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FeedBook: A Web-based Workbook for English

From Supporting the Interaction of Students and Teachers to Automatic Adaptive Scaffolding for Individual Learners

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Introduction

- SLA and FLT research has stressed the importance of individualized, immediate feedback for language learning.
- Problem: limited opportunity for individual, immediate feedback
- In the classroom, the teacher is generally the only source of reliable and accurate feedback available to students, but:
  - little time to focus on individual students, and
  - heterogeneity of students is challenging in the classroom
- Outside of class, how can students be supported in a fair way (not relying on parents)?

Computer-Assisted Language Learning (CALL)

- CALL systems can support practice, but they require hand-coding of all potential responses for which feedback is to be provided.
  - As a result, immediate system feedback generally is only given for restricted form-based exercises and limited to true/false feedback.
  - But teachers may log in to provide feedback after exercise completion.
- Example: *Englishtown* CALL system (EF Education First)
  - It is of particular interest here to showcase the rich, task-based data on language learning that web-based systems can provide.
  - Cambridge University (Dora Alexopoulou) provides the EnglishTown learner & teacher data in EFCamDat Corpus (Geertzen et al. 2013)

EFCamDat Corpus

- 16 levels covering A1 to C2 in the CEFR
- In EnglishTown each level consist of 8 units with receptive and productive activities; EFCamDat includes the free writing data.
- The second release about to be made available contains
  - 175 thousand learners, who provided
  - 1.18 million scripts, with
  - 787 thousand scripts (= 66.7%) containing teacher corrections
- Supports empirically grounded analyses of development, e.g.
  - relative clauses (Alexopoulou, Geertzen, Korhonen, and Meurers 2015)
  - complexity & task effects (Alexopoulou, Michel, Murakami, and Meurers 2017)
  - …

Tutoring Systems

- How can we design CALL systems in a way avoiding massive manual specification and for a broader range of tasks?
- Intelligent Tutoring Systems (ITS) can help address this issue
  - interactive and adaptive to individual student
  - quite a bit of research (cf., e.g. Heift and Schulze 2007)
  - but virtually absent from real-life formal teaching

→ Our goals:

  - close gap between ITS research, FLT insights, and real-life classroom
  - address real formal education needs using current NLP technology

FeedBook: a web-based workbook for English

- Starting point: *Camden Town Gymnasium 3* Workbook
  - approved for 7th grade English classes in German secondary schools

  → existing workbook, already integrated into real-life formal education
- Our FeedBook system provides a web-based implementation of the traditional print workbook enabling
  - students to complete activities online
  - teachers to give formative and summative feedback

  → was pilot tested in four classes last school year
- New system version about to be released in addition provides
  - immediate scaffolding feedback for individual learners to incrementally guide them towards successful completion and understanding

  → will be used throughout the new school year in eight classes

Adapting a paper-based workbook

- Goal: Improve the learning experience for the students and support the teachers with minimal overhead.
  - make FeedBook as similar as possible to look and feel of print version

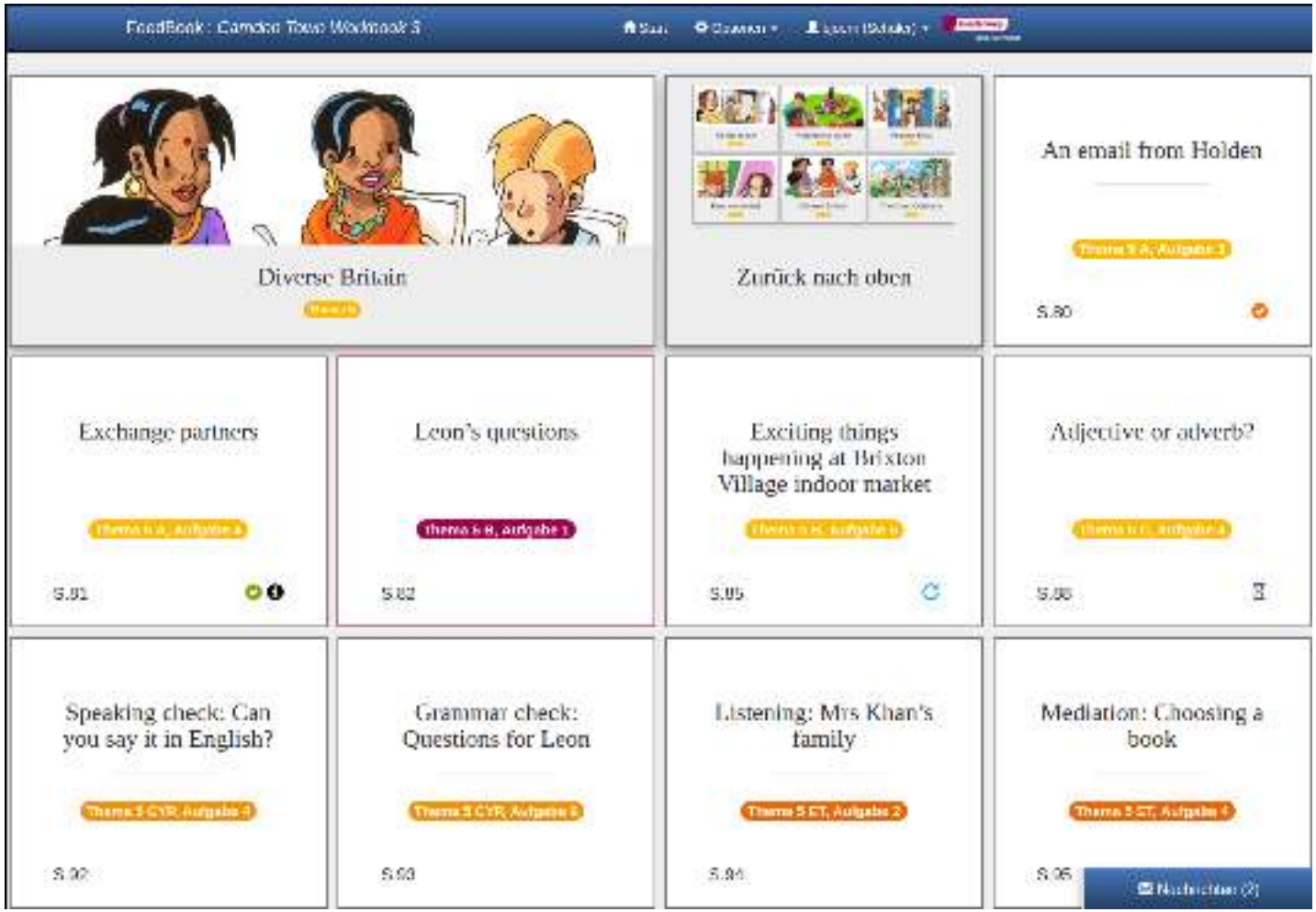
  $\Rightarrow$ without training, users familiar with print workbook immediately benefit
- Originally focused on two main activity types:
  - short answers, requiring sentences, usually meaning-oriented
  - fill-in-the-blanks, usually targeting lexical content or form

  Given teacher feedback, we are extending coverage to all exercises in the print workbook to offer full replacement.
- Online version adds some functionality:
  - interaction, navigation, user management, . . .

The FeedBook System (Version 1.0)

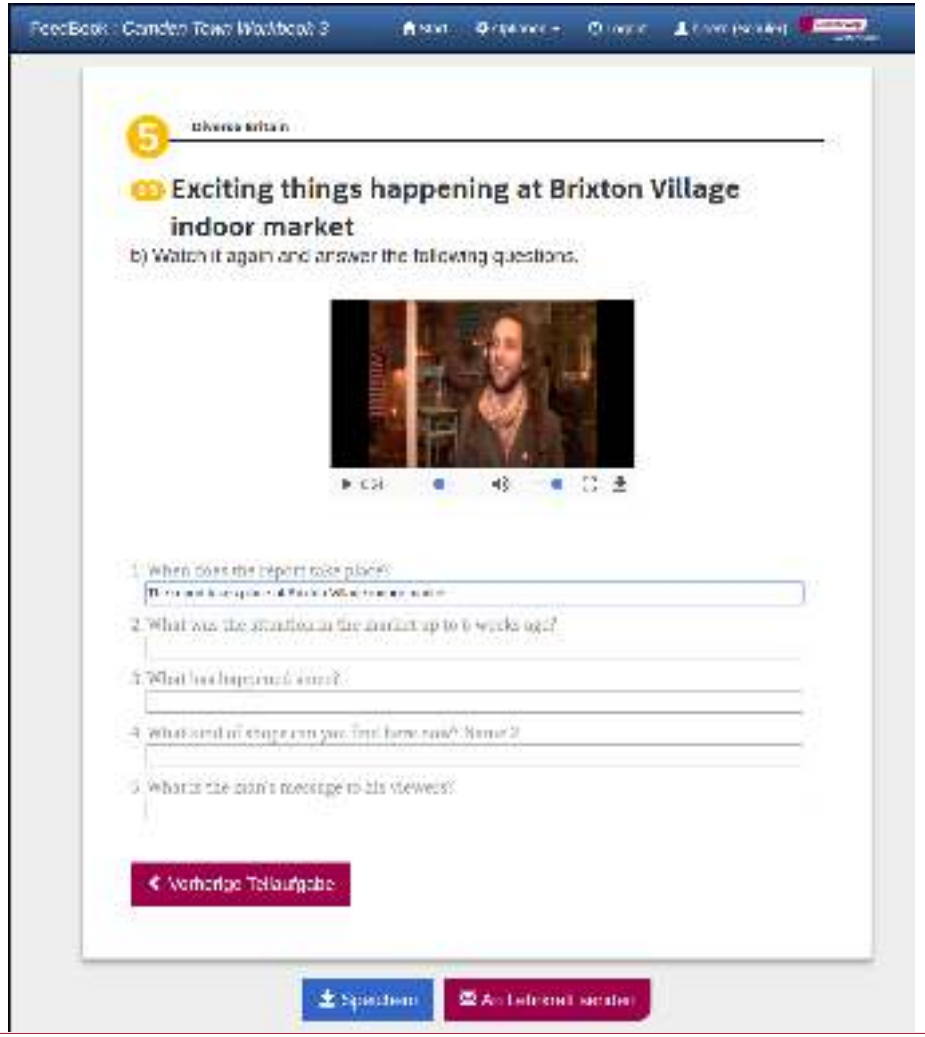
- Platform-independent web application, designed to run on computers, tablets, and smartphones.
- Common school workflow supported by FeedBook 1.0:
  1. students work on exercises assigned as homework
  2. students submit results to their teacher
  3. teachers correct student answers and return them with feedback
  4. students inspect the teacher's response

FeedBook - Student Lobby

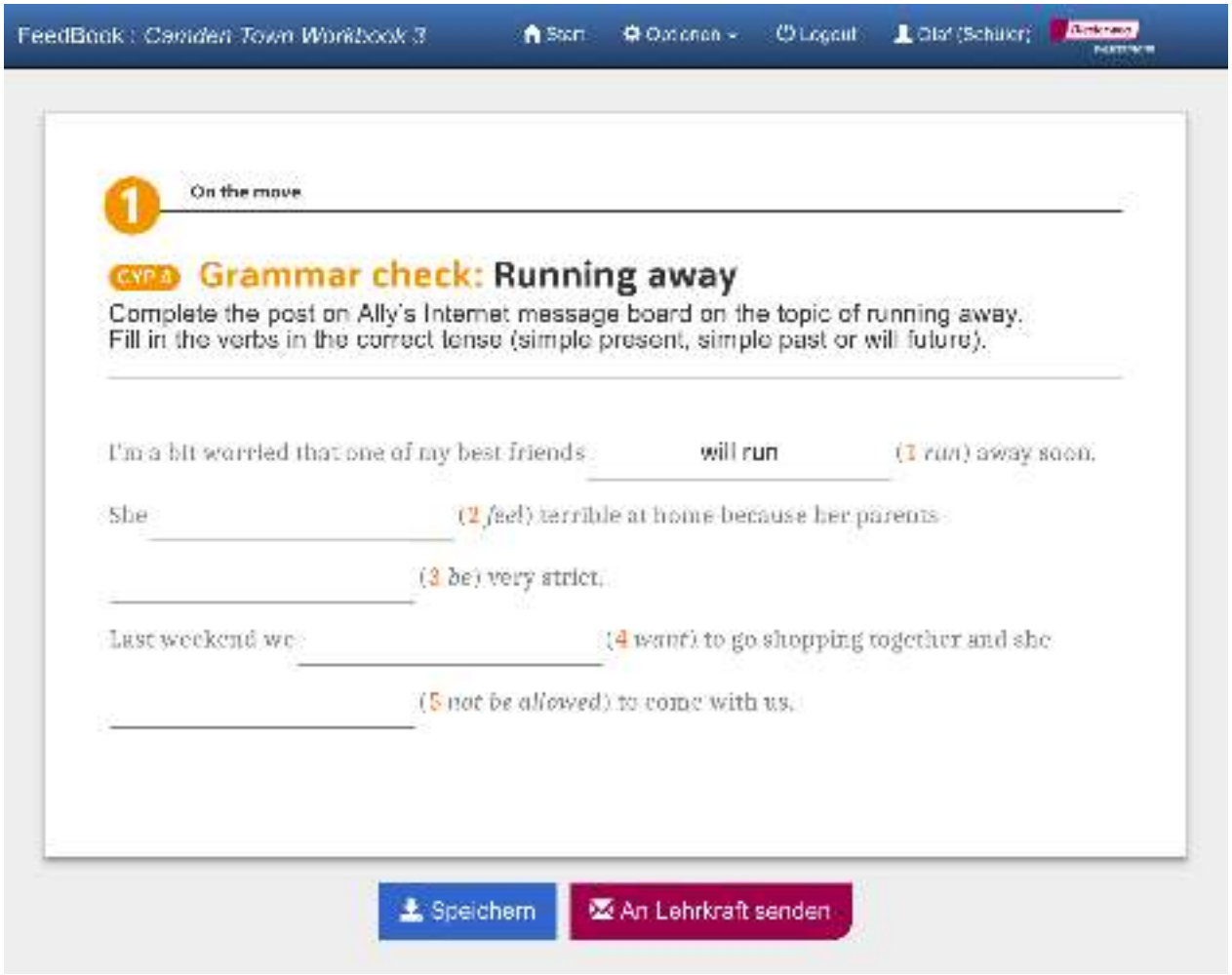


Meaning-based example: listening comprehension

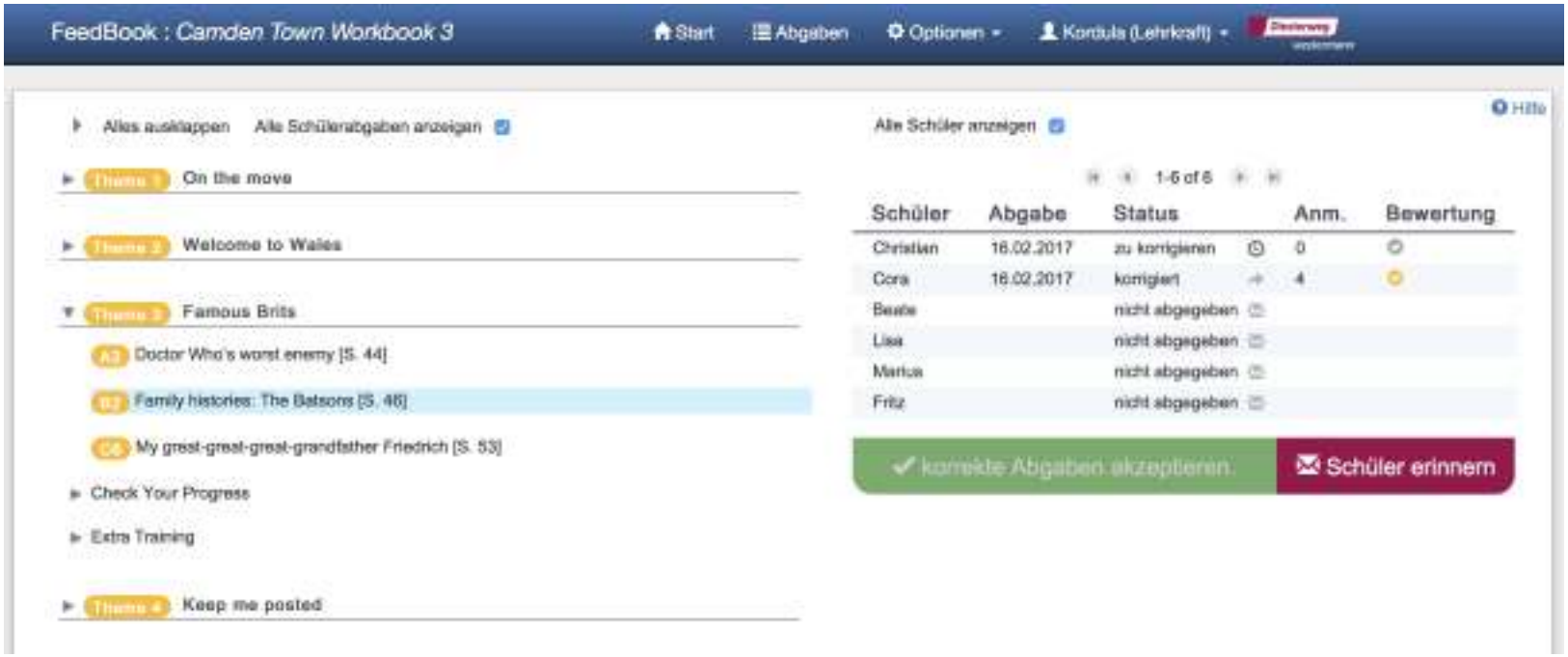
- Each subtask is displayed on one page.
- Each page contains all relevant information & media.
- Student can save or submit exercise.



Form-based example: fill-in-the-blanks



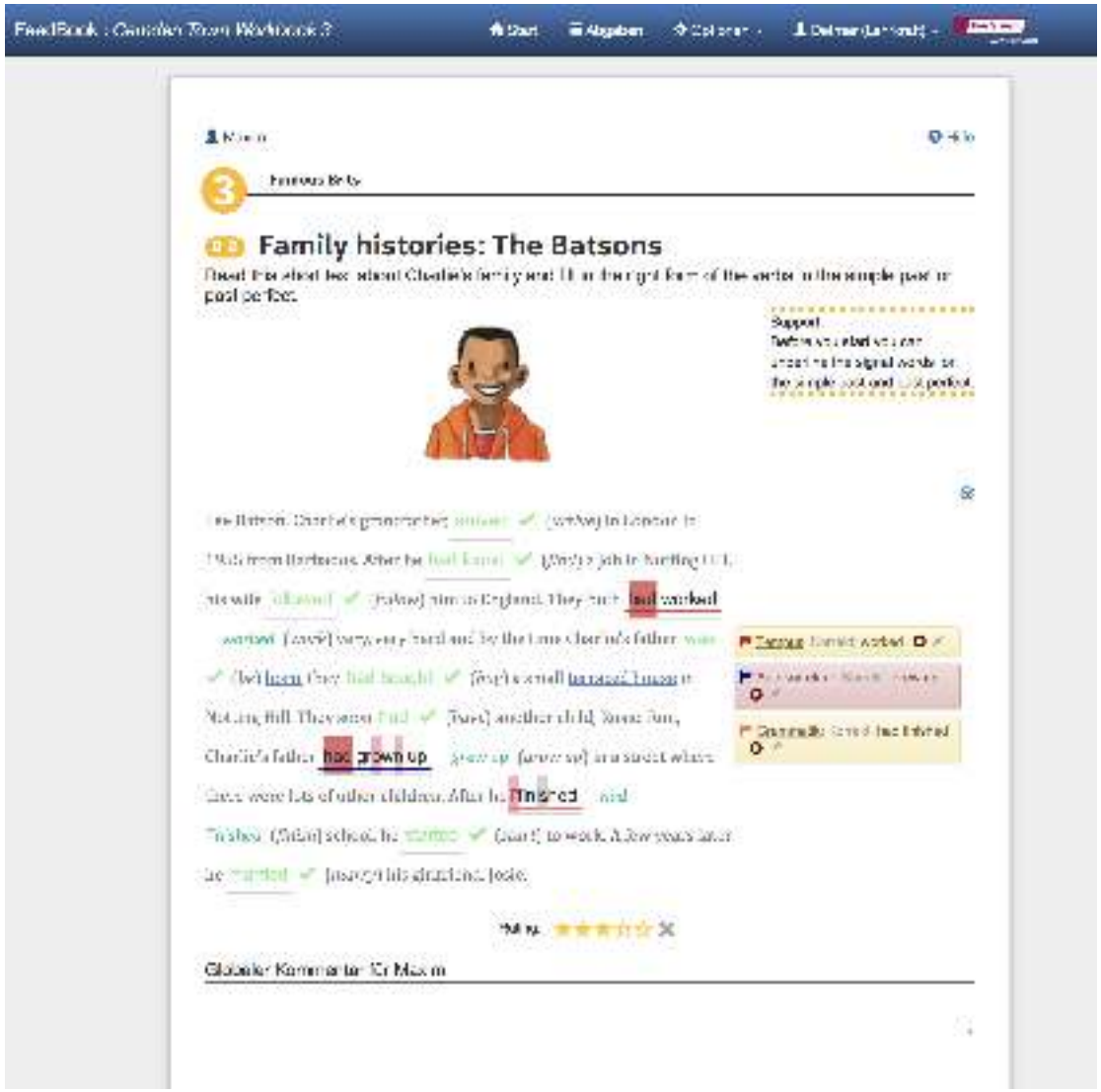
FeedBook - Teacher Lobby



- System shows overview of student submissions and indicates tasks to be corrected.
- Teacher selects exercise for correction.

Correction Interface

- Interface shows:
  - complete exercise
  - student answers
  - target answers
  - correction aids
- Task of the teacher:
  - mark & categorize learner errors
  - give optional comments & rating



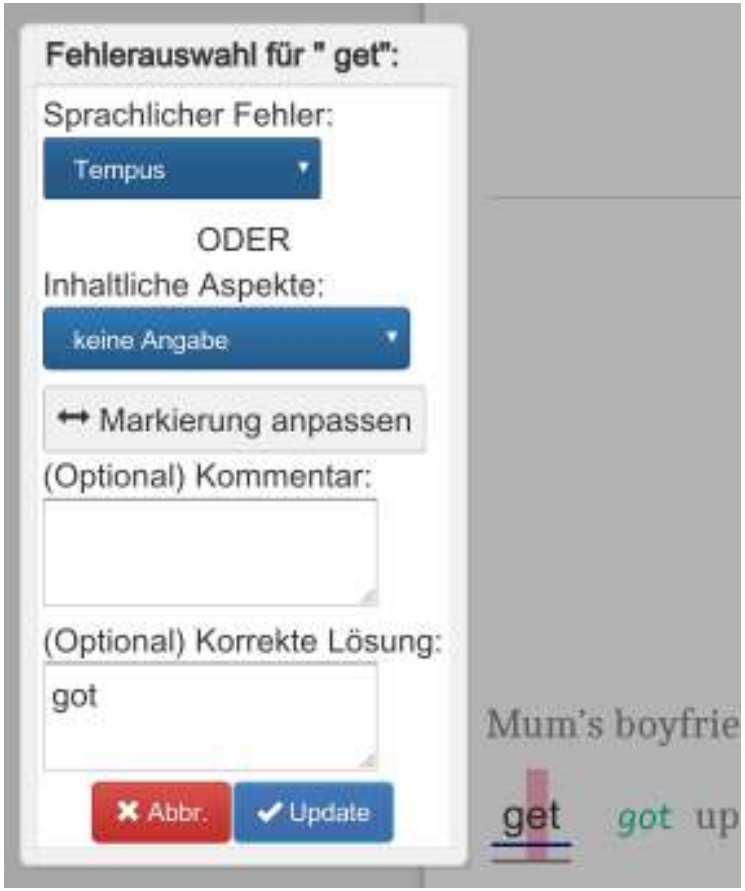
Correction Aid: Visual Highlighting

- Student answer is string-matched against target from teacher booklet.
- If match is positive, students answer is marked as correct.
- Diff-like algorithm finds & highlights parts of student answer that differ from target answer.



Annotation by Teachers

- Teacher selects part of the student answer and
- chooses error category describing nature of divergence.
- Optional free-form comment and automatic inclusion of correct solution.



Annotation Types in FeedBook

- based on annotations by teachers in a paper-based pilot

Language form errors	Content errors
- grammar	- problematic understanding
- spelling	- missing information
- agreement	- wrong information
- clause structure	- lack of understanding
- tense	- extra information
- determiner	- alternate answer
- pronoun	
- preposition	
- word choice	
- missing word	
- word order	
- punctuation	

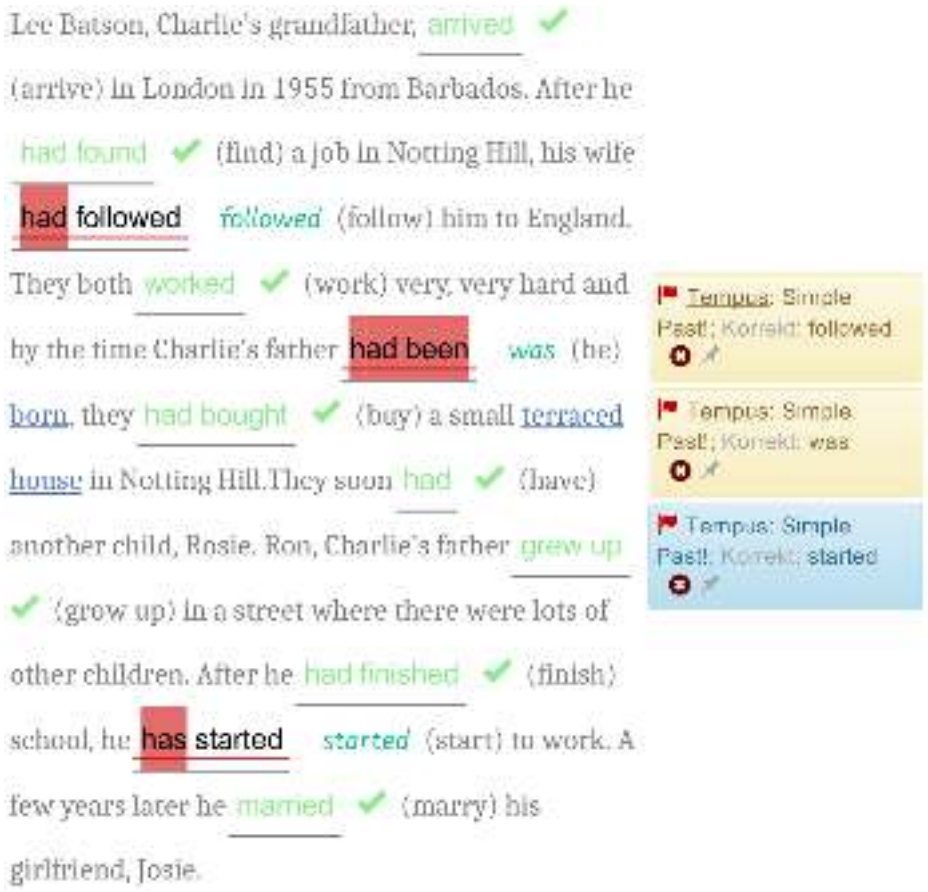
Correction Aided by Feedback Memory

- FeedBook remembers and reapplies previously given feedback for a given item.
- “Auto-correct” annotations are added by system for each other divergence.
- Teacher can spell out or modify any annotation.

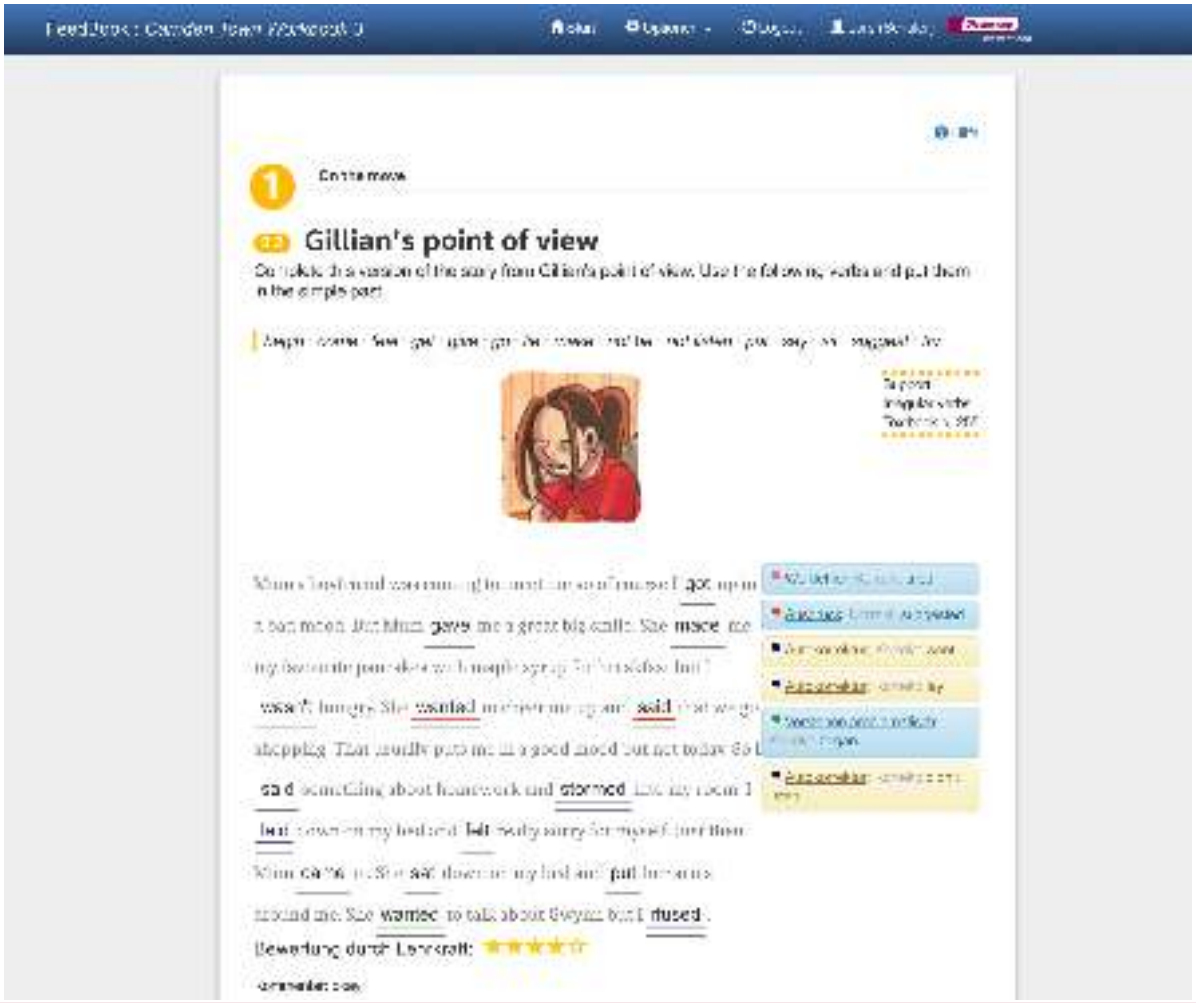


Correction after Teacher Interaction

- Teacher error annotation visually distinguished
- Stepwise increase of coverage & consistency

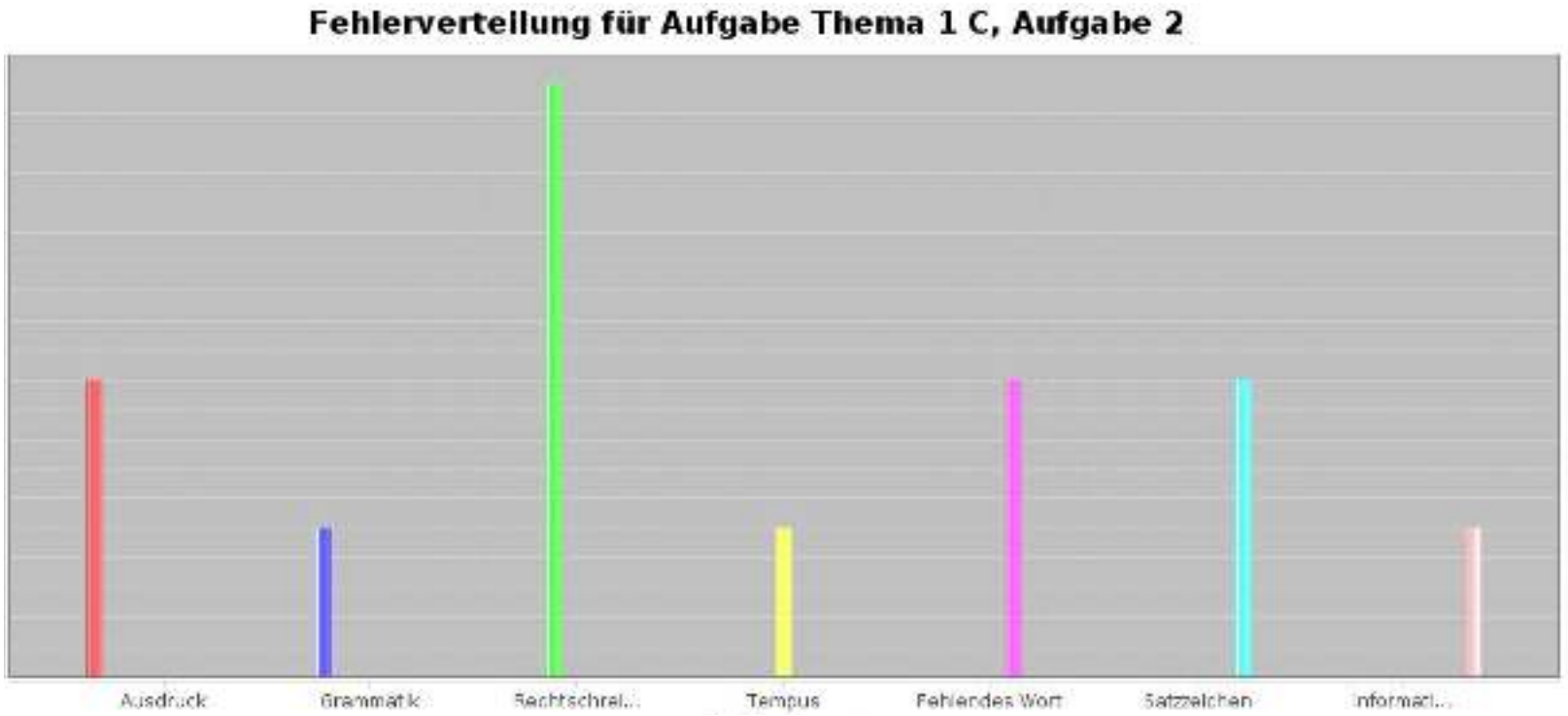


Result Interface for Students



Diagnostics Interface for Teachers

- Teachers can group and visualize errors, e.g., by task
  → specific problems can then be targeted in class



Insights from our interaction with teachers

- Grading exams is already a massive time commitment, so homeworks normally are only discussed as a group in class
- Opportunity to provide individual feedback without additional work (feedback memory, automatic feedback) greatly appreciated
  - Teachers then hope to use class time for communicative/task-based activities with students on a more similar level of ability.
  - But note: freeing teachers from discussing homework in class also a potential threat for those uncomfortable in more communicative classroom
- Use of already established workbook very much appreciated
  - preference for not having to switch between web and paper
- Seeing who did the homework and who didn't is what counts – not fancy ideas about tracking individual learning, etc.

Insights from our interaction with teachers (cont.)

- The fact that students are connected via WhatsApp and similar services means they may quickly share solutions.
  - We are adding functionality to let a teacher inspect the interaction history of each student, i.e., how quickly did they get it right?
  - Individualizing exercise assignment based on the learner models can provide a general, pedagogically meaningful solution.
- Workbooks are seen as most important in the first three or four years of learning a language.
  - NLP can focus on meaning- and form-based exercises for which the exercise contains enough information to specify target answers.
  - A broad range of tasks can be designed to constrain the well-formed & ill-formed variability of potential learner answers (Quixal and Meurers 2016).

Issues involving parents

- The different amount of homework support children get from parents at home is a source of significant social injustice, which the FeedBook can help overcome.
- But some parents are also concerned since they feel
  - hand-writing is important, so homeworks should be written by hand
  - children should spend less time with digital devices
  - they cannot or do not want to provide internet at home

The FeedBook System (Version 2.0)

- Second version of FeedBook extends approach
  1. students work on exercises assigned as homework, receiving immediate, scaffolding feedback incrementally leading student to successful completion of exercise
  2. students submit (usually correct) final result to their teacher
  3. teachers can see result and can optionally provide further feedback, inspection of interaction history is planned,
  4. teacher will be able to view aggregates of student performance, e.g., typical problems

Examples: Irregular verbs

Gillian's point of view

Complete this version of the story from Gillian's point of view. Use the following verbs and put them in the simple past.

• *LiF1Rc: Simple past*

begin · come · feel · get · give · go · lie · make · not be · not listen · put · say · sit · suggest · try



Support
Irregular verbs:
Textbook p. 255

Mum's boyfriend was coming to meet me so of

But Mum *gived* me a great big smile.

with maple syrup for breakfast but I

me up and that we go s

mood but not today. So I something

room. I down on my bed and

Feedback für "gived"

This is not a correct form of the simple past. In the list of irregular verbs, the simple past is the second form.

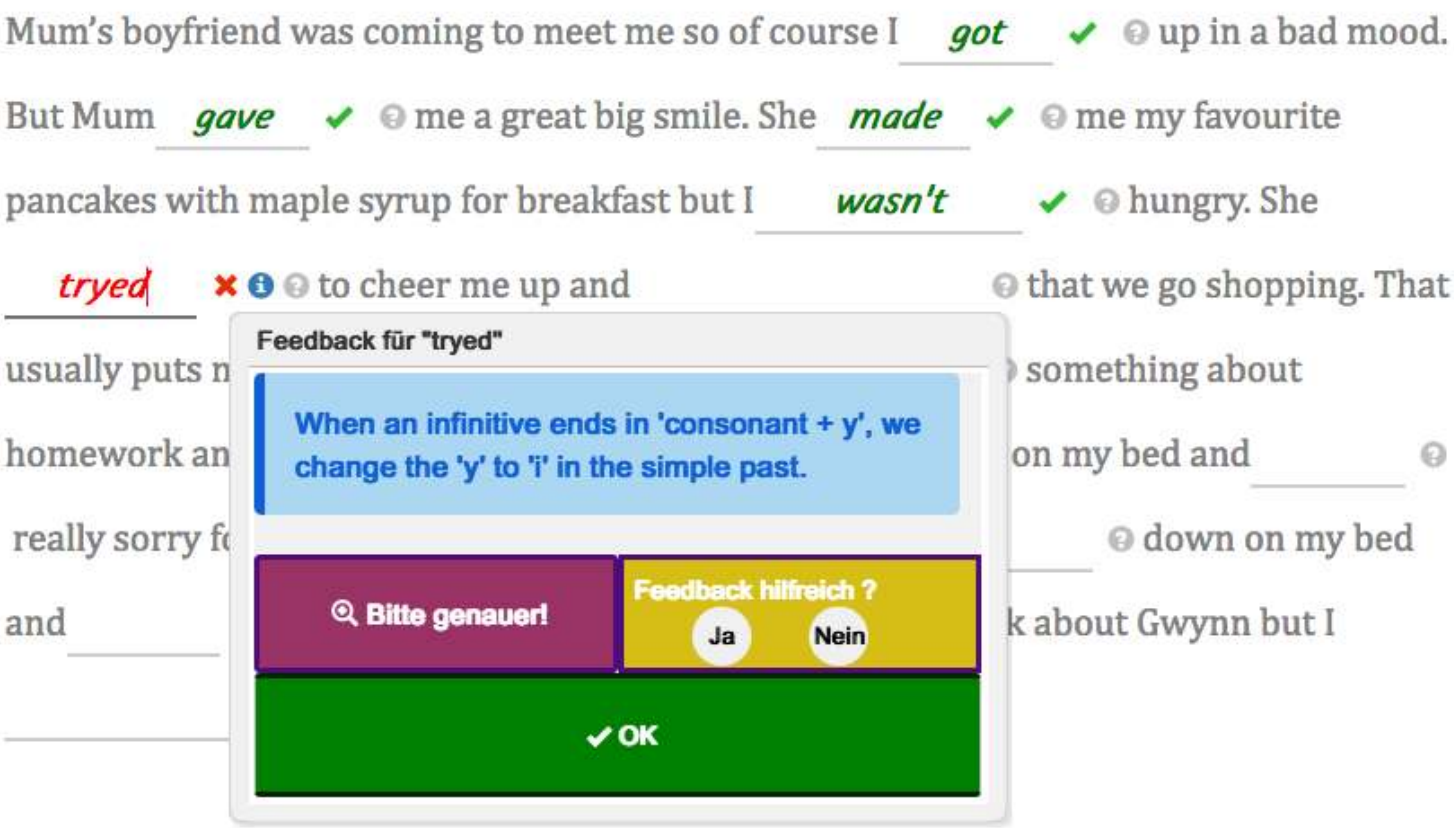
Bitte genauer!

Feedback hilfreich ?

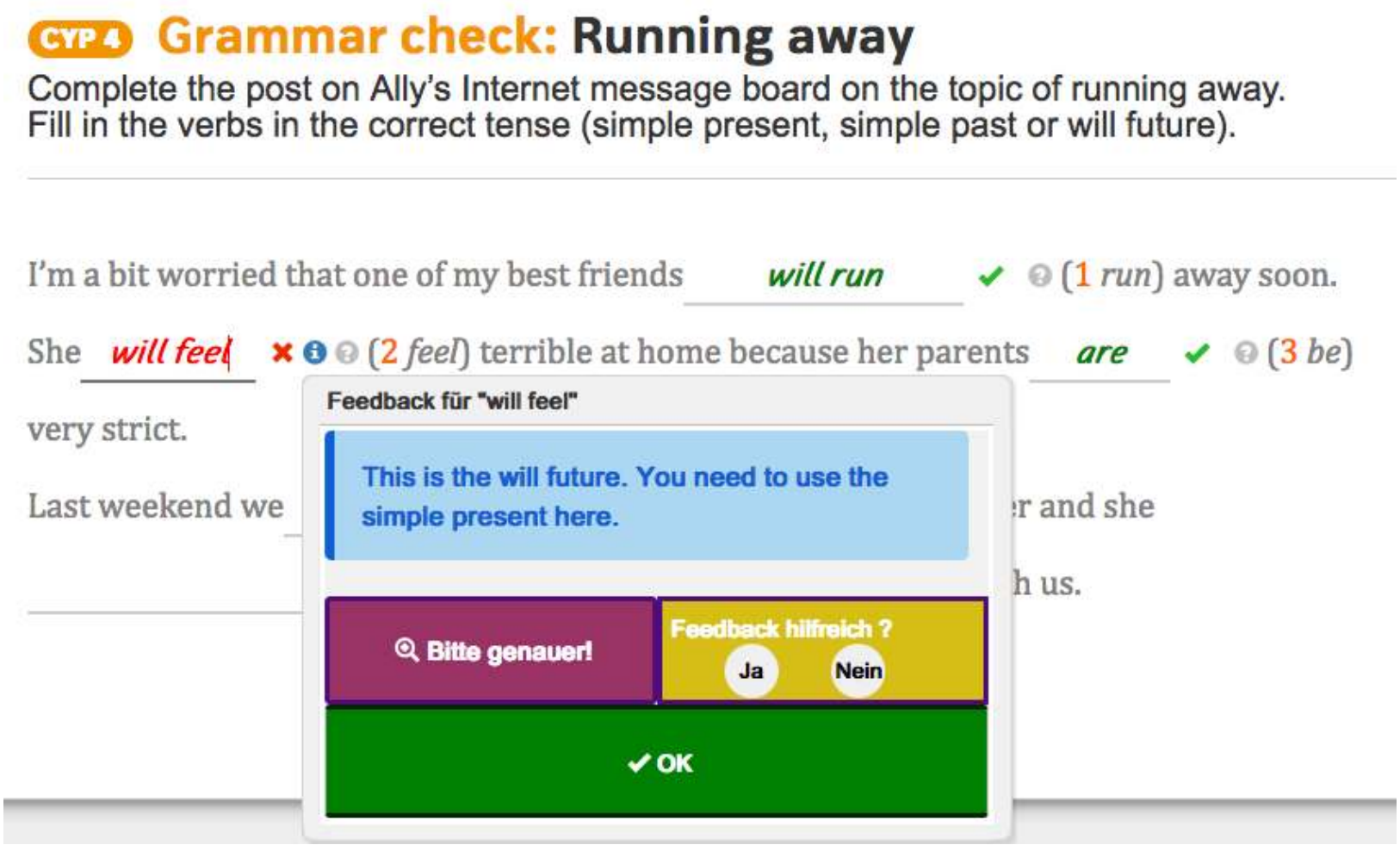
Ja Nein

OK

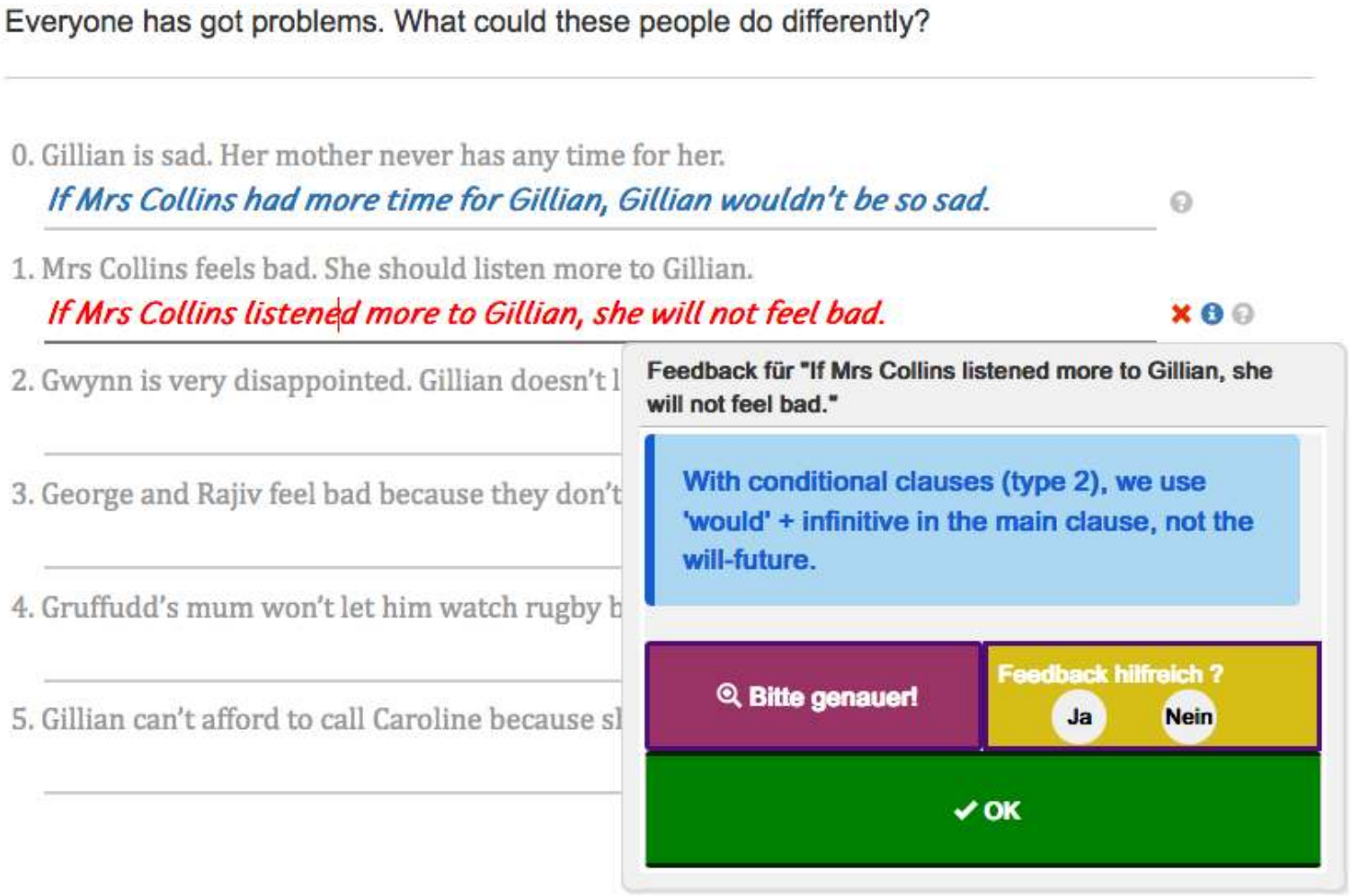
Examples: Subregularities



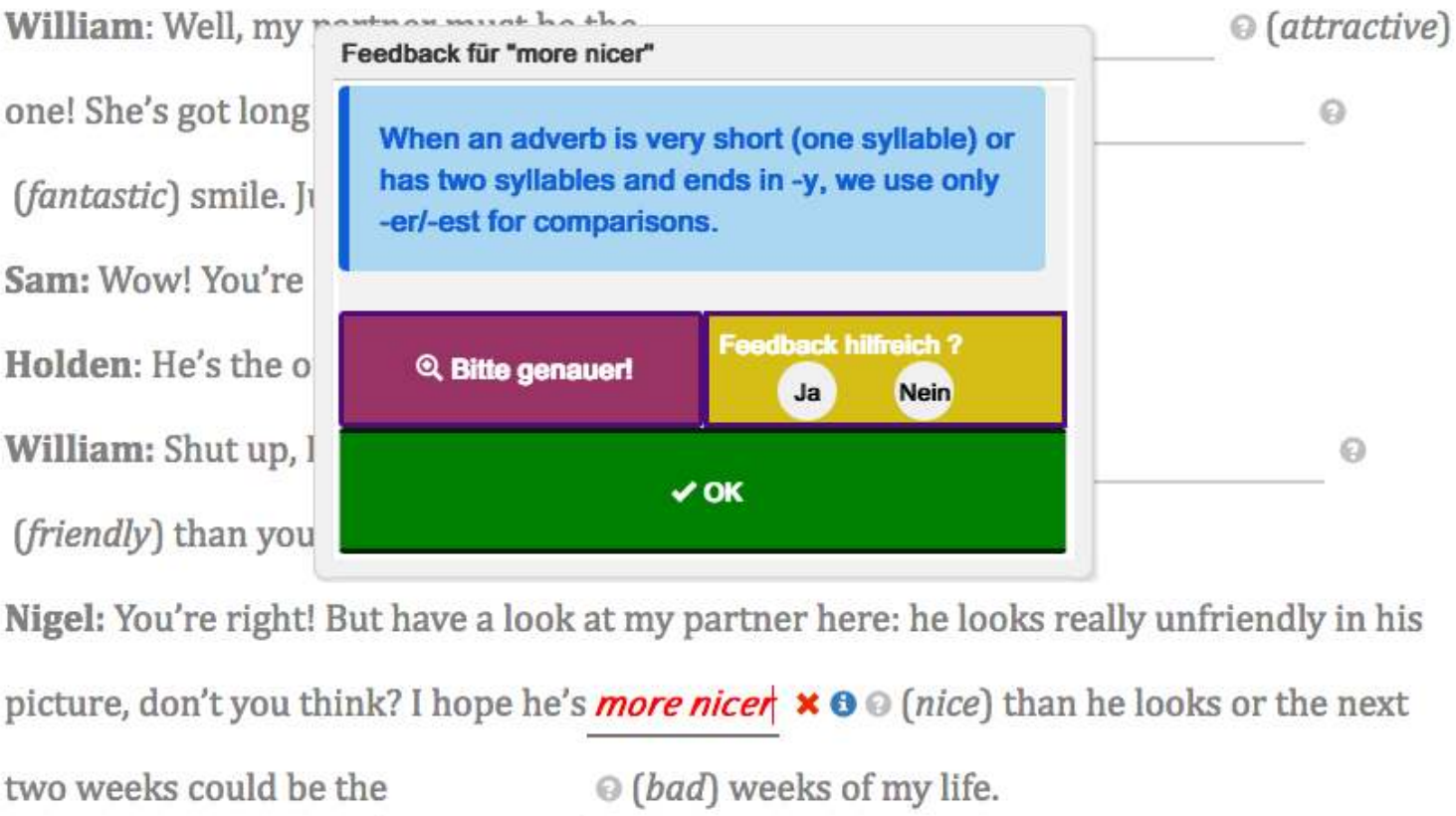
Examples: Tenses



Examples: Conditionals



Examples: Comparatives



Summary

- The FeedBook system provides
  - an opportunity for students to individually practice using online exercises at any time.
  - automatic error annotation assistance and a feedback memory to facilitate the work of the teacher.
  - relieves teachers from the repetitive work of providing feedback on the same issues over and over again,
  - while at the same time allowing them to view aggregates of student performance
- First version of FeedBook used in pilot classrooms since October 2016, positive feedback from teachers and students
- Second version with automatic feedback while students work on exercise about to be released.

Next Steps

- Evaluate and extend immediate, automatic feedback
  - diagnosis component
  - feedback, with more and different scaffolding steps depending on learner model
- Evaluate impact of FeedBook on learning outcomes
  - Randomized controlled field study integrating measures of the process and product of learning
  - Compare web-based workbook with automated feedback to a version only transmitting teacher feedback to students
  - Include web-based measures of individual differences (procedural memory, working memory capacity, MLAT-V, . . .)

  → intervention study during entire school year 2018/2019

Questions?

You can also contact us at

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or visit our website:

http://feedbook.website

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