





Linking Second Language Acquisition Research and Digital Language Learning

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based on collaborative research: http://icall-research.de

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Introduction

• Schools going digital is a common topic in public discourse, e.g.:

Computers in all schools, all students at the computers – this is the program the ministers of education want to realize quickly. [Spiegel No. 47 / 18.11.1984]





In foreign language education, computers are being used

- to increase **motivation** through authentic, multimedia material
 - authentic language material from the target language context (websites, audios, videos)
 - curated language learning material
- to support **communication** with native speakers (using audio, video)
 - asynchronous, e.g., Email, ...
 - synchronous or asynchronous, e.g., Skype, WhatsApp, Snapchat, ...
- to mechanically **practice** vocabulary and grammar
 - mechanically = without modeling the learner, providing feedback
- \rightarrow Computer are used to provide and exchange information & materials.



Beyond computers as digital materials

- More recently, Artificial Intelligence (AI) has become a popular buzzword in Education
 - esp. related to ChatGPT,
 - but usually illustrated with robots.
- What is AI and what opportunities can it potentially provide for (foreign language) education?

KI IN DER BILDUNG

DER DIGITALE LEHRER

Von Katharina Lehmann \cdot 2021

Statt Frontalunterricht mit den gleichen Lerninhalten für über zwanzig Schüler zu geben, gehen KI-Systeme individuell auf die Lernbedürfnisse jedes einzelnen Schülers ein. Für Lehrer bedeutet das Entlastung – sie können sich vor allem um die Schüler kümmern, die ihre Hilfe am dringendsten brauchen.





What is Artificial Intelligence?

- AI = imitating abilities with the computer for which a human needs intelligence
- traditional AI approach, since the 50s: make knowledge and rules explicit
 - successful: e.g., Deep Blue beat chess world champion Garry Kasparov in 1997
 - limited: knowledge and rules not widely available & lack of robustness
- machine learning approach, since the 80s: systems learning from data
 - successful: (only) where a lot of data is available
 - limited: to make predictions, labeled training data is needed



What is Artificial Intelligence? (II)

- Al is increasingly used in practice since 2011: digital voice assistant Siri
 - typically hybrid approaches ("Don't guess if you know.")
 - digital assistants, dialog systems in cars, machine translation, recommender systems
- Self-supervised machine learning approach using deep neural networks (ChatGPT, etc.)
 - challenge: requires machine learning of billions of parameters
 - idea: use texts as "labeled" training data by predicting masked words
 - result: Large Language Models (LLM) trained on \approx a billion words for GPT in 2018 to \approx a trillion now

Note: LLMs know about the world only through the language that they learn to predict.

"The boundaries of my language are the boundaries of my world." (Wittgenstein)



Large Language Models in Practice: ChatGPT

- What can we already do with large language models?
- Potentially interesting opportunities for education.
 - Prompts support generating texts and dialogues
 - \rightarrow generating learning activities (and solving them)





Hello! I'd be happy to help you understand the difference between the past perfect and the \bigcirc \bigcirc simple past tenses in English. Let's take a closer look at each one.

1. Simple Past:

The simple past tense is used to describe actions or events that occurred and were completed at a specific point in the past. It is often used with time expressions such as "yesterday," "last week," "in 2010," etc. The simple past tense is formed by adding "-ed" to the base form of regular verbs, or using the past form of irregular verbs.

Examples:

- She watched a movie last night. (regular verb)
- He ate his breakfast this morning. (irregular verb)
- 2. Past Perfect:

The past perfect tense is used to describe an action or event that was completed before



Limitations of Large Language Models

Being based on likely language sequences, systems such as ChatGPT cannot systematically

- provide reliable knowledge: GPT "hallucinates" whatever is needed to produce well-formed language
- perform **abstractions**: linguistic analysis, logical inferences
- detach from the social and cultural context of the language trained on \rightarrow **bias**
- model **learners** and how to adaptively foster learning

Limitations: Linguistic analysis

Certainly! Let's practice using the simple past and past perfect tenses. I'll provide you with a short paragraph that has a few missing verbs. Your task is to fill in the blanks with the correct verb forms. Here's the paragraph:

Yesterday, Jane (1) her friend Mary for a coffee. Before they (2) each other, Jane (3) a book about a similar topic they (4) during their conversation. Jane (5) Mary about the book, and they (6) an interesting discussion about it.

Fill in the blanks using the following verbs in either simple past or past perfect tense: 'meet', 'read', 'have', 'discuss', 'tell', 'finish'.

Remember to consider whether the action was completed in the past or if it happened before another action in the past. Good luck!



S

1 meet



Great, you've got the first one correct! The simple past tense is used for actions completed \bigcirc \bigcirc in the past. Now try filling in the rest of the blanks with the correct verb forms. Here's the paragraph again with the first verb filled in:

Limitations: Linguistic analysis (II)



Apologies for the confusion, and you are absolutely right! The correct past form of "meet" is $\Box \nabla$ "met." Here's the corrected paragraph with the first verb filled in:

Yesterday, Jane met her friend Mary for a coffee. Before they (2) each other, Jane (3) a book about a similar topic they (4) during their conversation. Jane (5) Mary about the book, and they (6) an interesting discussion about it.

Please proceed with filling in the remaining blanks.



2 have met



Good job! You've used the past perfect tense correctly for the second verb, showing that the \bigcirc \bigcirc action of meeting happened before another action in the past. Here's the updated paragraph:

Yesterday, Jane met her friend Mary for a coffee. Before they had met each other, Jane (3) a

Limitations: Bias

Social Media Test. X ♀ DeepL Translate - Der präziseste X +					\sim	_		ζ
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	Create a class test about social media.							
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D Uniforms in Schools.	Name:							
School Uniforms Debate.	Date:							
Social media in Shakespearea	carefully and choose the best answer from the options provided. You have 60 minutes to							
Social media and Shakespeare	Multiple Choice Questions (2 points each):							
Teaching Comment Writing.	1. Which of the following is NOT a common feature of social media platforms?							
D Social media's potential impac	a) User profiles b) Instant messaging							
面 Clear conversations	c) Algorithmic news feed d) Automatic dishwashing							
은 My plan	 In terms of social media, what does UGC stand for? a) User-Generated Content 							
ô Settings	b) Universal Graphics Consortiu G Regenerate response						\checkmark	
☐ Get help	Send a message	1						

ChatGPT Mar 23 Version. ChatGPT may produce inaccurate information about people, places, or facts.

Limitations: Bias (II)

Social Media Test. x ♀ DeepL Translate - Der pr		∨ – ō ×
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+ New chat	c) Astroturfing d) Phishing	
Social Media Argument.	True or False (1 point each):	
口 Social Media Test. 🥒 前	 True or False: Social media platforms can have both positive and negative effects on mental health. 	
Uniforms in Schools.	12. True or False: Social media algorithms are designed to show users only the content they agree with.	
School Uniforms Debate.	 True or False: Social media platforms have no responsibility for the content posted by their users. 	
Social media in Shakespearea	 True or False: Instagram and Snapchat are examples of image-based social media platforms. 	
D Social media and Shakespeare	15. True or False: It is impossible to make a living through social media.	
Teaching Comment Writing.	Short Answer Questions (3 points each):	
D Social media's potential impac	 Briefly explain the concept of "FOMO" and how it relates to social media. Describe two potential risks associated with oversharing personal information on social media platforms. 	
面 Clear conversations	18. Name two ways businesses can use social media for marketing purposes.	
은 My plan	 19. Explain the term "echo chamber" in the context of social media. 20. List three benefits of using social media for educational purposes. 	
鐐 Settings	S Regenerate response	(\mathbf{v})
☑ Get help	Send a message	1
[→ Log out	ChatGPT Mar 23 Version. ChatGPT may produce inaccurate information about people, places, or facts.	



Towards AI-based tools for foreign language learning

- Digitalization and AI are not values in themselves it is essential to consider
 - what concretely we want to facilitate,
 - to solve which real desiderata of the educational context,
 - based on which scientific insights into learning and teaching (SLA, psychology, pedagogy, ...).

11/47



What do we want to facilitate?

• Interactivity

- facilitate interactive activities and tutorial dialogue
- provide feedback, stepwise leading to successful task completion

Adaptivity

- provide materials at the learner's level (by searching/generating)
- \Rightarrow How? It requires AI methods to
 - analyze and generate **language**
 - model learners and their development towards the curricular learning goals
 - analyze and generate adaptive learning activities
- \Rightarrow Why? To support individual learners (and teachers)
 - How is this grounded in research on the mechanisms of foreign language learning?



Research on Foreign Language Teaching & Learning

- Systematic Second Language Acquisition Research (SLA)
 - since the 60s (Corder 1967; Selinker 1972)
 - recognized as a discipline since around Larsen-Freeman (2000)
 - foundational SLA research, Instructed SLA (ISLA), Foreign Language Teaching and Learning (FLTL)
- Goal is to understand factors and mechanisms involved in SLA
 - and to make use of them for effective teaching and learning
- What key factors have been identified, and how can digitalization become relevant for those?
 - Input
 - Noticing and Focus-on-Form
 - Practice, Feedback
 - Output, Interaction

and the importance of Individual Differences in all of this.



Key Factors: Input

- Input Hypothesis (Krashen 1985)
 - access to comprehensible input at i+1 is essential
 - input should be one step more complex than the interlanguage of the learner
- \Rightarrow AI-based digital tools can help us search for *i*+1 input:
 - SyB: Syntactic Benchmark (http://complexity.schule, Chen & Meurers 2019)
 - FLAIR (http://flair.schule, Chinkina & Meurers 2016)

SyB: Syntactic Benchmark (http://complexity.schule, Chen & Meurers 2017)



	sif	nos.sfs.uni-tuebingen.de		0	<u> </u>
Complexity		How It Works	Analyzer	Challenge	Go to Analyzer
		Your Text			
The children had three impo and poverty at home, the da saw gun violence, when she everything was new for her. both of them got support. Th provides pro-bono lawyers t tries to take of her fears. Be proofe capefrom a fairy tale where they get new clothes	Prtant traumatic experiences they w angers of travel and to be alone and a was a small child and had to chan Both of them had the experience o ne children from the local shelters a o represent unaccompanied minors cause of him, Lara has the feeling of , what tells her, her dad. The childre and other basic needs like food.	rent through. The gang viole d illegal in the US. Also Lara nge the neighbourhood, who f violence at a little age but and the organisation KIND, s, and Lara from her dad, w of securnes. She wears a b en feel secure in the shelter	ence a ere who ho ullet 's,	This text is used to sca proficiency on the targ will be analyzed autom identify the aspect of y that needs to be furthe	ale your get levels. It natically to your language er improved.
	Challenge	Analyze			





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From research to a tool useful in practice

- An exclusive focus on adaptive input is too academic.
- + Support adaptive selection of material that is rich in developmentally proximal language.
 → Enable teachers to specify overall proficiency level and pedagogically-focused linguistic target forms.
- + Support motivating reading tasks for learners!
 - \rightarrow Enable **learners** to search for texts that fit their individual interests!
- ⇒ FLAIR: Form-focused Linguistically Aware Information Retrieval
 - global complexity classification according to GER A1–C2.
 - identification of all language means on the official school curriculum for English

FLAIR Search Engine (http://flair.schule, Chinkina & Meurers 2016)

FLAIR		¢	
	Search Click on the search icon below and type in a query. FLAIR will fetch the top results from the Bing Search Engine. Configure Configure the settings: text (difficulty, length) and language (the passive, wh- questions, academic vocabulary,). You can export the settings to		
Climate change site:www.bbc.c	com English 50 Results CANCEL	SEARCH	<u> </u>

FLAIR: analyzed search results

← FLAIR

€



FLAIR: enriching pedagogically targeted language means

← FLAIR

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SentencesParts of Speech	2	'climate change site:www.bbc.com' B1-B2 149 Sentence(s) 2802 Word(s)	an >
VerbsVerb Forms	5	1 The law that could make climate change illegal - BBC Future https://www.bbc.com/future/article/20200706-the-law-that-could-make-climate-change-illegal Climate change is a global problem - if it is not tackled everywhere, it will affect everyone. The modern world is also incredibly intertwined: products - and resultant emissions - made in one	nts nave ne us," the ions that problem own in
 Tenses Aspect Time Voice 	2 2	 Climate change: US formally withdraws from Paris agreement https://www.bbc.com/news/science-environment-54797743 After a three-year delay, the US has become the first nation in the world to formally withdraw from the Paris climate agreement. President Trump announced the move in June 2017, but UN regulations Image: Climate change: US formally withdraws from Paris agreement is a succession of governments from taking decisions is collectively end up with them being missed. But a new and ambitious climate law recently pass Denmark tries to find a way around this problem, ar of the other common pitfalls of climate laws. It ma Denmark one of a small number of countries begin 	stop a that ed in nd some kes ning to
 Phrasal Phrasal verbs 	48/50	 Climate change: Can an enormous seaweed farm help curb it? https://www.bbc.com/news/science-environment-63200589 He's confident his Seafields floating farm will draw sufficient CO2 from the air to moderate the effects of climate change, while also earning its backers carbon credits. At 55,000 sq km (21,200 	nuinely one of the e change r illegal.
Ƴ Modal		4 Plant-based diet can fight climate change - UN - BBC News https://www.bbc.com/news/science-environment-49238749 Construction Count Weight Image: Climate change poses a threat to the security of our food supply. Rising temperatures, increased rain and more extreme weather events will all have an impact on crops and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Climate change poses a threat to the security of our food supply. Rising temperatures, and livestock. Image: Climate change poses a threat to the security of our food supply. Rising temperate the security of our food supply. Rising temperatures,	
✓ Transitive✓ Imperative	2	5 The climate films shaping society - BBC Future Export document Export document	<

FLAIR: exporting selected text





Key Factors: Noticing and Focus-on-Form

- Input alone only results in **Basic Varieties** (Klein & Perdue 1997).
- Some attention to forms crucial: **Noticing** Hypothesis (Schmidt 1995)
- Foreign language learners need a Focus-on-Form (Long 1991; Lightbown 1998).
 - Why? to overcome partial or missing competencies
 - How? Input enhancement to increase salience (Sharwood Smith 1993)
- \Rightarrow AI-based digital tools can support Input Enhancement (IE):
 - \Rightarrow Visual Input Enhancement of the Web (Meurers et al. 2010)
 - ⇒ Functional IE: Generation of questions targeting sentences with relevant forms (Chinkina & Meurers 2017)

Visual Input Enhancement Example



Americas

Europe

England

Scotland

UK Politics

Education

Magazine

Business

Science &

Environment

Technology

Entertainment

Health

Wales

UK

Asia-Pacific

Middle East

South Asia

Northern Ireland

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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.



Cows moo with a regional twang

Listen Cow moo recordings

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.

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

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Visual Input Enhancement Example: Making Prepositions Salient



Middle East

South Asia

UK

England

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1 Doubt cast on Israel raid

Northern Ireland Scotland Wales UK Politics Education Magazine Business Health Science & Environment

Technology Entertainment

Input enhancement supporting young readers (COAST, Holz et al. 2018)

COAST

Betmar Meurers

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Startseite → Text anlegen Eingabe ⑦ Titel Herbst (aus dem Klexikon) Inhalt Lindat

Der Herbst ist eine Jahreszeit. In Süddeutschland nennt man ihn auch Spätjahr, das Gegenteil zum Frühjahr oder Frühling. Der Herbst folgt auf den heißen Sommer. Nach dem Herbst kommt der kältere Winter.



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In der Natur ist der Herbst die Zeit, wenn die Blätter an den Bäumen sich verfärben. Das Wasser in den Bäumen zieht sich zurück in die Äste, den Stamm und die Wurzeln. Die Blätter



Key Factors: Practice and Feedback

- Skill Acquisition Theory (DeKeyser 2005)
 - Teaching provides declarative knowledge, then **practice** is needed for automated, proceduralized skills.
 - Goal: fluent ability that does not bind attention
- Feedback is one of the most effective factors in supporting learning (Hattie & Timperley 2007).
- How can students effectively practice, given the large individual differences?
 - Without adaptive activity selection and scaffolding feedback at home, effective practice is not possible.
- How can students receive activities at their level and feedback?
 - limited time with teachers
 - dependence on support at home bad for educational equity
- ⇒ Intelligent tutoring system: FeedBook (Rudzewitz et al. 2017; Meurers et al. 2019)



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From printed workbook to AI-based FeedBook

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.

2. Gwynn is very disappointed. Gillian doesn't like Wildings School as much as l

Welcome to Wales

ZIEL



GYP2 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. Feedback für "If she listens more to Gillian			
If she listens more to Gillian, she feels better.	With conditional clauses (type 2), we use the		
2. Gwynn is very disappointed. Gillian doesn't like Wilding	simple past in the if-clause, not the simple present.		
3. George and Rajiv feel bad because they don't have a pres	Hilfreich? O Ja Nein		

FeedBook: Feedback on language forms

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. • *LiF8R: 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
 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 	 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.

0

FeedBook: Feedback on language forms

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Welcome to Wales 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 centre, I could at least go shopping. But there's look at two boarding schools with Gwynn. His sister nothing, no shops, no cinema, no nothing ... only went to Wildings and he says it would be great for sheep! me. If they had a football team, it wouldn't be so bad, My room is really nice and big though and we have a but it's all so girly-girly with horses and ballet fab garden which is great for playing football. If I 5 dancing and everything, yuk! I don't want to go to made some friends in the village, we could have a the school in Llandysul either. It still feels like Gwynn great time there. I met Gruffudd, the boy from next and Mum just want me to go to boarding school door, this afternoon. He seems nice. He started because of the new baby. Miss my pals like crazy, talking to me in Weish and I couldn't understand miss London and my old school. If my friends were ANYTHING. He then spoke English and told me he 10 here, boarding school would actually be fun. Being plays rugby. Well, it's not football but I might have to the new girl at school without any friends will be learn to like it. They all love rugby here. horrible. 1 And it's all Gwynn's fault! The village Aargh, If I had some credit on my phone, I could call where we live now is the worst. 20 minutes to the Caroline. Hope I get some pocket money tomorrow. nearest supermarket. If there was a shopping 35

20

25

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

it is great

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it is great

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

his sister goes there

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What does the FeedBook offer?

- immediate, supportive feedback that guides students towards understanding
- Automatic analysis with AI methods instead of manual coding for each activity or submission.
 - 188 different feedback types to tenses, comparatives, relative & reflexive pronouns, gerunds, passives, conditionals, (in)direct speech.
 - covers all language means of the 7th grade English curriculum
 - Each new task entered by the editor is immediately interactive.
- Is this effective in a real-life school context?
 - First randomized trial (RCT) with Intelligent Language Tutoring System in Germany (Meurers et al. 2019).
 - regular English classes, but FeedBook replaces printed workbook and within-class randomization: children receive specific feedback on different grammar topics
 - \Rightarrow 63% higher learning gains for specific feedback condition (Cohen's d = 0.56)

A clear win-win situation

- Students
 - + receive individualized support while practicing \rightarrow 63% learning improvement
 - + at their level \rightarrow automatic internal differentiation
 - + regardless of family characteristics \rightarrow educational equity

Teachers

- + have a reduced burden to provide written feedback
- + can rely on internally differentiated practice without additional effort
- + can work in class with better-prepared students
- + are better informed about abilities of individuals and class
- Researchers in authentic settings can investigate the effects of
 - + different types of feedback, exercise types, learning targets given individual learner differences
- Textbook authors and curricular designers
 - + learner & activity analytics enable systematic, empirically-based improvement of materials & curriculum

Learner model: What do I know & what should I work on?

Lernermodell betrachten

Hier werden Statistiken zum Lernverhalten angezeigt. Bitte unten auf eine Kategorie klicken um mehr zu erfahren.

future tense	
present tense	
past tense	
reported speech	
conditionals	
comparatives	
relatives	
reflexives	
gerunds	
passive	

Detmar Meurers: "Linking Second Language Acquisition Research and Digital Language Learning"

Learner model: How about the past tense?

Learner Model: What should I work on?

Learner Model: What are my most common errors?

Activity model identifies typical student misconceptions

Present progressive = form of 'be' + -ing.: 2.57 %

Activity model: Is this activity effective for learning?

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

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.		0
3. watch TV/sit on the bus	6	0

Activity model: Yes, this activity is effective for this population

April 28, 2023

Detmar Meurers: "Linking Second Language Acquisition Research and Digital Language Learning"

Integration of individual practice & teacher-orchestrated task-based class?

- Organize exercises so they empower learners to participate in the functional tasks.
 - improves acceptance of practice as pre-task activities in a task-based curriculum
 - fosters intrinsic motivation of students

• RCT with 847 students: higher learning gains for task-based dashboard (Parrisius et al. in prep).

Task-oriented vocabulary practice (Santhi Ponnusamy & Meurers 2021)

- How can we support learners in reading any texts they are interested in?
- To read and understand a text, about 98% of words must be known.
 - Special editions of texts for foreign language learners are lexically annotated.
- Treat vocabulary learning like a pre-task activity for the task of reading a book.
- Goal: systematically introduce learners to the lexical material they need
 - automatically derive the structured, semantically organized vocabulary space to organize learning efficiently
 - support individual learner models, with preactivation using proficiency level
 - contextualize lexical learning using sentences from the book of interest

Generating the lexical graph for a book

• Given a book, the graph is automatically derived from the semantic vector representation (GloVE) of the word families.

Learning activity generation

- Vocabulary practice and testing uses generated multi-gap activities (Zesch & Melamud 2014).
 - Sentences taken from book, ranked using GDEX (Kilgarriff et al. 2008).
 - Distractors automatically selected from graph based on semantic similarity range.

Recording learning in the learner model

• The learner model is an overlay on the book's graph representation.

Key Factors: Interaction and Output

- Interaction is central for language development (Vygotsky 1986; Lantoff & Appel 1994)
 - Learning results from interacting with a learner in their **Zone of Proximal Development (ZPD)**
 - Partner **scaffolds** learner development.
- Output hypothesis (Swain 2005)
 - only language production requires full specification
 - since understanding of input can rely on "good enough" processing

Interaction in dialogue with spoken language: AISLA (Chen et al. 2022)

Summary

- Digital tools can support a range of aspects of Foreign Language Teaching based on mechanisms established by SLA research:
 - input adapted to the learner level supporting input enrichment & enhancement fostering noticing
 - adaptive practice with scaffolding feedback
 - interaction and output
- Such tools require AI methods to
 - analyze and generate language
 - model learners, activities and curricular learning goals
- Integrating such AI-based tools into educational practice can support the empirical evaluation of tools & underlying research in authentic, ecologically valid contexts to
 - effectively support students with scaffolding feedback (Meurers et al. 2019)
 - better inform teachers about the learning progress and reduce their work load
 - improve materials and curricula
 - advance our understanding of second language acquisition

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