

DESIGN AND DEVELOPMENT OF A RESEARCH-INFORMED SOFTWARE TOOL FOR FOREIGN LANGUAGE LEARNING

Annotation. The paper discusses the conceptual design of a software tool for learning foreign languages that integrates insights from second language acquisition, computer-assisted language learning and learning analytics. Drawing on research into CALL, MALL and digital language learning, the proposed system is conceived as a mobile-first, cross-platform environment that embeds task-based pedagogical principles, extensive vocabulary support and alignment with the Common European Framework of Reference for Languages. A modular architecture is outlined, in which communicative tasks, focused form activities and assessment components are orchestrated into adaptive learning paths driven by learner and domain models. Particular attention is given to learner autonomy, with facilities for goal setting, reflection, and portfolio building, as well as to the role of learning analytics dashboards for learners, teachers, and researchers. The paper also emphasises the importance of teacher education and authoring tools to ensure meaningful integration of the software into formal and informal learning ecologies. The resulting design aims to provide a research-informed, scalable, and ethically responsible platform for supporting diverse language learners while generating data that can inform ongoing improvements in both technology and pedagogy.

Keywords: foreign language learning; computer-assisted language learning; mobile-assisted language learning; adaptive learning systems; learning analytics; learner autonomy; vocabulary acquisition; CEFR-aligned assessment

The development of a software tool for learning foreign languages is situated at the intersection of second language acquisition research, educational technology, and software engineering. Over several decades, research in computer-assisted language learning (CALL) has shown that digital tools can create rich environments for practice, assessment, and research when grounded in sound pedagogical principles rather than technological novelty alone [1]. More recent work on “digital language learning” emphasises that language learning technologies should not only digitise existing materials, but also exploit data and multimodal interaction to support cognitive, affective and social dimensions of learning [2]. In this context, the proposed software tool aims to design a flexible, data-driven environment that integrates contemporary theories of language learning with mobile access, adaptive content, and learning analytics to provide sustainable support for diverse learners and teaching contexts.

The evolution from early CALL programs to mobile-assisted language learning (MALL) highlights the importance of ubiquity, contextualisation and personal ownership of devices. Mobile apps are now a dominant way for learners to engage with vocabulary, grammar drills, and simple communicative tasks [3]. MALL research has shown that handheld devices enable situated and just-in-time language learning, but also that design must carefully consider screen size, interruptions and learners’ self-regulation [4]. At the same time, the spatio-temporal organisation of learning is changing: learners increasingly combine short episodes of mobile engagement with more sustained work at home or in institutional settings, leading to what has been termed language learning “defined by time and place” [5]. For a modern software tool, this implies a mobile-first but cross-platform architecture, where activities are synchronised across devices and can be adapted to the learner’s current context (for example, silent reading on public transport versus speaking tasks in a private space).

Empirical studies of commercially available language-learning platforms demonstrate both their potential and their limitations. The widely cited Duolingo effectiveness study, for instance, reported that for beginning learners of Spanish and French, an average of 34 hours of work on the platform was comparable to a university semester of instruction in terms of reading and listening outcomes [6]. At the same time, systematic reviews of CALL in school contexts show that effects are highly variable and depend strongly on alignment with curricular goals, teacher mediation and task design [7]. These findings suggest that the proposed software tool should not be conceptualised merely as a stand-alone app, but rather as a component in a broader learning ecology that interfaces with formal courses, informal practice and teacher-guided activities. From a research perspective, the system should be designed to support controlled studies of usage patterns and learning gains, enabling iterative refinement of both the technology and the pedagogical scenarios in which it is embedded.

The pedagogical design of the tool draws on established theories of second language acquisition (SLA). Comprehensive syntheses of SLA research highlight the role of rich, comprehensible input, opportunities for pushed output, and interaction that promotes noticing of linguistic form [8]. Task-based language teaching principles propose that technology should be used to create tasks with clear communicative outcomes, where learners manipulate meaningful content rather than merely completing decontextualised drills [9]. Accordingly, the core learning units in the software tool are not isolated sentences, but tasks such as information gaps, opinion exchanges or problem-solving activities, implemented through multimedia dialogues, interactive scenarios and short projects. Grammar and vocabulary exercises are embedded as preparation or follow-up to these tasks and are designed to recycle language items in varied contexts. Adaptive feedback, including prompts to repair errors and reformulate utterances, is provided in ways that support learners' attention to form without interrupting the communicative flow.

Vocabulary development remains a central challenge in foreign language learning, and any software tool must address both the breadth and depth of lexical knowledge. Studies of vocabulary learning emphasise the need for extensive encounters with high-frequency words, systematic recycling, and support for different aspects of "knowing a word", including form, meaning, collocations and constraints on use [10]. The proposed system, therefore, incorporates a vocabulary engine that selects items based on frequency lists and domain-specific needs, associates each item with multiple receptive and productive tasks, and schedules review using spaced-repetition algorithms. Learners encounter target items across listening, reading, speaking and writing modalities; for example, they first meet new words in graded texts, practise recognition through picture-word matching, and then produce them in short written or spoken messages. The engine maintains an individual lexical profile for each learner and targets items that are on the verge of being forgotten, while also introducing new items relevant to upcoming tasks.

To ensure that learning progress is interpretable across institutions and contexts, proficiency descriptors and task difficulty are aligned with the Common European Framework of Reference for Languages (CEFR) and its Companion Volume [11]. Descriptors for reception, production and interaction are operationalised as competencies within the system, and each task is tagged with estimated CEFR levels and relevant descriptors. This allows the software to generate personalised learning pathways (for example, A2 learners focusing on simple social exchanges, or B1 learners practising argumentation) and to report progress in terms recognisable to teachers, learners, and institutions. The alignment with CEFR descriptors also supports test development and formative assessment, as the system can present can-do statements and collect learner evidence (such as spoken samples) mapped to those statements.

Contemporary developments in learning technologies illustrate how diverse tools - from virtual reality to online games - can be harnessed for language learning when integrated into coherent pedagogical designs [12]. The proposed software tool adopts a modular approach, with different activity types (e.g., micro-dialogues, pronunciation exercises, collaborative writing, and game-like challenges) implemented as reusable components that can be orchestrated into sequences. Visual and audio resources are curated or generated to provide culturally authentic contexts, while accessibility considerations (captions, adjustable playback speed, alternative input methods) ensure inclusion of learners with differing needs. The tool is designed not only for individual practice but also for blended learning scenarios: teachers can assign specific task sequences as homework, monitor progress, and adapt classroom activities in response. This modularity also facilitates localisation into different target languages and cultural settings by replacing content while retaining the underlying task and feedback structures.

Learner autonomy is another key design principle. Research on autonomy in language learning stresses that learners need opportunities to set goals, select resources and reflect on strategies if they are to become self-regulated and lifelong learners [13]. Consequently, the tool provides a goal-setting interface where learners can specify priorities (for example, professional communication, exam preparation or travel), time commitments and preferred modalities. Based on these inputs and ongoing performance data, the system proposes weekly learning plans but maintains flexibility for learners to override recommendations. Embedded reflection prompts, such as short self-reports on perceived difficulty or strategy use, help learners to develop metacognitive awareness. Portfolios of written texts, audio recordings and task achievements are stored in a personal area that learners can review over time or share with teachers. Rather than locking learners into a rigid pathway, the software is designed to scaffold informed choice and gradual assumption of responsibility for the learning process.

Learning analytics is central to the added value of the proposed tool. Learning analytics is generally defined as the measurement, collection, analysis, and reporting of data about learners and their contexts to understand and optimise learning [14]. In practice, dashboards can provide learners and teachers with visual summaries of engagement patterns, task performance and progression, and there is evidence that well-designed dashboards can positively influence satisfaction and achievement [15]. In the context of language learning, analytics can illuminate which tasks lead to sustained engagement, how learners navigate between receptive and productive activities, and where bottlenecks occur. Building on conceptual work that combines MALL, self-regulated learning and analytics

into integrative frameworks [16], the proposed tool includes separate dashboards for learners, teachers and researchers. Learners see simple indicators such as streaks, time-on-task by skill, and mastery estimates for key competencies. Teachers access more detailed views, including distributions of learner performance on specific tasks and automatic flags for learners at risk of disengagement. Researchers can access anonymised datasets for deeper analysis of interaction patterns and learning trajectories, subject to ethical guidelines and data protection regulations.

Adaptivity in the system is driven by underlying learner and domain models, as discussed in the broader literature on adaptive educational hypermedia [17]. The learner model stores estimates of each learner's proficiency by skill, lexical knowledge, mastery of grammatical structures and affective variables such as persistence. The domain model represents language content as interconnected knowledge elements, including vocabulary families, grammatical constructions and communicative functions. An adaptation engine uses these models to decide, for each learner, which task variant to present, which feedback to prioritise, and when to prompt review. For example, if the learner repeatedly struggles with past tense forms in narrative tasks, the engine can insert short, focused activities targeting this feature within otherwise communicative sequences. At the same time, guardrails prevent over-personalisation that might narrow learners' exposure by ensuring that they still encounter new structures and genres. Ongoing evaluation of the adaptation strategies, using A/B testing and qualitative feedback, is essential to avoid opaque or unfair behaviour of the system.

Finally, the successful integration of the software tool into real educational ecosystems depends on teacher expertise and institutional support. Studies of teacher education in CALL highlight that teachers need not only technical skills but also a principled understanding of how technologies mediate language learning, and how to design tasks that exploit specific affordances [18]. The proposed system, therefore, includes teacher-facing authoring tools that allow educators to adapt existing task templates, upload their own materials and set assessment criteria aligned with local curricula. Built-in guidance, examples and analytics-informed recommendations support teachers in making design decisions, while professional development materials introduce key concepts from CALL, MALL, SLA and learning analytics. Interoperability with virtual learning environments and assessment systems, through standards-based APIs, further facilitates adoption. In this way, the software tool is conceived not as a replacement for teachers, but as an instrument that amplifies their capacity to orchestrate rich, data-informed language learning experiences.

Taken together, the conceptual design outlined above positions the software tool as a research-informed, adaptable environment that responds to contemporary needs in foreign language learning. By combining SLA-grounded task design, robust vocabulary and proficiency modelling, support for autonomy, and carefully implemented analytics and adaptivity, the system seeks to bridge the gap between experimental prototypes in the research literature and scalable solutions for everyday learners and teachers.

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