 'more' and the superlative with 'most'.



Hilfreich?

Ja

Nein

OK



1.

The tickets at Air-Con are expensiver than at Midair.

2.





2

Welcome to Wales

B 1 Gillian's diary

Read Gillian's diary entry and complete these sentences.

<p>5</p> <p>10</p> <p>15</p>	<p><i>Friday 23rd September</i></p> <p><i>We'll drive to the north coast tomorrow and have a look at two boarding schools with Gwynn. His sister went to Wildings and he says it would be great for me. If they had a football team, it wouldn't be so bad, but it's all so girly-girly with horses and ballet dancing and everything, yuk! I don't want to go to the school in Llandysul either. It still feels like Gwynn and Mum just want me to go to boarding school because of the new baby. Miss my pals like crazy, miss London and my old school. If my friends were here, boarding school would actually be fun. Being the new girl at school without any friends will be horrible. ☹️ And it's all Gwynn's fault! The village where we live now is the worst. 20 minutes to the nearest supermarket. If there was a shopping</i></p>	<p>20</p> <p>25</p>	<p><i>centre, I could at least go shopping. But there's nothing, no shops, no cinema, no nothing ... only sheep!</i></p> <p><i>My room is really nice and big though and we have a fab garden which is great for playing football. If I made some friends in the village, we could have a great time there. I met Gruffudd, the boy from next door, this afternoon. He seems nice. He started talking to me in Welsh and I couldn't understand ANYTHING. He then spoke English and told me he plays rugby. Well, it's not football but I might have to learn to like it. They all love rugby here.</i></p> <p><i>Aargh, if I had some credit on my phone, I could call Caroline. Hope I get some pocket money tomorrow.</i></p>
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1. Gwynn thinks Wildings School would be great for Gillian because

it is great



2

Welcome to Wales

B1

Gillian's diary

Read Gillian's diary entry and complete these sentences.

Friday 23rd September

We'll drive to the north coast tomorrow and have a look at two boarding schools with Gwynn. His sister went to Wildings and he says it would be great for me. If they had a football team, it wouldn't be so bad, but it's all so girly-girly with horses and ballet dancing and everything, yuk! I don't want to go to the school in Llandysul either. It still feels like Gwynn and Mum just want me to go to boarding school because of the new baby. Miss my pals like crazy, miss London and my old school. If my friends were here, boarding school would actually be fun. Being the new girl at school without any friends will be horrible. ☹️ And it's all Gwynn's fault! The village where we live now is the worst. 20 minutes to the nearest supermarket. If there was a shopping

centre, I could at least go shopping. But there's nothing, no shops, no cinema, no nothing ... only sheep!

My room is really nice and big though and we have a fab garden which is great for playing football. If I made some friends in the village, we could have a great time there. I met Gruffudd, the boy from next door, this afternoon. He seems nice. He started talking to me in Welsh and I couldn't understand

Feedback für "it is great"

There seems to be important information missing in your answer. Please have a look at the highlighted passage in the text.



Hilfreich?

Ja Nein

OK

1. Gwynn thinks Wildings School would be great for Gillian because

it is great



2

Welcome to Wales

B1 Gillian's diary

Read Gillian's diary entry and complete these sentences.

Friday 23rd September

We'll drive to the north coast tomorrow and have a look at two boarding schools with Gwynn. His sister went to Wildings and he says it would be great for me. If they had a football team, it wouldn't be so bad, but it's all so girly-girly with horses and ballet dancing and everything, yuk! I don't want to go to the school in Llandysul either. It still feels like Gwynn and Mum just want me to go to boarding school because of the new baby. Miss my pals like crazy, miss London and my old school. If my friends were here, boarding school would actually be fun. Being the new girl at school without any friends will be horrible. ☹️ And it's all Gwynn's fault! The village where we live now is the worst. 20 minutes to the nearest supermarket. If there was a shopping

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Feedback für "it is near the coast"

I'm still missing some information. Please look at the highlighted text again.



Hilfreich?

Ja Nein

OK

1. Gwynn thinks Wildings School would be great for Gillian because

it is near the coast



2

Welcome to Wales

B1 Gillian's diary

Read Gillian's diary entry and complete these sentences.

Friday 23rd September

We'll drive to the north coast tomorrow and have a look at two boarding schools with Gwynn. His sister went to Wildings and he says it would be great for me. If they had a football team, it wouldn't be so bad, but it's all so girly-girly with horses and ballet dancing and everything, yuk! I don't want to go to the school in Llandysul either. It still feels like Gwynn and Mum just want me to go to boarding school because of the new baby. Miss my pals like crazy, miss London and my old school. If my friends were here, boarding school would actually be fun. Being the new girl at school without any friends will be horrible. 😞 And it's all Gwynn's fault! The village where we live now is the worst. 20 minutes to the nearest supermarket. If there was a shopping

centre, I could at least go shopping. But there's nothing, no shops, no cinema, no nothing ... only sheep!

My room is really nice and big though and we have a fab garden which is great for playing football. If I made some friends in the village, we could have a great time there. I met Gruffudd, the boy from next door, this afternoon. He seems nice. He started talking to me in Welsh and I couldn't understand

Feedback für "his sister goes there"

We are talking about something that happened in the past. Please use the simple past, not the simple present.



Hilfreich?

Ja Nein

OK

1. Gwynn thinks Wildings School would be great for Gillian because

his sister goes there



2

Welcome to Wales

B 1 Gillian's diary

Read Gillian's diary entry and complete these sentences.

<p>Friday 23rd September</p> <p>We'll drive to the north coast tomorrow and have a look at two boarding schools with Gwynn. His sister went to Wildings and he says it would be great for me. If they had a football team, it wouldn't be so bad, but it's all so girly-girly with horses and ballet dancing and everything, yuk! I don't want to go to the school in Llandysul either. It still feels like Gwynn and Mum just want me to go to boarding school because of the new baby. Miss my pals like crazy, miss London and my old school. If my friends were here, boarding school would actually be fun. Being the new girl at school without any friends will be horrible. ☹️ And it's all Gwynn's fault! The village where we live now is the worst. 20 minutes to the nearest supermarket. If there was a shopping</p>	<p>centre, I could at least go shopping. But there's nothing, no shops, no cinema, no nothing ... only sheep!</p> <p>My room is really nice and big though and we have a fab garden which is great for playing football. If I made some friends in the village, we could have a great time there. I met Gruffudd, the boy from next door, this afternoon. He seems nice. He started talking to me in Welsh and I couldn't understand ANYTHING. He then spoke English and told me he plays rugby. Well, it's not football but I might have to learn to like it. They all love rugby here.</p> <p>Aargh, if I had some credit on my phone, I could call Caroline. Hope I get some pocket money tomorrow.</p>
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his sister went there

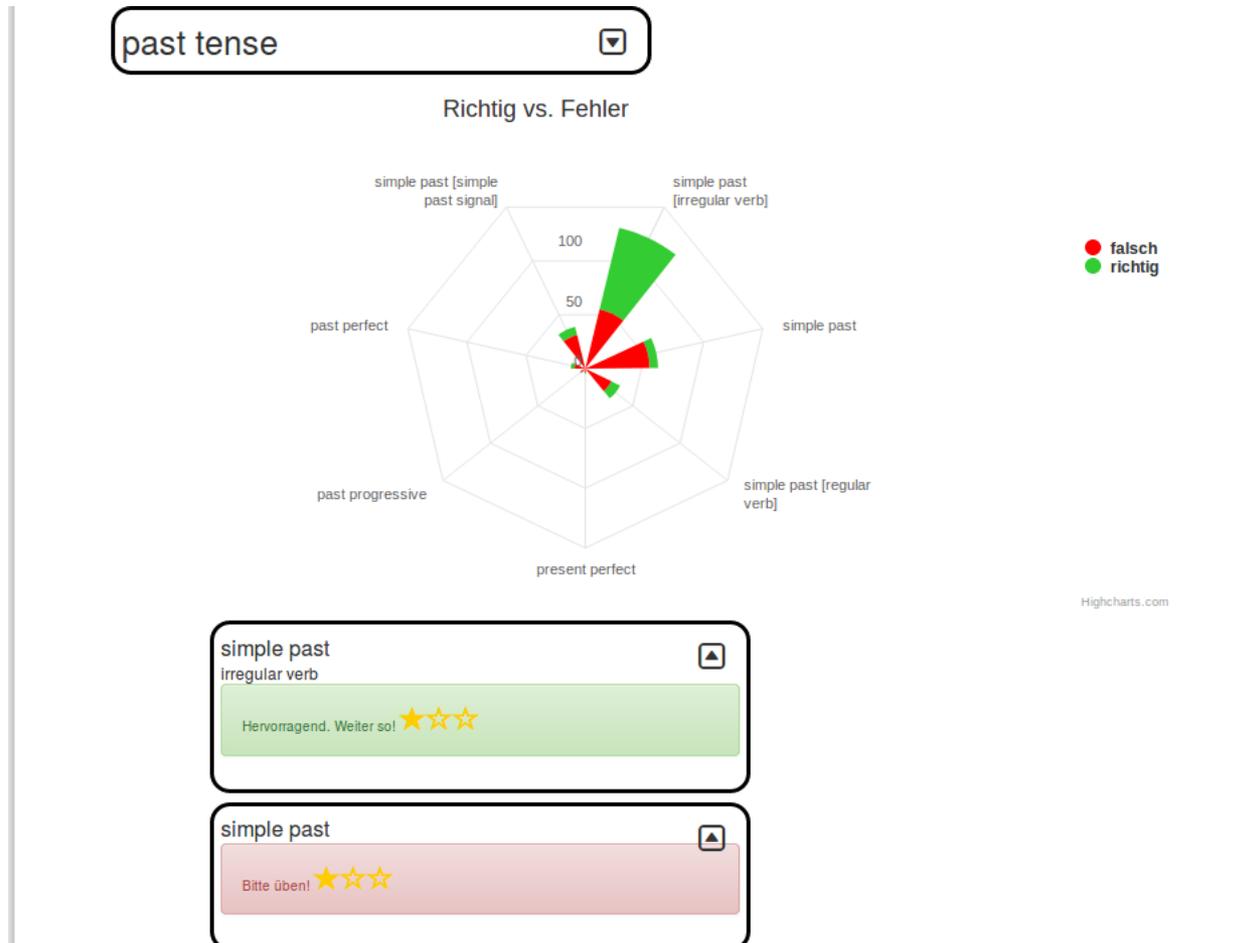


Was bietet das FeedBook?

- sofortige, unterstützende Rückmeldungen, die Schüler zu einem Verständnis des Lerngegenstandes führen
- Automatische Analyse von tausenden von Antwortvarianten durch KI Methoden, statt manueller Kodierung in der Aufgabe.
 - 188 verschiedene Feedbacktypen zu tenses, comparatives, relative & reflexive pronouns, gerunds, passive, conditionals, (in)direct speech.
 - Deckt alle Sprachkonstrukte des Bildungsplanes 7. Klasse ab.
- Das FeedBook integriert eine explizite Lerner- und Aufgabenmodellierung.



Lernermodell: Was weiß ich, und was noch nicht?





Lernermodell: Welche Aufgaben sind für mich richtig?

simple past

Bitte üben! ★★☆☆

Vorschläge für Übungen

Empfohlene Übungen:

 Moving trouble 1 Theme 1 AP 18 b  S.25 	 PRESENTING FACTS 1 Theme 3 AP 11  S.89 	 NO PARTY FOR FAY 1 Theme 4 AP 8  S.118 	 AN INSTAGRAM STAR QUILTS 1 Theme 4 AP 35  S.141 
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Aufgabenmodell: Sind die Aufgaben lernförderlich?

C3 What was ... doing while Gillian was doing something else?

Write down what Gillian's friends were doing while she was running away from home. Use the past progressive in both parts of the sentence.

- LiF1Re: Past progressive



buy Arsenal tickets



feed Patch



watch TV



sit on the bus

1. buy Arsenal tickets/sit on the bus

Charlie was buying Arsenal tickets while Gillian was sitting on the bus.



2. feed Patch/sit on the bus

George was feeding Patch while Gillian was sitting on the bus.



3. watch TV/sit on the bus

|



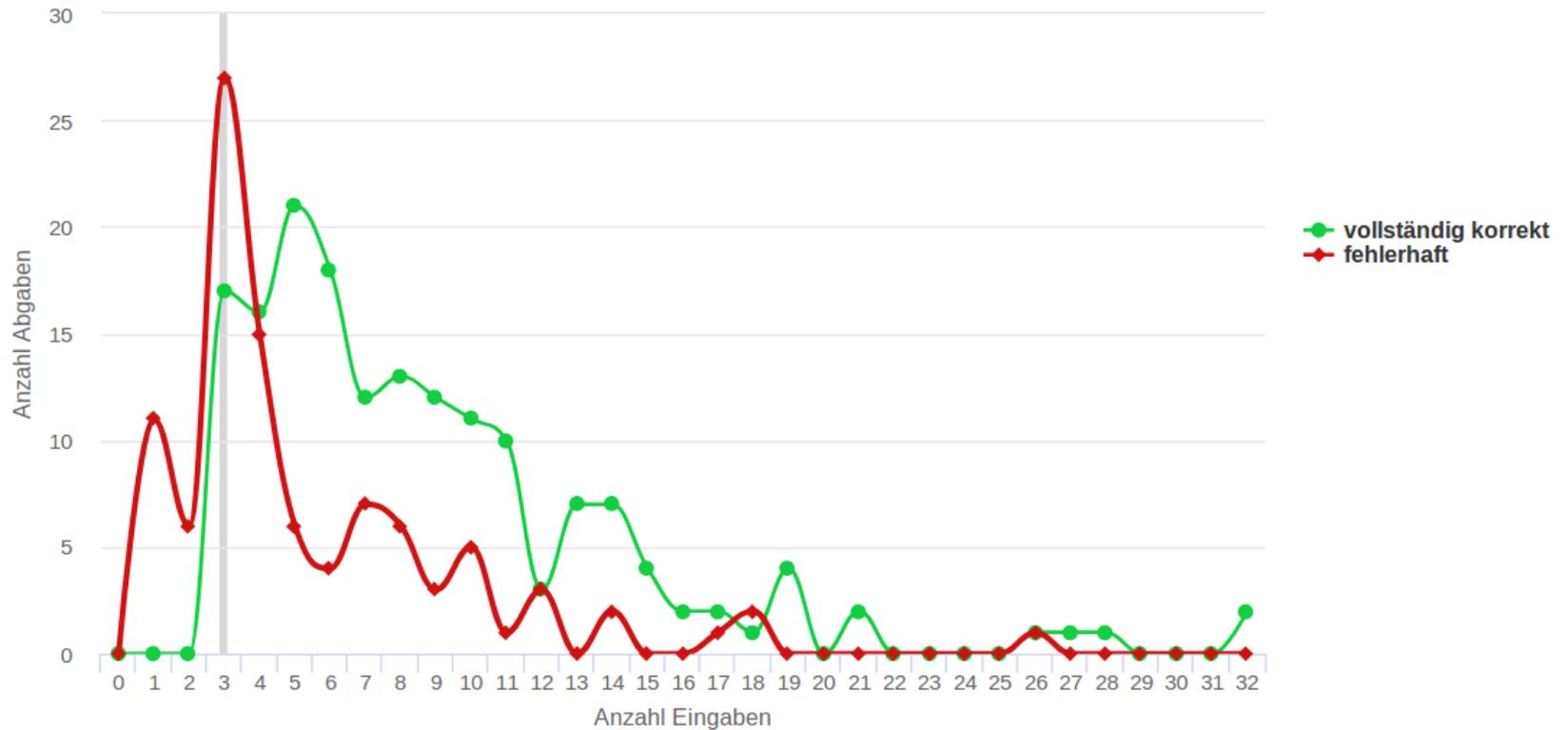


Taskperformance

Theme 1 C, SubTask 3 [short answers]

anzeigen

267 Abgaben (167 vollständig korrekt, 100 fehlerhaft)



Highcharts.com



Was bringt das System in der Schulrealität?

- Ganzjährige Studie mit zehn Klassen (7. Klasse Gymnasium).
 - Erste randomisierte Feldstudie mit einem intelligenten Sprachtutorsystem in Deutschland (Meurers et al. 2019b).
 - Regulärer Englischunterricht, aber FeedBook als Arbeitsheft.
 - Randomisierung innerhalb jeder Klasse: Kinder erhalten spezifisches Feedback zu unterschiedlichen Grammatikthemen
- ⇒ Lernerfolg der Schüler mit spezifischem Feedback ist 63% höher
- bei den sprachlichen Mitteln aus dem Bildungsplan!



Ein klare Win-Win Situation

- Schüler
 - + erhalten individuelle Unterstützung beim Üben → 63% Lernverbesserung
 - + auf ihrem Niveau → automatische Binnendifferenzierung
 - + unabhängig vom Elternhaus → Bildungsgerechtigkeit
- Lehrer
 - + werden von Korrekturaufwand entlastet
 - + können binnendifferenzieren ohne Mehraufwand
 - + Arbeit in der Klasse mit besser vorbereiteten Kindern
- Aufgaben- und Bildungsplanerstellung und -weiterentwicklung
 - + interaktives System ohne Mehraufwand bei der Kodierung
 - + Learner und Task analytics ermöglicht systematische, empirisch fundierte Verbesserung der Materialien und des Bildungsplans!



Aktuelle Weiterentwicklungen des FeedBooks

- Individuelle Differenzierung und Aufgabensequenzierung nach fachlichen und kognitiven Unterschieden
 - Projekt DigBinDiff.de mit Caterina Garwilow (Tübingen)
 - Motivationales Feedback und Schnittstelle vom individuellen digitalen und gemeinsamen schulischen Lernen
 - Projekt Interact4School.de mit Ulrich Trautwein, Benjamin Nagengast (HIB Tübingen) & Torben Schmidt (Lüneburg)
 - Lehrer-Dashboard und Lehrerfortbildungsangebote
 - AI2Teach Projekt (<http://ai2teach.de>) mit HIB (Tübingen), DIE (Bonn), in Kooperation mit dem ZSL
- ⇒ Zwei Studien im aktuellen Schuljahr (*Interesse? Bitte melden!*)



Scaling Up: In der Realität einen Unterschied machen

- Ansatz konzeptionell breit & technisch prinzipiell hoch skalierbar
 - aber Projekte nur finanziert zur Entwicklung und Evaluation für die 7. Klasse Englisch im Gymnasium
- Wie können die nachgewiesenen Vorteile für alle Stakeholder in der Realität ankommen und weiterentwickelt werden?
 - ⇒ In Kooperation mit dem Land hochskalieren als integrierte Lernstandsdiagnostik & Förderinstrument
- ⇒ Vision: Kooperationsprojekt von Universität und Land
 - Weiterentwicklung des Ansatzes und wissenschaftliche Begleitung
 - Inhaltlichen Ausgestaltung für die Klassenstufen und Schularten nach den Lehrplänen durch abgeordnete LehrerInnen
 - Kooperation bei der LehrerInnen-Fortbildung



Zusammenfassung

- Digitalisierung auf Basis etablierter Mechanismen des Zweitspracherwerbs bietet vielfältige Möglichkeiten für
 - Input Enrichment und Enhancement: → FLAIR, KANSAS, (VIEW)
 - Interaktives, entwicklungsproximales Üben mit lernbegleitendem Feedback → FeedBook
- Systematische Verzahnung von KI-Methodenentwicklung, Fachdidaktik und Bildungsforschung ist notwendig für Erfolg
 - effektive Adaptivität und Interaktivität nur mit KI-Methoden möglich
 - KI-Methodenentwicklung nur mit authentische Bildungsdaten möglich
- Systeme bieten nachweisbaren Mehrwert für die Lernenden und entlasten die Lehrenden
 - Essenzielle Grundlage: KI Methoden zur Analyse und Modellierung



Übersicht zu Systemen & Projektseiten (Links jeweils unter System-/Projektname)

- DiDi.schule und FeedBook.schule: Englisch Tutorsystem (7. Klasse)
- Prosodiya.de: Intelligentes Tutorsystem zur Förderung der Lese- und Rechtschreibleistung
- FLAIR.schule: Sprachaffine Suchmaschine für Englisch und Deutsch Lehrkräfte
- KANSAS-Suche.de: Sprachaffine Suchmaschine für Lehrkräfte Alphabetisierung/Grundbildung
- CTAP: Webbasiertes Interface zur Analyse sprachlicher Komplexität für Deutsch, Englisch & bald mehr

- FeedBook Projekt: Entwicklung eines interaktiven Workbooks für den englischen Fremdsprachenunterricht
- DigBinDiff.de Projekt: Digitale Binnendifferenzierung – Integration sprachlicher & kognitiver Maße zur adaptiven Förderung
- Interact4School.de Projekt: Außerschulisches individuelles Lernen und die Schnittstellen zum Schulunterricht
- AI2Teach Projekt: Individuelle Förderung auf der Basis eines erweiterten digitalen Lehr-Lern-Konzepts für den Fremdsprachenunterricht
- Aisla Projekt: An intelligent agent for second language English learning in real-life contexts
- KANSAS Projekt: Entwicklung einer kompetenzadaptiven, nutzerorientierten Suchmaschine für authentische Sprachlerntexte
- CoMiC Projekt: Comparing Meaning in Context (SFB 833/A4)
- ISAAC Projekt: Interactive Short Answer Assessment Component

- Weitere Informationen:
 - ICALL-Research Group: <http://icall-research.de>
 - LEAD Forschungsnetzwerk: <http://www.lead.uni-tuebingen.de>



Zitierte Arbeiten

- Alexopoulou, T., J. Geertzen, A. Korhonen & D. Meurers (2015). Exploring big educational learner corpora for SLA research: perspectives on relative clauses. *International Journal of Learner Corpus Research* 1(1), 96–129.
- Alexopoulou, T., D. Meurers & A. Murakami (2022). Big Data in SLA: advances in methodology and analysis. In N. Ziegler & M. Gonzalez-Lloret (eds.), *Routledge Handbook of Second Language Acquisition and Technology*, Routledge. URL <http://purl.org/dm/papers/Alexopoulou.Murakami.Meurers-22.pdf>.
- Alexopoulou, T., M. Michel, A. Murakami & D. Meurers (2017). Task Effects on Linguistic Complexity and Accuracy: A Large-Scale Learner Corpus Analysis Employing Natural Language Processing Techniques. *Language Learning* 67, 181–209. URL <https://doi.org/10.1111/lang.12232>.
- Berendes, K., S. Vajjala, D. Meurers, D. Bryant, W. Wagner, M. Chinkina & U. Trautwein (2018). Reading demands in secondary school: Does the linguistic complexity of textbooks increase with grade level and the academic orientation of the school track? *Journal of Educational Psychology* 110(4), 518–543. URL <https://doi.org/10.1037/edu0000225>.
- Berkling, K., J. Fay, M. Ghayoomi, K. Hein, R. Lavalley, L. Linhuber & S. Stüker (2014). A Database of Freely Written Texts of German School Students for the Purpose of Automatic Spelling Error Classification. In *Proceedings of the Ninth International Conference on Language Resources and Evaluation (LREC'14)*. Reykjavik, Iceland: European Language Resources Association (ELRA), pp. 1212–1217. URL http://www.lrec-conf.org/proceedings/lrec2014/pdf/255_Paper.pdf.
- Chen, X. & D. Meurers (2016). CTAP: A Web-Based Tool Supporting Automatic Complexity Analysis. In *Proceedings of the Workshop on Computational Linguistics for Linguistic Complexity*. Osaka, Japan: COLING, pp. 113–119.
- Chinkina, M., M. Kannan & D. Meurers (2016). Online Information Retrieval for Language Learning. In *Proceedings of ACL-2016 System Demonstrations*. Berlin, Germany: Association for Computational Linguistics, pp. 7–12. <http://anthology.aclweb.org/P16-4002>.
- Chinkina, M. & D. Meurers (2016). Linguistically-Aware Information Retrieval: Providing Input Enrichment for



- Second Language Learners. In *Proceedings of the 11th Workshop on Innovative Use of NLP for Building Educational Applications (BEA)*. San Diego, CA: ACL, pp. 188–198. URL <http://aclweb.org/anthology/W16-0521.pdf>.
- Chinkina, M. & D. Meurers (2017). Question Generation for Language Learning: From ensuring texts are read to supporting learning. In *Proceedings of the 12th Workshop on Innovative Use of NLP for Building Educational Applications (BEA)*. Copenhagen, Denmark, pp. 334–344. URL <http://aclweb.org/anthology/W17-5038.pdf>.
- Chinkina, M., A. Oswal & D. Meurers (2018). Automatic Input Enrichment for Selecting Reading Material: An Online Study with English Teachers. In *Proceedings of the Thirteenth Workshop on Innovative Use of NLP for Building Educational Applications*. pp. 35–44. URL <https://aclweb.org/anthology/W18-0504.pdf>.
- DeKeyser, R. M. (2005). What Makes Learning Second-Language Grammar Difficult? A Review of Issues. *Language Learning* 55(S1), 1–25.
- Geertzen, J., T. Alexopoulou & A. Korhonen (2013). Automatic linguistic annotation of large scale L2 databases: The EF-Cambridge Open Language Database (EFCAMDAT). In *Proceedings of the 31st Second Language Research Forum (SLRF)*. Cascadilla Press. URL <http://purl.org/icall/efcamdat>.
- Hattie, J. & H. Timperley (2007). The Power of Feedback. *Review of Educational Research* 77(1), 81–112.
- Klein, W. & C. Perdue (1997). The Basic Variety (or: Couldn't natural languages be much simpler?). *Second language research* 13(4), 301–347.
- Krashen, S. D. (1985). *The input hypothesis: Issues and implications*. New York: Longman.
- Lantoff, J. P. & G. Appel (eds.) (1994). *Vygotskian Approaches to Second Language Research, Second Language Learning*. Norwood, NJ: Ablex Publishing Corporation.
- Lightbown, P. M. (1998). The importance of timing in focus on form. In C. Doughty & J. Williams (eds.), *Focus on Form in Classroom Second Language Acquisition*, Cambridge: Cambridge Univ. Press, pp. 177–196.
- Long, M. H. (1991). Focus on form: A design feature in language teaching methodology. In K. De Bot, C. Kramsch & R. Ginsberg (eds.), *Foreign language research in cross-cultural perspective*, Amsterdam: John Benjamins, pp. 39–52.
- Meurers, D., K. De Kuthy, F. Nuxoll, B. Rudzewitz & R. Ziai (2019a). KI zur Lösung realer Schulherausforderungen:



-
- Interaktive und adaptive Materialien im Fach Englisch. *Schulmanagement-Handbuch* 169, 65–89. URL <http://purl.org/dm/papers/Meurers.DeKuthy.ea-19ki.pdf>.
- Meurers, D., K. De Kuthy, F. Nuxoll, B. Rudzewitz & R. Ziai (2019b). Scaling up intervention studies to investigate real-life foreign language learning in school. *Annual Review of Applied Linguistics* 39, 161–188. URL <https://doi.org/10.1017/S0267190519000126>.
- Meurers, D., R. Ziai, L. Amaral, A. Boyd, A. Dimitrov, V. Metcalf & N. Ott (2010). Enhancing Authentic Web Pages for Language Learners. In *Proceedings of the 5th Workshop on Innovative Use of NLP for Building Educational Applications (BEA)*. Los Angeles: ACL, pp. 10–18. URL <http://aclweb.org/anthology/W10-1002.pdf>.
- Michel, M., A. Murakami, T. Alexopoulou & D. Meurers (2019). Effects of task type on morphosyntactic complexity across proficiency: Evidence from a large learner corpus of A1 to C2 writings. *Instructed Second Language Acquisition* 3, 124–152. URL <https://doi.org/10.1558/isla.38248>.
- Murakami, A. (2016). Modeling Systematicity and Individuality in Nonlinear Second Language Development: The Case of English Grammatical Morphemes. *Language Learning* 6(4), 834–871.
- Pienemann, M. (1989). Is Language Teachable? Psycholinguistic Experiments and Hypotheses. *Applied Linguistics* 10(1), 52–79.
- Schmidt, R. (1995). Consciousness and foreign language learning: A tutorial on the role of attention and awareness in learning. In R. Schmidt (ed.), *Attention and awareness in foreign language learning*, Honolulu, HI: University of Hawaii, pp. 1–63.
- Sharwood Smith, M. (1993). Input enhancement in instructed SLA: Theoretical bases. *Studies in Second Language Acquisition* 15, 165–179. URL <https://doi.org/10.1017/s0272263100011943>.
- Vygotsky, L. S. (1986). *Thought and Language*. Cambridge, MA: MIT Press.



Wozu Sprachverarbeitung und maschinelles Lernen?

- Interpretation von authentischen Lernprodukten und -prozessen
 - **Erkenntnisgewinn** zu Lernverläufen & dafür relevanten Parametern
 - repräsentative, longitudinale “Big Data” (Alexopoulou, Meurers & Murakami 2022)
- **formative** Evaluation (→ FeedBook & Folgeprojekte)
 - unmittelbares, interaktives Feedback in Tutorsystemen
 - Auswahl oder Generierung von Materialien/Items zur Unterstützung individuell optimierter Lernpfade (automatische Binnendifferenzierung)
- **summative** Bewertung (large scale assessment → CoMiC, ISAAC)
 - Einsparung von Aufwand, Verbesserung der Konsistenz der Bewertung
 - ermöglicht Nutzung offenerer Itemtypen in großen Studien

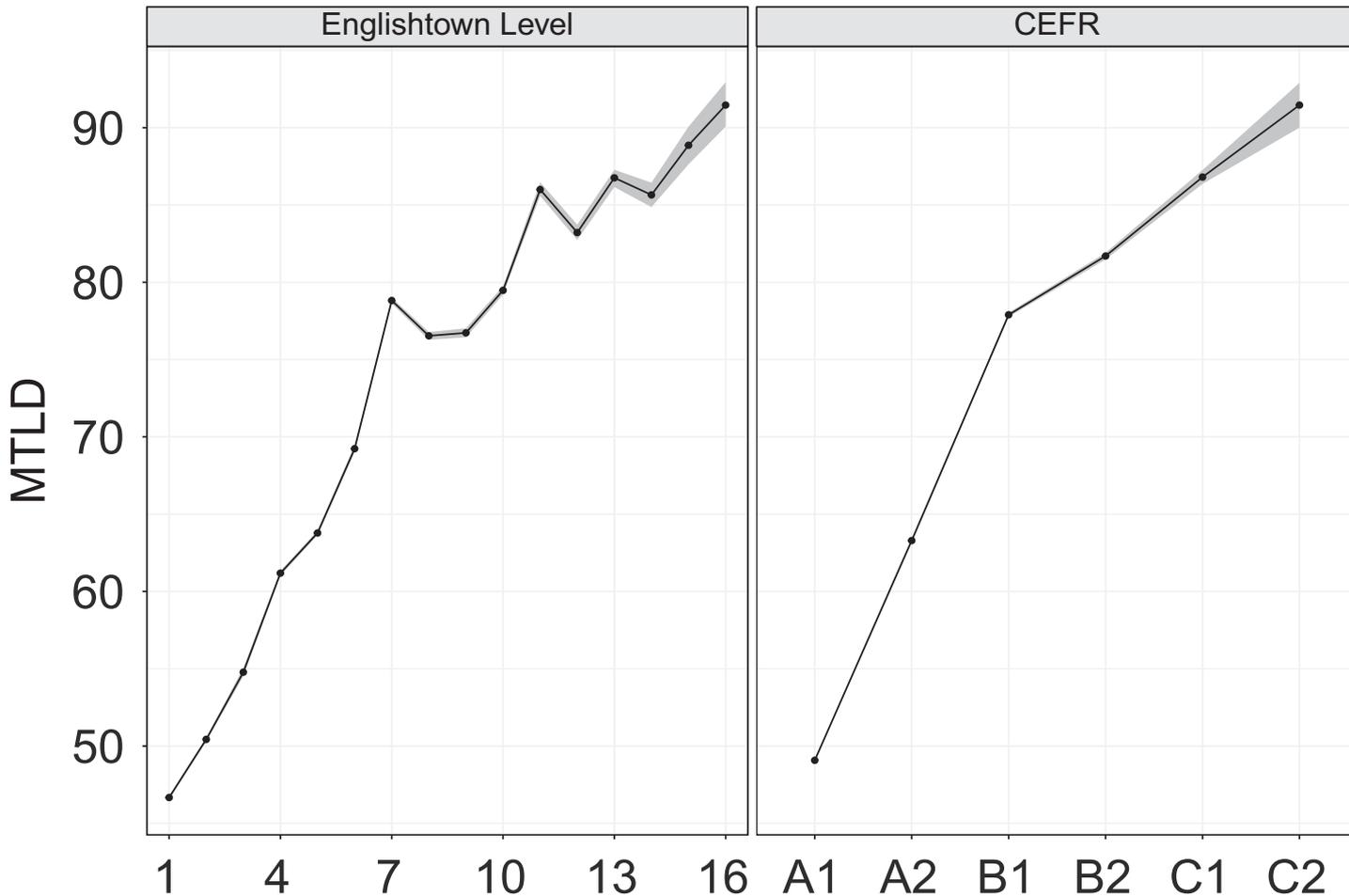


Beispielanalyse zur Sprachentwicklung in Big Data

- Computergestütztes Sprachenlernen unterstützt die Sammlung von groß angelegten Lernerdaten:
 - English Town system → EFCamDat (Geertzen et al. 2013)
 - 16 Niveaustufen (A1–C2 im GERS)
 - EFCamDat v. 2: 1,18 Mio. Texte geschrieben von 175 k Lernern
 - Erlaubt empirisch breit fundierte Analysen
 - des Erwerbs von spezifischen Aspekten des Sprachsystems, z.B. Relativsätze (Alexopoulou, Geertzen, Korhonen & Meurers 2015)
 - der allgemeinen Entwicklung sprachlicher Komplexität (Alexopoulou, Michel, Murakami & Meurers 2017; Michel, Murakami, Alexopoulou & Meurers 2019)
- und des Einflusses von individuellen Unterschieden (Murakami 2016).

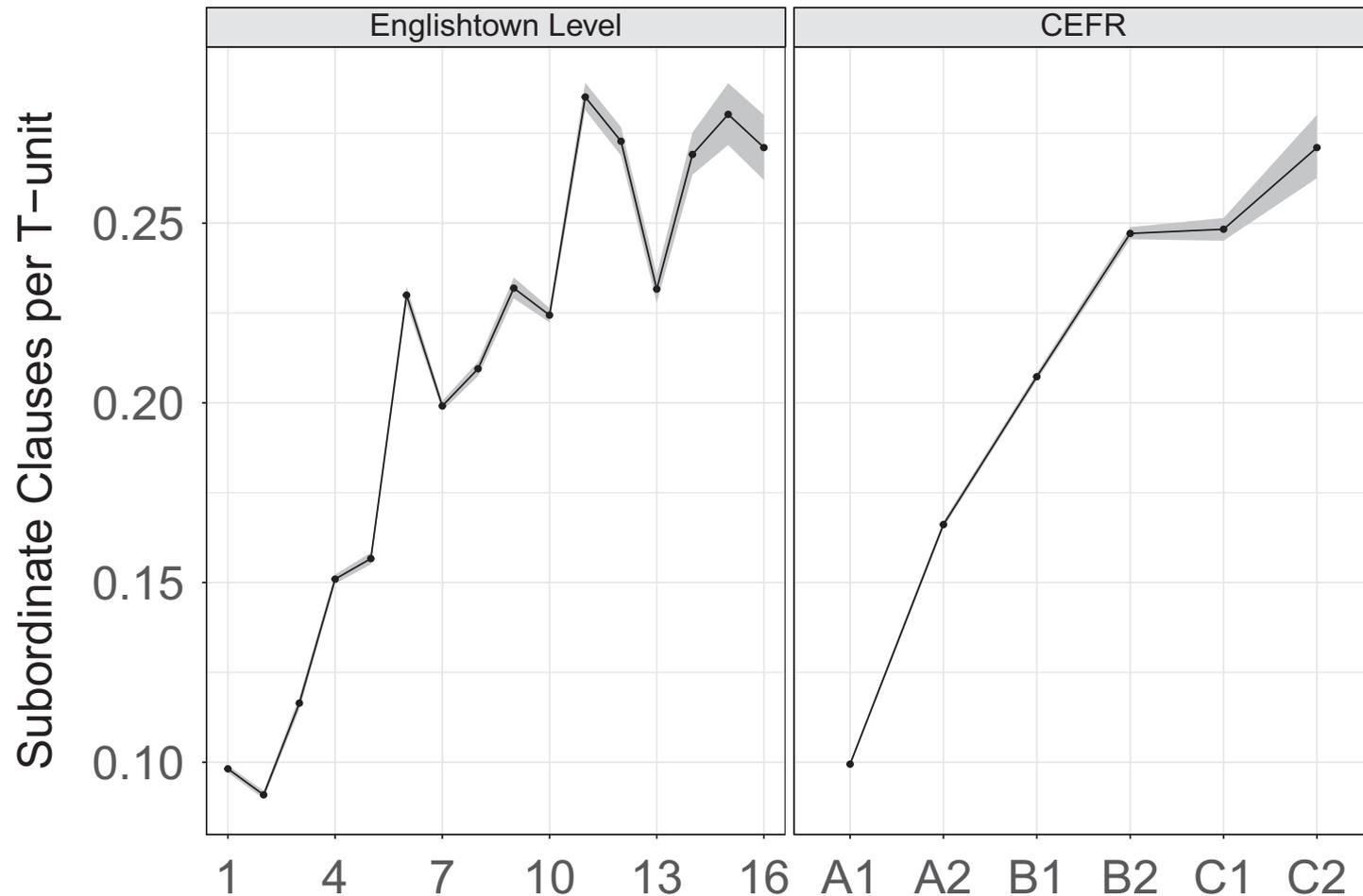


Lexikalische Vielfalt (Mean Textual Lexical Diversity)





Syntaktische Elaboriertheit (Subordination)



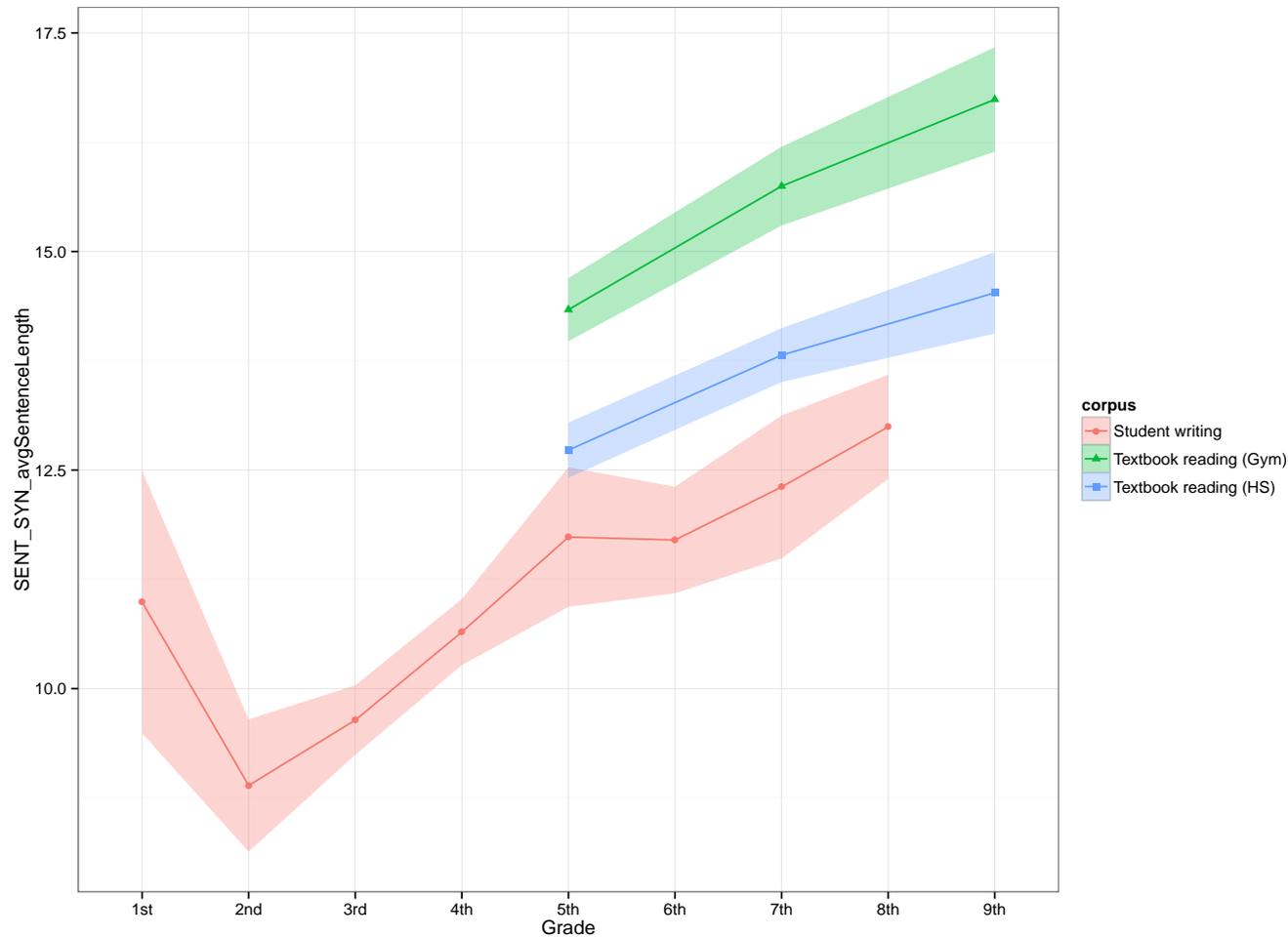


Von der Analyse von Texten zu adaptivem Input

- Ziel: Texte auf sprachlichem Niveau der Lernenden anbieten
- Fachliches Lernen eng mit Bildungs-/Fachspracherwerb verbunden
- Idee: Vergleich der Komplexität von Schulbüchern & Schülertexten
 - Analyse aller zugelassenen Geographiebücher
(Berendes, Vajjala, Meurers, Bryant, Wagner, Chinkina & Trautwein 2018)
 - Referenz: Aufsätze von 1.730 Schülern, 1–8 Klasse
(Berkling, Fay, Ghayoomi, Hein, Lavalley, Linhuber & Stüker 2014, KCT Corpus)

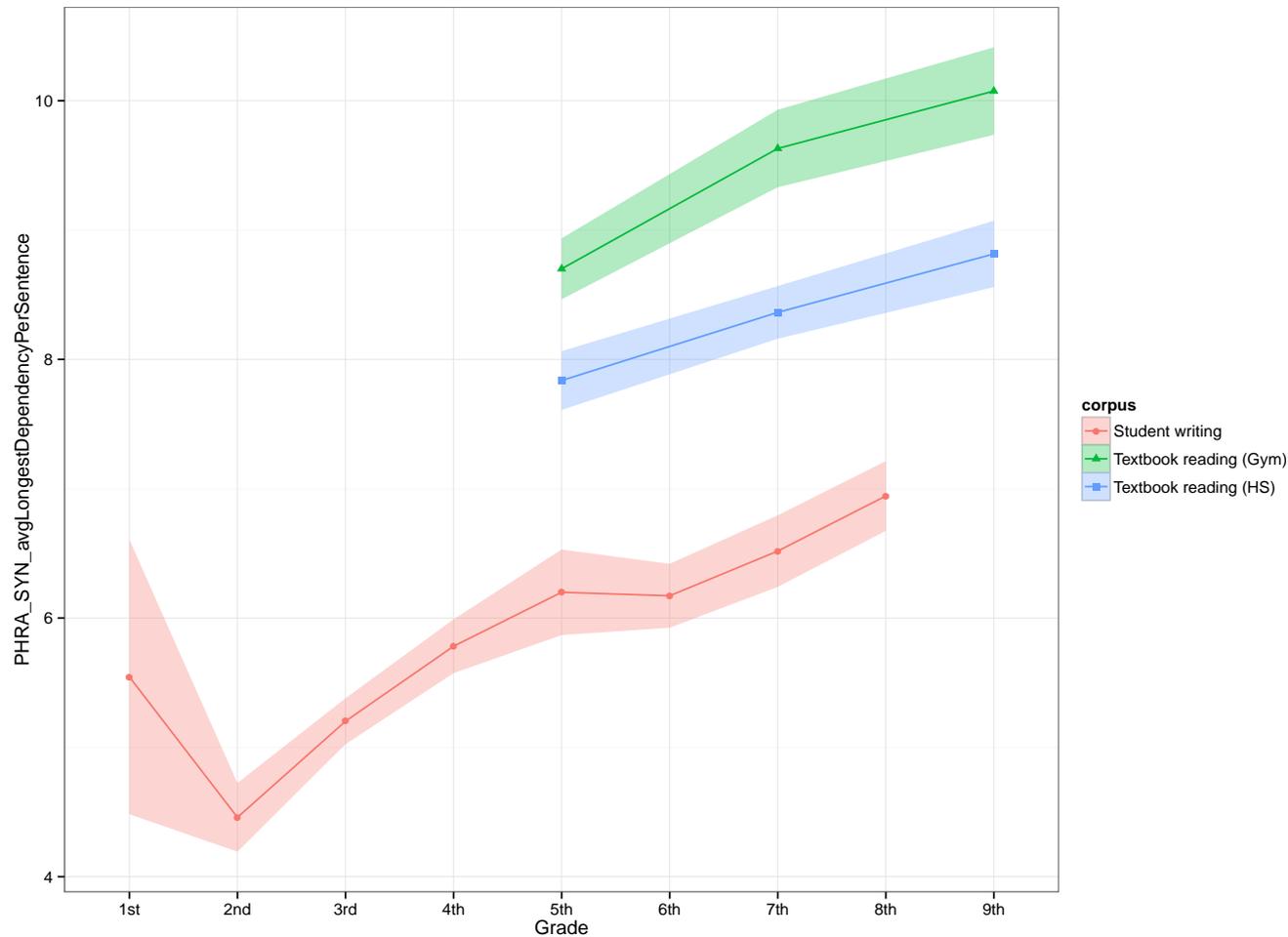


Durchschnittliche Satzlänge



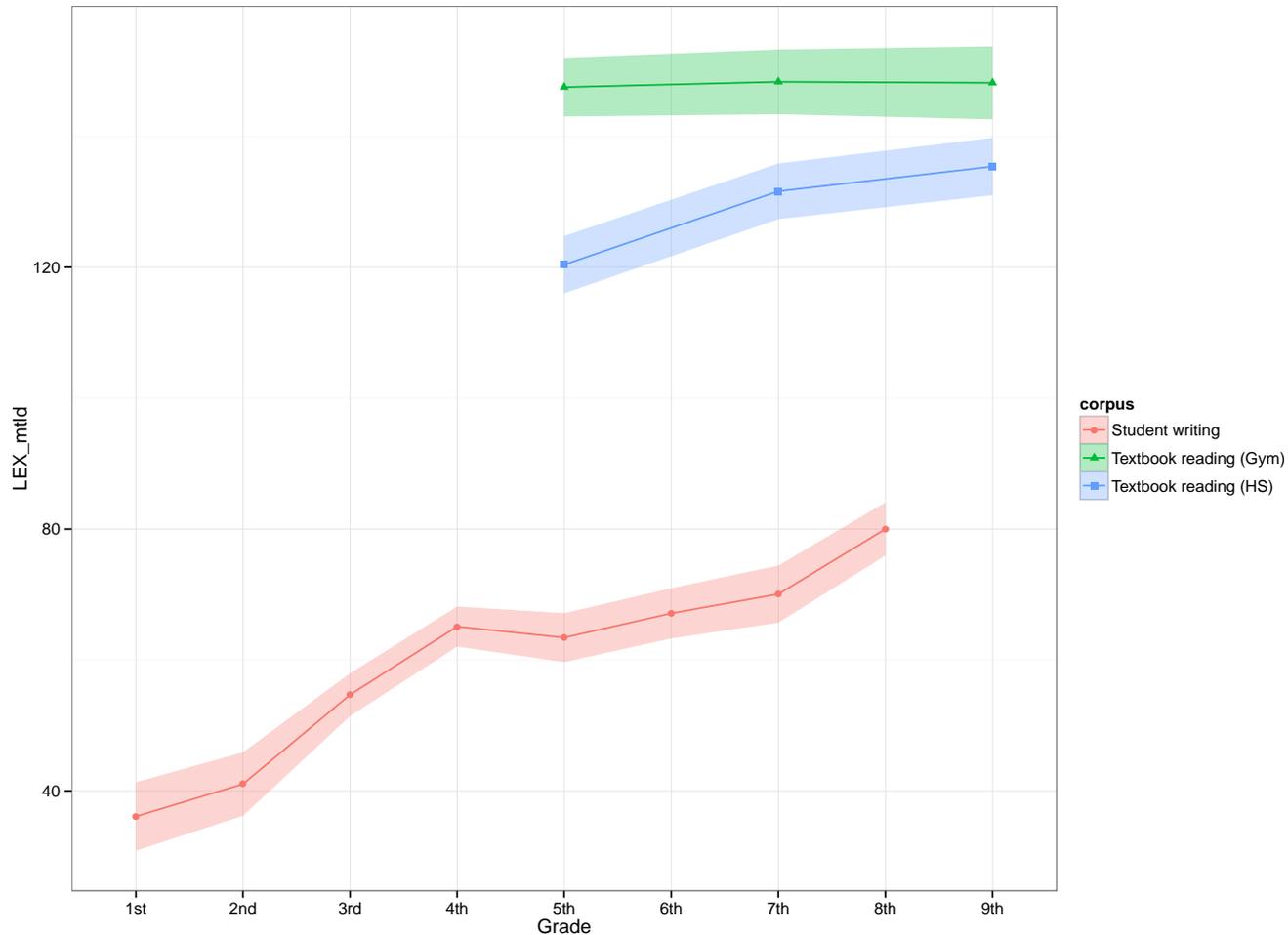


Durchschnittliche längste Abhängigkeit im Satz



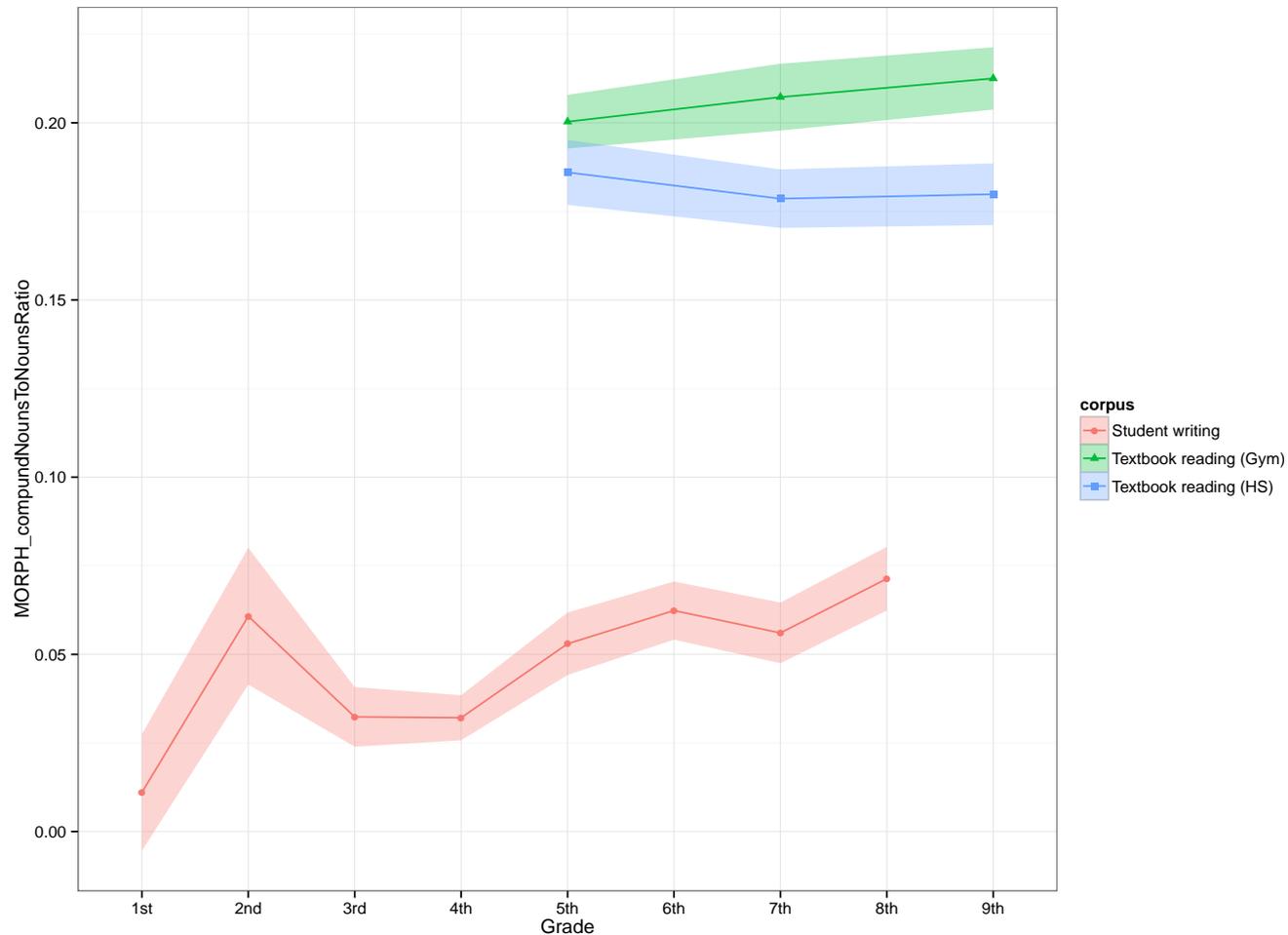


Lexikalische Vielfalt (MTLD)





Nominalkomposita (pro Nomen)





Macht es für's fachliche Lernen einen Unterschied?

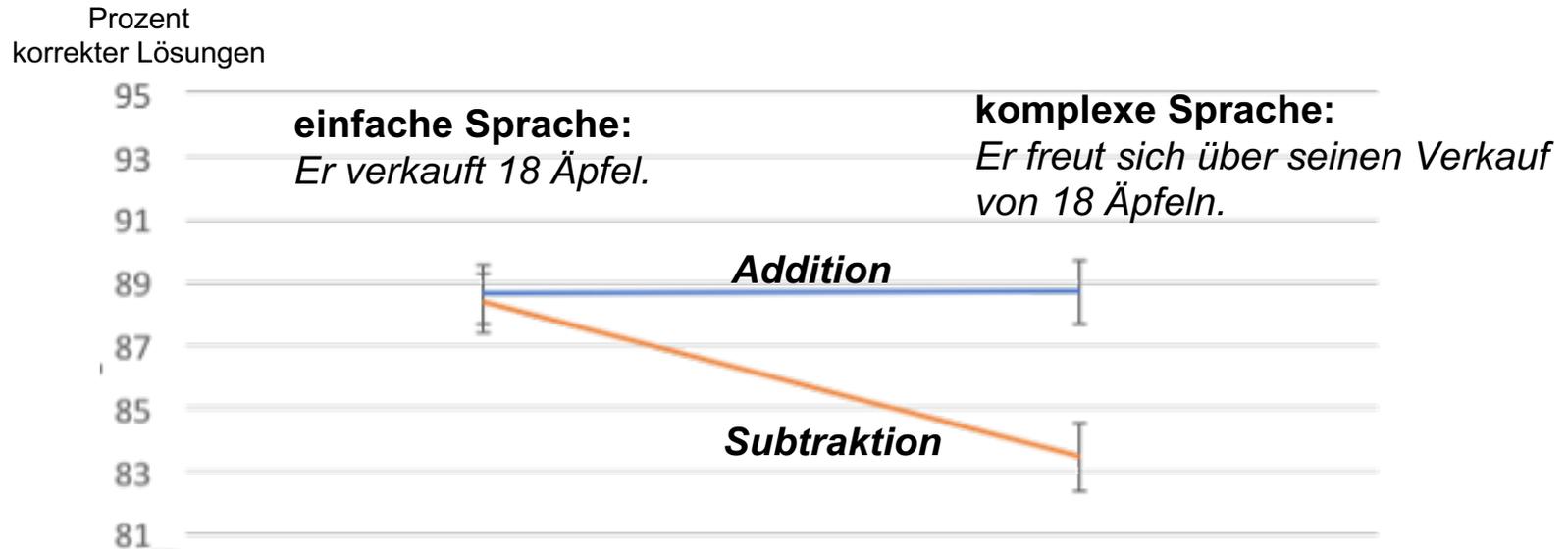
- Mathematische Textaufgaben sind fachlich unterschiedlich schwer (Wahl der arithmetischen Operation, Übertrag, ...):
 - (1) *Ein Bauer führt zum Markt mit 47 Äpfeln.*
 - a. *Er verkauft 5 Äpfel.*
 - b. *Er verkauft 18 Äpfel.*

Wie viele Äpfel hat er am Ende übrig?
 - (2) *Ein Bauer führt zum Markt mit 47 Äpfeln.*
 - a. *Er verkauft 18 Äpfel.*
 - b. *Er freut sich über seinen Verkauf von 18 Äpfeln.*

Wie viele Äpfel hat er am Ende übrig?



Sprachliche Komplexität verursacht Interaktionseffekt!



N = 331 SchülerInnen (10-13 Jahre)

(Daroczy, ..., Meurers, & Nuerk, 2015, *Frontiers in Psychology*;
Daroczy, ..., Meurers, & Nuerk, 2014, *KogWis*)



Analysen für die Praxis nutzbar machen

- Komplexitätsanalyse für Deutsch & Englisch mit web-basiertem CTAP ohne Programmieren möglich (<http://ctapweb.com>)
- Komplexität von Lernmaterialien sprachlich und fachlich adaptiv entsprechend der individuellen Lernerkompetenzen auswählen
 - Sprachaffine Suchmaschine FLAIR (<http://flair.schule>) für Englisch & Deutsch, sowie KANSAS (<http://kansas-suche.de>) für Grundbildung