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Bridging classrooms and technology: Supporting teaching practice with an LLM-powered ICALL system

Mihwa Lee[a], Björn Rudzewitz[b] and Xiaobin Chen[c]

[a]Hector Research Institute of Education Sciences and Psychology, University of Tübingen, , email: mihwa.lee@uni-tuebingen.de; [b]Hector Research Institute of Education Sciences and Psychology, University of Tübingen, , email: bjoern.rudzewitz@uni-tuebingen.de and [c]Hector Research Institute of Education Sciences and Psychology, University of Tübingen, , email: xiaobin.chen@uni-tuebingen.de

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Abstract

Recent years have witnessed the rapid advancement of Artificial Intelligence (AI) technologies, holding immense potential for revolutionising learning and teaching in the realm of Intelligent Computer-Assisted Language Learning (ICALL). However, most ICALL systems tend to prioritize learners' perspectives over those of teachers, whose involvement is crucial for integrating these systems in real-life school contexts. This oversight often results in teachers' reluctance to adopt and introduce these systems in daily teaching, thereby limiting their potential use in schools and reducing the ecological validity of research findings in actual language learning environments. This article aims to illustrate the ICALL system "ARES" to support teachers in their daily teaching practice with the power of a Large Language Model (LLM) with cooperating teachers' knowledge, enabling full integration into real-life school education. Aiming to foster the teachers' use of ICALL systems in real-life English as a Foreign/Second Language (EFL/ESL) settings, the design and development of the system have employed a cooperative approach with educators to optimize its responsiveness to user needs. In this article, we specifically present features designed to support teachers in their daily teaching practice and outline further evaluation of the system via questionnaires and log data.

Keywords: *Intelligent Computer-Assisted Language Learning (ICALL); Second Language Acquisition (SLA); teaching practice.*

1. Introduction

Classrooms today are more diverse than ever, with students representing a wide array of linguistic, cultural, and socioeconomic backgrounds. This diversity brings unique challenges and opportunities for educators, as highlighted by research emphasizing the need for individualized support (e.g., Dumont, 2019; Shemshack & Spector, 2020). AI applications in education (AIED), such as ICALL systems, present unique opportunities for innovative learning and teaching approaches (Amaral & Meurers, 2011). These systems have been shown to enhance learning engagement and achieve better language acquisition through features such as automatic feedback, intelligent tutoring, and personalized support (Ahmadi & Reza, 2018). Despite the advantages of such educational technology, the use of AI-powered educational products in schools and by teachers is still limited in many instances

(Tondeur et al., 2008). One possible reason is that such systems often focus solely on learner effectiveness, neglecting the practical needs of teachers, which leads to skepticism toward such products among educators (Chen et al., 2022). While teachers can implement technology integration practices, they also need to see how technology fits into their actual classroom and teaching practice (Cheng & Wang, 2023; Tondeur et al., 2008). This gap hinders teachers from utilizing these systems in classrooms with large student populations. Teachers are crucial for the successful integration of technological tools (Hedayati et al., 2018), and their use of these systems enables researchers to conduct interventions in ecologically valid settings, ensuring that findings are applicable to real-life language learning (Meurers et al., 2019). Thus, the successful implementation of educational technology, including ICALL systems, relies on teachers' perceptions of how they see clear benefits of such systems for their teaching practice (Akram et al., 2022; Motteram et al., 2013), which directly and indirectly impacts their classroom roles (Hedayati et al., 2018).

With the rapid advances of LLMs, much recent research has started to leverage the capabilities of these LLMs to support learners and teachers in various tasks (Kasneci et al., 2023). Given the potential of newly powerful LLMs in educational technologies, it is necessary to explore not only applications that align with the multifaceted demands of daily teaching practice such as content delivery, assessment, feedback, and individualized support for diverse student needs (Lan et al., 2024; Li et al., 2023) but also the way to incorporate teachers in the loop of such LLM-powered applications in daily teaching. In order to address the gap between foreign language teaching practice and the advantages of the technology, we have developed a pedagogically oriented LLM-powered ICALL system for reading in English, specifically targeting EFL/ESL contexts. While the primary goal is to enhance reading competence and motivation in second language (L2) English, the system is designed to integrate seamlessly with daily teaching practices in actual classrooms. The design and development have followed a collaborative approach with educators from the beginning to ensure the system is highly responsive to user needs. By incorporating an LLM, specifically ChatGPT 4o[1], the system allows teachers to perform various teaching tasks such as assignment creation and grading. We will demonstrate these features, designed to specifically support teachers in real classrooms, aiming to reduce their workload and facilitate personalized teaching practice.

2. Background

2.1. Teaching practice in ICALL systems

While many ICALL systems exist, most systems are research prototypes that are neither designed to align with the teaching practice of regular foreign language classes, focusing on a single aspect of teaching, nor tested widely in the classrooms (Amaral & Meurers, 2011; Choi, 2016; Quixal et al., 2021), offering limited functionalities to support teachers in their daily teaching. Based on the literature educational and SLA theories and iterative consultations with actual educators, here, we describe four particular functions that are considered to be effective for L2 reading instruction and teaching practice.

Reading comprehension questions. It is well known that deploying questions in teaching encourages students to self-explain, which has been shown to be highly beneficial for learning (Chi et al., 1994) by uncovering knowledge gaps in learners (Tenenberg & Murphy, 2005). Empirical evidence demonstrates the effectiveness of teacher questions as a scaffold for enhancing student text comprehension. (Blything et al., 2019). Especially, including higher level questions (e.g., inferential questions) promotes deeper processing and learning from text by activating relevant prior knowledge when compared with using only lower level questions (e.g., factual questions) (Blything et al., 2019). Therefore, using questions to direct attention to text content and scaffold understanding is a key element of effective L2 reading instruction, both in classroom settings (McKeown et al., 2009) and in computer-based learning environments (Graesser et al., 2005).

Input enhancement. While reading is considered an essential method for increasing the amount of rich language input received by L2 learners, at the same time, it is important to trigger language awareness on linguistic forms

[1] https://chatgpt.com/

and categories during such meaning-based activities to successfully acquire a L2 (Long & Robinson, 1998). One way to increase learners' selective attention to linguistic features is to provide input enhancement, which is a strategy that uses a range of visual cues such as highlighting or underlining to increase the saliency and noticing of the linguistic forms (Sharwood Smith, 1993). A series of empirical studies have demonstrated that input enhancement in general has been found to facilitate noticing and enhance learning (Ruiz et al., 2024), highlighting the importance of directing the learners' attention to forms in L2 reading practice.

Feedback. Feedback is information communicated to learners to modify their thinking or behaviors to close the gap between their actual performance and the target performance (Hattie & Timperley, 2007). The importance of feedback is well-documented in the field of SLA (Macky, 2006) and numerous studies have proven its effectiveness in improving learning (Shute, 2008) and enhancing emotions/motivation during (Fong, 2019). Among different types of feedback, elaborated feedback that includes extra-instructional information (Swart, 2022) such as hints of the correct information in the text has been especially shown to have positive effects compared to simply providing correct/incorrect feedback or the target answer (Van der Kleij et al., 2015; Wisniewski et al., 2020).

Teacher dashboard. Teachers regularly make decisions that lead to pedagogical actions based on their knowledge of both individual students and the classroom. This pedagogical knowledge includes understanding students' abilities, domain knowledge, common learning difficulties, and how specific errors indicate developmental challenges (Shulman, 1986). It also involves recognizing social dynamics and group-level progress in knowledge and skill development (Molenaar & Knoop-van Campen, 2017). A teacher dashboard could enhance this decision-making by providing information about students' progress (Knoop-van Campen et al., 2021). For instance, if many students are struggling with a particular skill, the dashboard could inform the teacher, allowing them to modify lesson plans accordingly. More broadly, dashboards can help teachers by making hidden patterns visible, enabling them to offer targeted support that goes beyond what educational systems can provide (Xhakaj et al., 2017).

Performing all these tasks, however, is both time-consuming and labor-intensive, particularly in classroom contexts where teachers often face constraints on time and resources. The recent development of LLMs offers a promising solution by automating various teaching tasks, potentially freeing up teachers' time and resources to focus on enhancing instructional quality (Law, 2024). In the following sections, we explore recent advances in LLMs and discuss how these models can be integrated with teachers' pedagogical knowledge to improve classroom practice.

2.2. The affordances and challenges of Large Language Models (LLMs)

LLMs generally function by leveraging extensive web corpus data and optimizing through reinforcement learning and human-AI interaction data (Liu et al., 2024). One of the most notable large language models is the Generative Pretrained Transformer (GPT) series, made publicly available as ChatGPT (Huang et al., 2023). This model has been shown to excel at a wide array of reasoning tasks including question-answering and assessment compared to previous LLMs (Nguyen et al., 2023). The release of ChatGPT has sparked a new wave of research exploring its optimal applications in language learning contexts as well (Bonner et al., 2023). Recent work has shown that it can act as a conversational partner that offers authentic natural conversations (Young & Shishido, 2023), or as a personal language tutor that pinpoints linguistic mistakes produced by L2 learners (Su et al., 2023) to improve learners' language proficiency. Simultaneously, concerns have arisen about potential cheating or plagiarism in writing assignments (Yang & Li, 2024), driven by how easily ChatGPT can produce human-like text in mere seconds. While much of the debate has centered on how students should or should not use ChatGPT, less focus has been given to how teachers and instructors might benefit from this cutting-edge technology (Nguyen et al., 2023). The increased productivity resulting from LLM utilization can alleviate stress among teachers, providing them with additional time and resources to enhance instructional quality (Law, 2024). Despite the promise these technologies hold, there remains a gap in applications designed to support teachers, emphasizing the need for a balanced approach that benefits both educators and learners in language education (Lan & Chen, 2024). This balanced approach can ensure that the full potential of LLMs is realized, leading to more effective and integrated

educational practices.

At the same time, it is important to note that LLMs still lack the same level of understanding and context awareness as humans (Bonner et al., 2023). Although they can perform a variety of tasks within seconds, LLMs struggle due to tendencies toward increased hallucination and subsequent performance issues from a lack of contextual awareness (Nye et al., 2023). For instance, in a study by Octavio et al. (2024) that investigates the potential of ChatGPT as a teaching support for EFL teachers, the authors found out that, while ChatGPT offers significant support to EFL teachers in planning and designing lessons, it is critical to incorporate teachers' teaching knowledge to be able to recognize inaccuracies of outputs by LLMs and identify relevant outcomes. Therefore, our work seeks to further explore the potential of the use of such LLM in an ICALL system to support teachers in their teaching in classrooms, as well as the way to incorporate teacher knowledge in such a LLM-powered system, combining the affordances of LLMs with teachers' expertise to create a more effective teaching environment. In the following section, we present the design of the system in detail.

3. Annotated Reading Enhancement System (ARES)

Building on the need for educational tools tailored to both teachers and students, *ARES (Annotated Reading Enhancement System)* is an LLM-powered ICALL system designed to enhance EFL/ESL students' reading comprehension. Importantly, by integrating the LLM (ChatGPT 4o) in the backend, ARES supports teachers by automating the processes of (1) question generation for assignments, (2) individualized feedback to student responses, and (3) scoring student submissions, significantly reducing their workload, while keeping them in the loop. Its design is based on iterative consultations with English teachers for the purpose of involving stakeholders in the system design and development process. While ARES provides interactive support to learners, here, we focus on illustrating features of the system that are specifically designed to support teachers in real classrooms.

3.1. Class and assignment management

The first function teachers encounter in the system is the class interface, where they can digitally create, delete, and edit classes and manage students, as shown in Figure 1. Here, teachers can assign a distinct class name and description. A 4-digit class code is automatically generated, allowing students to enroll in the class. Additionally, teachers can view and remove students enrolled in specific classes.

After creating a class, teachers can create assignments with instructions and a deadline and assign them to a specific class for students to work on individually. ARES provides automatically generated suggestions for two types of reading comprehension questions: factual and inferential questions. Teachers can select the number of each question type, and an LLM on the backend generates the requested number of questions. The generated questions are displayed on the frontend as suggestions, as shown in Figure 2. As noted in the Background section, in order to incorporate teacher knowledge in an LLM-powered system, we designed the system in a way that teachers hold the decision-making power based on the output by the LLM: they can post-edit the suggested questions by the LLM, confirm them, or manually add additional questions if needed.

In addition, teachers can select which input enhancement on grammar to present to students, allowing them to tailor assignments and annotations to meet specific learning objectives, as shown in Figure 2. The selected grammar constructions will be highlighted to students, which is also clickable to open a panel explaining the grammar in detail with examples. The rationale behind this customization is that reading texts often contain a broad range of grammatical structures, making it challenging for teachers to selectively direct students' attention on specific grammar constructs within the texts. By allowing teachers to customize grammar annotations based on learning objectives, the system ensures that reading materials highlight the target grammatical structures, thus making the learning process more efficient and aligned with pedagogical goals.

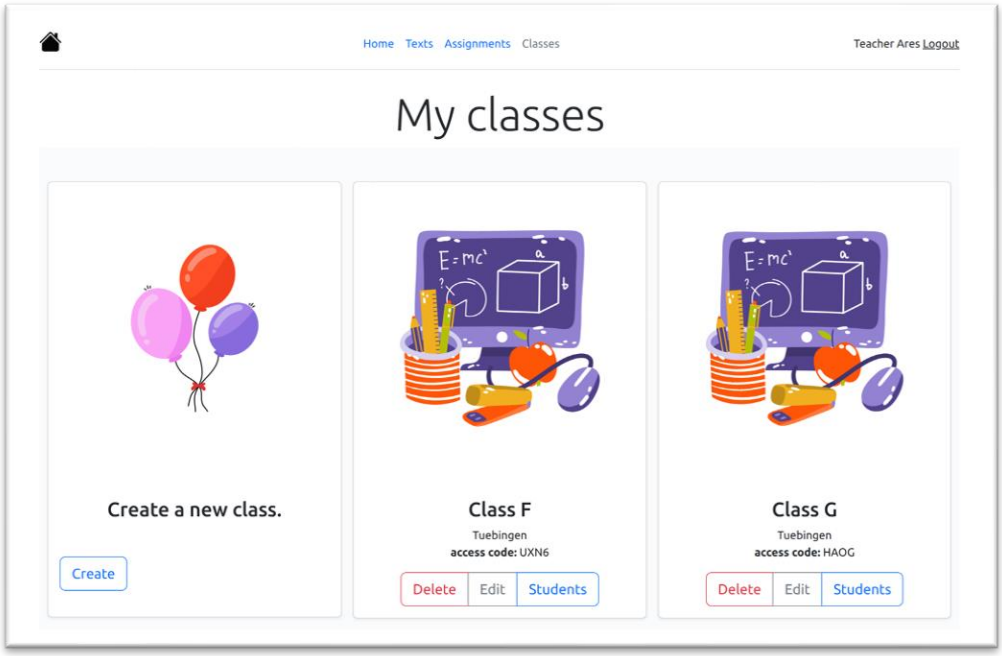

Figure 1. Teacher interface to manage classes and enrolled students

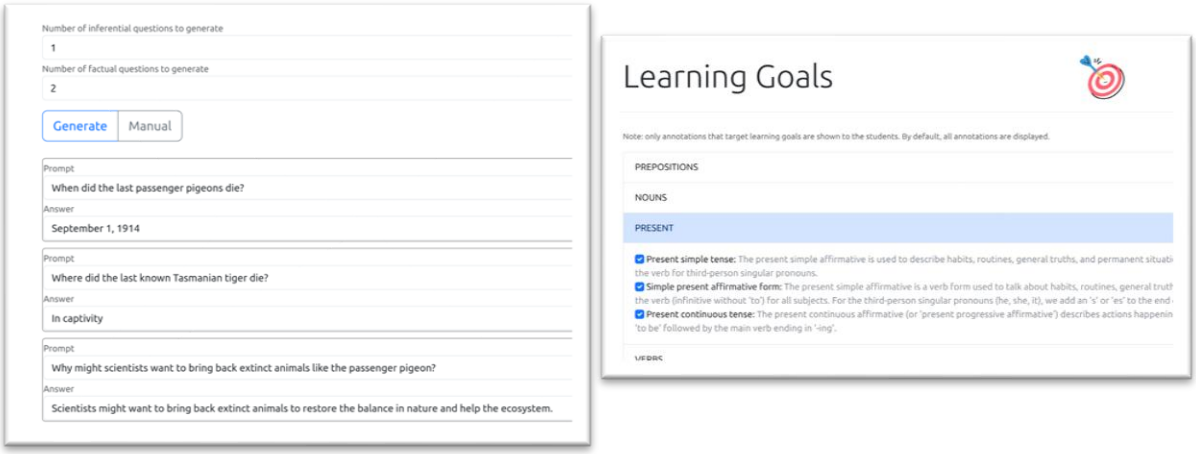

Figure 2. Reading question generation and in-context grammar support selection of the assignment creation

3.2. Feedback and grading

ARES automates feedback and grading process as well using an integrated LLM. Upon selecting the evaluation mode (Meaning only or Meaning and form), the “Grade all automatically” button in the grading interface shown in Figure 3 initiates the process, where all student responses are sent to the LLM in parallel. The LLM evaluates the student responses against target responses for each question, considering the reading text as context. As a result, teachers receive feedback suggestions for each response and a percentage score of correct responses as a grade based on the selected evaluation mode. Teachers can then confirm the feedback suggested by the system by clicking the “Accept all corrections” button. Again, to ensure that teachers remain in control, the system allows them to review and modify the automated scores by clicking the “Grade” button within the submission table, redirecting them to the individual submission page. Here, as shown in Figure 4, detailed evaluation information (questions, student responses, target answers, automatic scores, and feedback) of each submission is displayed, allowing teachers to adjust scores and feedback as needed. If the teacher agrees with the automated grading, they can use the “Copy all” button to transfer the automated scores and feedback to the manual grading section. Ultimately, students see only what teachers confirm at the end. This approach reduces teachers' grading burden

while ensuring teachers retain full control over what students see. After confirming the feedback and scoring, all the results are sent to each student.

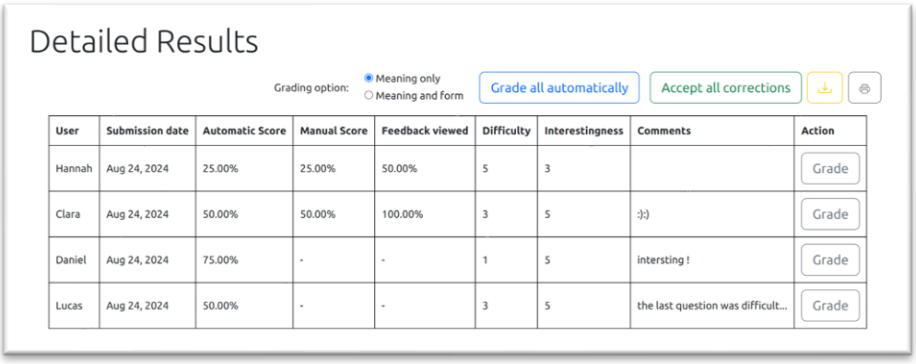

Figure 3. Overall feedback and grading in the evaluation interface

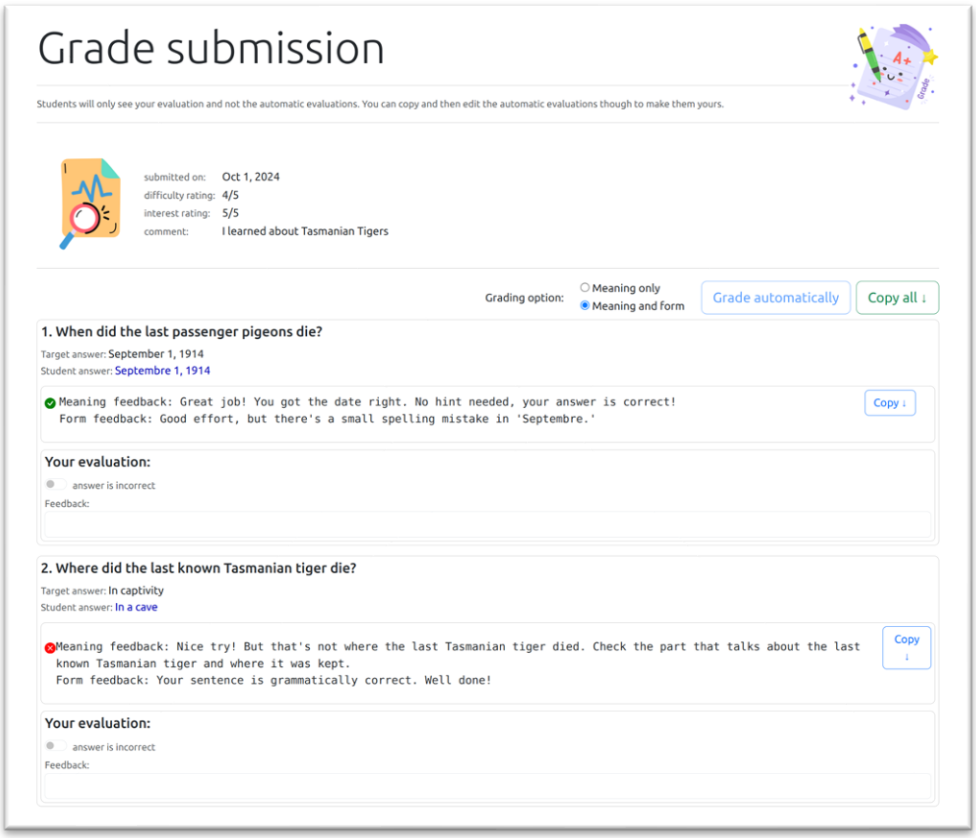

Figure 4. Individual feedback and grading in the evaluation interface

3.3. Dashboard

In addition to providing informative and meaningful feedback on learner input, an ICALL system can also offer ongoing assessment and learner progress. ARES is equipped with an extensive user interaction logging system using xAPI[2], an interoperability specification for recording user interactions. The log records the entire interaction between the system and a user, capturing details such as unique student IDs, timestamps, activity types, student inputs, system feedback, and navigation patterns like clicks. This information is stored in a Learning Record Store

[2] https://adlnet.gov/projects/xapi/

(LRS). However, choosing which information to display is not straightforward, as not all data from digital learning environments is useful for teaching. Based on iterative consultations with English teachers, we are currently enhancing the teacher dashboard for each assignment to better visualize and inform teachers about learning-related data recorded in the system. In addition to the existing summative information — such as the number of submissions, overall scores, and ratings of the assignment's interestingness and difficulty — and the common mistakes and misconceptions made by students in each assignment as shown in Figure 5, we are currently implementing new functionalities such as tracking words and grammar that students frequently click on, which teachers can bring to and review in the class afterwords.

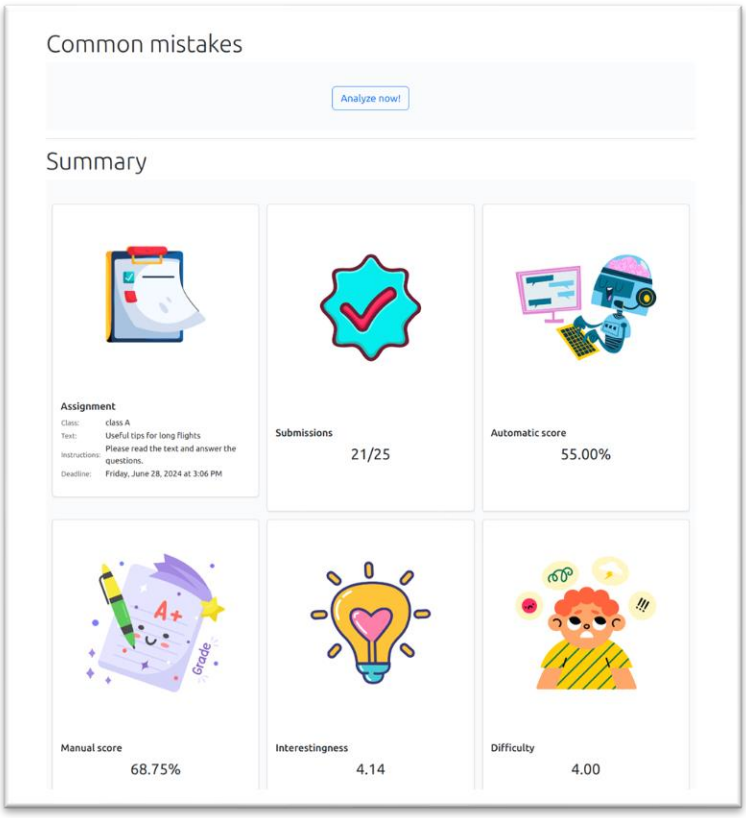

Figure 5. Current summative assessment interface in the teacher dashboard

4. Conclusion and future work

In this article, we presented the design and the features of a pedagogically oriented ICALL system ARES, designed to support teachers in real classrooms, aiming to reduce their workload and facilitate personalized teaching practice. We emphasized the importance of considering pedagogical needs and the teacher's role in real-life classrooms when designing and developing ICALL systems. While significantly reducing teachers' workloads through automation with the LLM, ARES also ensures that teachers are involved at every stage of the teaching process, combining AI affordances with teachers' expertise to create a more effective learning and teaching environment. Teachers retain ultimate decision-making power, confirming or editing the system's suggestions, thereby achieving human-AI collaboration in teaching. As the next step, we will investigate teachers' and learners' perceptions and usage of the system in real-life EFL contexts with both adult and young learners. System perceptions by both teachers and learners will be measured using a self-report questionnaire adapted from Lai et al. (2022) for a comprehensive evaluation of educational technology. Teachers' and learners' actual use of the system will be analyzed through log data to further improve the usability of the system.

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