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Classification of Technology-based Language Learning Resources according to Pedagogical and Functional Criteria

Clasificación de recursos de aprendizaje de lenguas basados en tecnología según criterios pedagógicos y funcionales

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The objective of this study is to propose a classification of ICT-based language learning resources using as organizing criteria the pedagogical functions of the language learning and teaching process. To meet this goal, first, a corpus of resources is collected, and a literature review is carried out with the aim of identifying the most important language learning pedagogical functions. Then, a two-level classification comprising fifteen types that describe key functions of the resources and a set of subcategories. This classification can be a pedagogical tool useful for language teachers and learners, researchers and instructional designers. Later, the classification is used in two studies, the aim of which is to demonstrate its usefulness to assess the real use of technology-based resources by teachers in two educational areas and to get feedback from practising teachers to improve such classification as well as to carry out an initial validation of this classification proposal.

Keywords: *Information and Communication Technologies (ICTs); Computer-Assisted Language Learning (CALL); technology-based resources and tools; pedagogical functions; language learning.*

El objetivo del presente estudio es proponer una clasificación de recursos de aprendizaje de lenguas basados en las TIC utilizando como criterio las funciones pedagógicas del proceso de enseñanza-aprendizaje de lenguas. Para ello, primeramente, se recopila un corpus de recursos y se hace una revisión bibliográfica para identificar las funciones pedagógicas más importantes en el aprendizaje de lenguas. Seguidamente, se presenta una clasificación de dos niveles que comprende quince tipos que describen las funciones de los recursos y diversas subcategorías. La clasificación puede ser una herramienta pedagógica útil para el profesorado y los aprendices de lenguas, investigadores y diseñadores instruccionales. Finalmente, la clasificación se utiliza en dos estudios cuyo objetivo es demostrar su utilidad para evaluar el uso real de recursos por parte del profesorado en dos áreas educativas y obtener retroalimentación de los docentes de lenguas, con el fin de mejorar dicha clasificación y realizar una validación inicial de esta propuesta.

Palabras clave: *Tecnologías de la Información y las Comunicaciones (TIC); Aprendizaje de Lenguas Asistido por Ordenador (ALAO); recursos y herramientas basadas en tecnología; funciones pedagógicas; aprendizaje de lenguas.*

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1. INTRODUCTION

Resources and tools based on Information and Communication Technologies (ICTs) have been used for a long time for the purposes of teaching or learning languages, and they increase in number, quality and functionalities at a fast pace. A large and growing body of research in areas such as Computer-Assisted Language Learning (CALL), educational technology and Second Language Acquisition (SLA) strongly suggest the pedagogical efficiency of ICTs to enhance the language learning and teaching process. To fully benefit from this technology-enhanced learning environment, language teachers and learners should know what to do with technology and how to do it in the best possible way. Thus, the pedagogical functions of technology when teaching or learning languages must be clearly identified. This is the main topic of this study, which has a double objective. First, it aims to identify the functions of the ICTs and their related resources and tools from the point of view of pedagogy in language teaching and learning. A second goal is to use these pedagogical functions to design a classification framework for ICT-based resources and tools in their use within the language teaching and learning process. Our assumption is that all ICT-based resources and tools can be used with a language learning purpose in mind, as long as the learning objectives and the related pedagogical functions, as well as the activities that may be carried out through these resources, are known by the users, i.e. teachers and learners.

The classification of technology-based language learning resources in different types and categories, therefore, should serve the purpose of assisting learners, teachers, and researchers to ascertain and identify the different varieties at hand, which will help to evaluate their potential (Rosell-Aguilar, 2017). Another advantage of this approach is that a theoretically-sound classification system of technological language learning resources implies a conceptualization of the functionalities of the technology, as well as a contextual clarification and use of specific terminology, a clear demand in the field of CALL (Levy, 1997).

To meet these objectives, first, this study delves into the functional features of the ICTs and their connection to the pedagogical functions of language learning and teaching. The classification is first presented as a tool for teachers, learners, designers and researchers. Then it is implemented, and two studies are conducted to ascertain the real use of ICT-based language learning resources by teachers, and to integrate the points of view of these teachers to get feedback on possible improvements of the classification, with the ultimate purpose of carrying out an initial validation of the proposal.

2. THEORETICAL FRAMEWORK

The term *ICT* refers to "various technologies that are used to access, collect, process, and share information" (Hiradhar & Bhattacharya, 2022: 4). A similar and complementary definition is given by the *United Nations Development Program*, which considers ITCs as "a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information" (Tinio, 2003: 4). These definitions are relevant for our classification framework, because they are based on verbs, actions –i.e. functions for which the technology may be useful and feasible, in our case, within the language learning and teaching process–. If we analyse the verbs and concepts embedded in both definitions, the two fundamental components of language learning clearly emerge: communication and a set of crucial actions that can be carried out with information and content when learning a language. Therefore, these verbs and the communication factor are used to conceptualize the various pedagogical functions of the classification proposed in this study. Pedagogical functions here are conceptualized as the roles that assist in the process of achieving learning goals (Campbell et al., 2012). That said, this research focuses on the latest computer and Internet-based technologies, rather than integrating

other technologies that are also considered as ICTs, such as compact discs, voice recorders or television, since all these technologies have been integrated in practice within the Internet and the Web. The way the types of resources are mostly referred to throughout this study is "technology-based", although it is understood that we imply "ICT-based resources", to avoid the use of acronyms.

An initial procedure in the study was to incorporate the wide range of technologies that Godwin-Jones has comprehensively discussed since 1997. As he recognised in an account of 20 years of language learning technologies (Godwin-Jones, 2016), this approach can also provide insights into possible affordances and uses of the technologies. Over that period and beyond, many technologies, from multimedia delivery to immersive technologies and Generative Artificial Intelligence have been studied by Godwin-Jones (2024), a theoretical base that was used here to conceptualize the types and subcategories of the classification framework. Additionally, and apart from some relevant websites that present collections and lists of technological tools for learning in general or language learning in particular, there are some pertinent books that present a collection of language learning technologies, and, although their main classification criteria are not pedagogical functions, they have been used to establish some categories in our classification, such as Kenning (2007) or Farr & Murray (2016). Also relevant for this research, a recent study comprehensively reviews fifty years of technologies relevant to language learning (González-Lloret, 2023).

In the area of mobile applications, Rosell-Aguilar (2017) proposes a taxonomy that classifies apps for language learning into three categories: applications designed for language learning, those not designed for but useful for language learning, and a third group comprising dictionaries and translators, incorporating grammar, vocabulary, interaction and the four communicative skills, as the final layer of the classification. Coherent as this framework may be, the present research has merged these two categories, i.e. language-learning vs. generic, since our assumption is that, regardless of the target purpose of the technological resource, the most important consideration is the pedagogical function, and most, if not all, ICT-based resources could be used for a pedagogical function within the language learning process.

In a comprehensive study that establishes close links between language theories, CALL and ICTs, Wilkinson (2016) classifies ICT-based resources for English as a Foreign Language (EFL) into different types, although his main purpose is not classificatory: L2 skill-specific applications, Web resources, mobile apps, sites for recording, Web 1.9 (static) tools, Web 2.0 tools, and social learning platforms. With a broader scope that includes language learning and teaching resources based on ICTs, Nirmal & Mohsen (2023) also differentiate between language-specific tools and more general productivity tools and classify ICT tools in this educational context with a functional approach into the following categories: E-communication tools, E-creation tools, Assessment tools, Reading/Writing E-tools and Virtual Learning Environments.

In our classification framework, Web 2.0 technologies have been incorporated, since these are the ones that best fit the principles of Task-based Language Teaching (TBLT) and Task-based Language Learning (TBLL). They enable users -teachers and mostly learners- to create digital content and communicate with other users, so that learners can engage in doing things with language and in cooperation with other learners, through the functionalities of Web 2.0, rather than simply carrying out language-based activities. Therefore, these technologies can be integrated into language learning as an environment for interaction and learning by doing realistic, goal-oriented tasks, and getting in contact with authentic input and authentic interaction with native speakers of the L2 (González-Lloret, 2017: 236).

In a study that reviews computer technologies, and their efficiency related to the field of CALL, Golonka et al. (2014) classify these technologies under the following categories: (1) "Classroom-based technologies", which assist classroom activity regarding material presentation and learner tracking, including *Course management systems (CMS)*, *Interactive white boards* and *ePortfolios*, with programs such as gap-filling exercises, simulations, multi-

ple-choice exercises, and the like; (2) "Individual study tools", resources which the learner or teacher can use as a complement in an individual level language learning process, such as *Corpus tools*, *Electronic dictionaries*, *Electronic gloss or annotation tools*, *Intelligent tutoring systems*, *Grammar checkers*, *Automatic speech recognition* (ASR) or *pronunciation programs*; (3) "Network-based social computing", including technologies such as *virtual worlds* or *serious games*, *chat-based environments*, *social networks* and *blogs*, learning environments the purpose of which is not related to language learning, but provide pedagogical advantages and value in terms of practicing language skills within real-life contexts and in a cooperative manner; and (4) "Mobile and portable devices", which are useful for language learners and teachers beyond the conventional scope of foreign language learning and CALL, with almost endless possibilities of delivering language material, establishing social networking environments, authoring potential, and so on. Some of these categories are reconceptualized and rearranged through the lenses of language learning functions in the classification framework proposed here.

Within the field of language learning, some categories of technology resources have been proposed. In some studies, focused on language learning, the criterion for classification is often based on the four communicative skills (Dash & Kuddus, 2020). This criterion has sometimes been expanded to include the major language components, such as grammar, vocabulary, pronunciation and culture as organizing categories, for example grouping the technological resources according to their usefulness for improving these skills and components (Levy, 2009). In other cases, studies have used criteria based on the specific Computer-based technology that supports the language learning process (Krajcso & Frimmel, 2017; Alkamel & Chouthaiwale, 2018; Bhushan, 2020; Budiman, 2020; Li & Lan, 2022; Madhavi, Sivapurapu & Kati, 2023).

All the abovementioned research studies within the field of language learning, though, do not have a classificatory purpose *per se*, and, apart from being very heterogeneous in their approach and purpose, they do not provide a comprehensive account of the pedagogical potential of ICTs in terms of the pedagogical functions of the technology (resources and tools), such as the classification framework presented in this research.

Outside the area of language learning, some studies have categorized educational ICT tools. For example, in a research work about Interactive Learning Systems (ILSs), Luo and Lei (2012) established the following four types of ICT tools: (a) *educational networking*; (b) *web-based learning*; (c) *mobile learning*, and (d) *classroom equipment*. Although learning systems are not the same as tools and resources, some of the concepts in their categorization have been incorporated into our classification, especially those to do with interactive learning technologies and functions. More informally, and without restricting the focus on language learning, the compilation of technological learning tools that Jane Hart has been building up since 2007, called *Top 100 tools for learning* (https://toptools4learning.com), proposes a category of general educational resources somehow resembling our research, since the tool categories are: Content (& app), Content development, Learning platform, Communication & Collaboration and Web tools.

In this section, we have been carried out a brief state-of-the-art review of earlier attempts to categorize ICT-based resources and technologies which can have a pedagogical function, not only within the field of language learning, so that our research can incorporate some key concepts that will help us to build up our classification framework. In this review process, Hart's model has been especially relevant, although it has not been directly used. Therefore, the classification proposals discussed above have played an *inspirational*, rather than a *developmental* role, in this research.

In the most recent version of the annual *Horizon Report - Higher Education Edition* (Becker et al., 2018), which identifies and describes the higher education trends, challenges, and developments in general educational technology with an impact on learning and teaching, the latest developments in technology are considered, such as adaptive learning technologies, games and gamification, mobile learning, natural user interfaces, Artificial Intelligence,

Learning Management Systems, and mixed reality, among others. This report also deals with certain technological trends with a high potential to contribute to the field of education. These significant trends in education nowadays can serve this research by incorporating pedagogical functions that can be implemented through ICTs within the language learning and teaching processes.

3. METHODOLOGY

In this study, two research designs can be distinguished, in line with the two objectives: developing a framework for the classification of technology-based language learning resources and carrying out an initial and partial validation of the classification. Both aspects of the research are closely intertwined in such a way that they do not take place in a linear fashion throughout the research process, but they provide feedback to one another in an iterative way, as the data is collected and analysed.

This is a descriptive and analytical study which follows a mixed research methodology, including qualitative and quantitative approaches. For the elaboration of the classification, a corpus of 350 ICT-based language learning resources was generated based on the contribution of 96 teachers, including the authors, most of whom were Content and Language Integrated Learning (CLIL) teachers. Apart from this corpus, in a more informal and holistic way, the researchers also observed and analysed between 20 and 30 additional technology-based resources that could be used in language learning. At this preliminary stage of the research, a collection of specialized publications on educational technologies have been incorporated, within a process of conceptual coding. For building up the classification framework and the related taxonomy, the research methodology was, therefore, qualitative.

Thus, the resources and tools were analysed qualitatively applying principles of the grounded theory research methodology, in this case, coding the information emerging from the analysis of the data, i.e. the ICT-based learning resources and tools, from the point of view of pedagogical functions. The resources were coded using the concepts of pedagogical functions and purposes, i.e. asking the following questions: (1) *What can the resource be used for within the language learning process?* (2) *What is the resource's primary function within the language learning process?* and (3) *What technology is behind the resource and allows it to have this function?* As a result of this coding, certain categories emerged from the data (i.e. the resources and tools) in the form of phrases starting with "for", which made up the first level of the classification framework, with the addition of further details about the technology or the way or format in which the pedagogical function is enabled in the resource, which made up the second level or subcategories of the classification. Consequently, the first level of the classification framework (labelled as phrases with "for") refers to pedagogical functions, which, in turn, may belong to 2 subfamilies: those focused on teaching (carried out by teachers) and those focused on learning (carried out by learners). And the second level of the framework refers to subcategories which correspond to practical results or uses of those pedagogical functions of the first level. This analytical procedure finally resulted in fifteen types of technology-based language learning resources, with a variable number of subcategories. The categorization process experienced a series of iterations aiming at refining the classification, including feedback from questionnaires completed by language teachers.

In the second stage of the study, a quantitative methodology was implemented, through the implementation of descriptive statistics. Two almost identical questionnaires, one in Spanish, called *Uso de herramientas digitales en la enseñanza de Español como Lengua Extranjera* (available online at https://forms.gle/naHohQjFER4oqGgN8) and the other in English, named *Use of digital resources for learning English as a Foreign Language* (available at

https://forms.gle/BES8xLjUVPABzCrMA), were designed using *GoogleForms* and administered to teachers of Spanish as a Foreign Language (ELE) and English as a Second Language (ESL), respectively.

The structure of both questionnaires was the same, comprising four parts. The first part included 7 questions covering ethnographic information about the participants, such as age, nationality, country of work, years of experience, academic qualification, etc. The second part had 17 questions about the use of technology-based language learning resources for specific functions. This part started with 3 questions dealing with the general use of these resources in the participants' teaching practices: (1) *Do you use digital tools/resources (ICT, Information and Communication Technologies) in your EFL teaching practice?* (2) *What is your favourite digital tool/resource (ICT) for teaching/learning purposes? (Please write the full name in capital letters)*, and (3) *For which teaching activities or functions do you use digital tools/resources (ICT)?* This last question included the following options: *Assessment, Development and preparation of learning materials, Adaptation of learning materials, Search for learning materials, Game-based language learning, Presentation of didactic content, Synchronous communication, Asynchronous communication, Simulations* and *Other*. These categories roughly correspond to key functions that came into view during the coding process. Then, the following questions of this second part of the questionnaire integrated the types and subcategories of the classification, corresponding to its first version (for the ELE questionnaire) and its second version (for the ESL questionnaire). This set of questions, based on the classification proposal, asked teachers whether they used the types and subcategories of language learning resources. The third part of the questionnaire comprised 2 questions about the classification of technology-based language learning resources. The first Yes/No question was: *The typology (questions 1 to 14) describes digital tools and resources (ICT) for the teaching-learning of EFL. Do you consider that they include all the pedagogical possibilities regarding the types of tools that can be found in ICT today for the teaching-learning of EFL?* The second question should only be answered if the participant marked "No" in the previous question, and was an open-ended question the objective of which was for the participant to write any possibility of resource type that was not included in the classification: *What type(s) of tools would you include that have not been described in this questionnaire?* This question was used to provide feedback to refine and improve the final version of the classification. The fourth and final part of the questionnaire also comprised 3 questions the purpose of which was to prompt a general reflection about the importance and pedagogical significance of ICTs and their resources within the language learning process, from the point of view of the teachers.

These questionnaires were part of an iterative process and provided the research with both qualitative and quantitative data, which were processed with the grounded theory methodology (conceptual coding) and descriptive statistics, respectively. The purpose of the questionnaires was two-fold. Firstly, and mainly, they provided data and feedback from teachers that was used to refine the classification framework, after a second process of data coding, also with concept of pedagogical functions in mind in order to construct the categories and subcategories. Secondly, the questionnaires also served as an initial and partial validation of the classification framework from the perspective of teachers. Using the grounded theory approach, and after a series of iterations in a non-linear process of analysis of the data (using codes to identify pedagogical functions and uses of the ICT-based resources), the questionnaires served, together with the observation of the resources, to the main objective of the research, that is, the building up of the final proposal of the classification framework.

The reason why two questionnaires for teachers of two target languages (Spanish and English) were used is to show how the classification framework may be valid and may be used in different target languages, and, possibly, in the future, it could also be used to carry out research studies about the real use of the different categories of ICT-based resources, comparing different target languages. Nevertheless, this was beyond the scope and purpose of the present

study, partly because the sample of teachers and the demographic data the questionnaires developed for this study was not sufficient to carry out such a comprehensive analysis. Additionally, it must be noted that the present research is only focused on teachers and, therefore, it cannot draw any conclusion about the point of view of language learners or the usefulness of the framework for learners. This validation is also beyond the scope of this study.

4. A CLASSIFICATION OF TECHNOLOGY-BASED LANGUAGE LEARNING RESOURCES

The classification is organized around two levels. The first level, represented in bold letters in Table 1, describes the pedagogical function of the resources, i.e. the action that is facilitated by the resource within the language learning and teaching process. At this first level, the ICT-based resources may belong to 2 different types: those mainly aimed and used by teachers and those mostly useful for learners. This difference is illustrated in the framework with the letters T (for teachers) and L (for learners). The second level in the classification framework incorporates a characterization of the technology, mechanics, or a more detailed account of the results or use of the pedagogical functions when they are implemented in the language learning and teaching process. A second purpose of the second level, more specifically, is to open the door for new subcategories, since the classification, at this level, can integrate new type descriptions to account for potential new uses and applications of the resources, as technology evolves. An overview of the categories is shown in Table 1:

Table 1: ***Types of Technology-based Language Learning resources***

RESOURCES FOR…
T-1. the development of didactic content: Elaboration of general language learning didactic materials / Creation of game-based didactic materials / Development of questionnaires / AI-based learning materials tool
T-2. obtaining didactic content: Language learning materials download / Access to linguistic input in the L2 / Games and gamified materials download
L-3. language practice and use: Content-based online practice / Content-based practice (through mobile app) / Online language practice / Language practice (through mobile app) / Game-based online language practice / Game-based language practice (through mobile app)
L-4. creativity purposes: Tool for general creative tasks / Tool for language-based creative tasks / AI-based creative tool
L-5. communication and collaboration: Communication tool / Collaborative platforms
T-6. learning management: Learning Management System (LMS) / Learning Experience Platform (LXP) / Self-assessment tool / Language proficiency assessment tool
L-7. notetaking: Note-taking application / Mind map tools
L-8. vocabulary management: Online dictionary / Dictionary mobile app / Concordancer / Searchable lexical database
L-9 translation management: Online translation tool / Translation mobile application
T-10. teaching professional development: Teaching information tool / Teaching training tool / Teaching network/association
L-11. Natural Language Processing: Text-to-speech tool / Speech recognition tool / Speech synthesis tool / Text analysis tool
L-12. social and cultural projects: Social networks / Online communities of practice / Social and cultural project
L-13. ICT-based exploration and basic research: WebQuest / Online resource for basic research purposes
L-14. immersive learning: Virtual world / Virtual Reality tool / Augmented Reality tool / Mixed Reality tool
L-15. text review purposes: Grammar checker / AI-based textual review tool

At the first level, the classification comprises fifteen types of learning resources and tools the identification of which starts with the preposition *for*, reflecting a functional and practical approach in the analysis and description, followed by a statement of the function that plays a role within the language learning process and is enabled or enhanced by the digital resource or tool. The actions used to build up the classification refer to pedagogical functions not necessarily restricted to the area of language learning, but they could also be regarded as relevant to the learning and teaching of other subjects through a target language. The 15 categories of the first-level classification are discussed below.

1) 1st category: "*Resources for the development of didactic content*" includes tools that allow teachers to develop all kinds of learning material, from individual Learning Objects (LOs) to complete didactic units and courses, for the purpose of language teaching and learning. These resources are particularly useful for teaching professionals and instructional designers who want to create language learning materials to be used in different learning settings. An especially relevant group of resources within this category are those known as Authoring Tools. Currently, the advent of Artificial Intelligence (AI) has contributed to expanding the possibilities of accessing specific L2 linguistic input that can be used in the development and adaptation of language learning materials. Subcategories within this type are: (1) Elaboration of general language learning didactic materials, (2) Creation of game-based didactic materials; (3) Development of questionnaires, and (4) AI-based learning materials tool.
2) 2nd category: "*Resources for obtaining didactic content*" comprises those tools that permit teachers and, in this case, also learners, to access, obtain and download language learning materials. The pedagogical material thus obtained may be both language learning materials or LOs that have been designed to learn a given language, and any relevant digital material that can be useful to teach or learn an L2 because it is expressed in that target language, even though it has not been devised with language learning in mind, such as online encyclopaedias, digital magazines, information dissemination platforms, multimedia repositories, and so on. Practically everything written or spoken in the L2 that is accessible through ICTs belongs to this category and can therefore be a source of linguistic input. The most important subcategories of this second type of resources are: (1) Language learning materials download; (2) Access to linguistic input in the L2, and (3) Games and gamified materials download.
3) 3rd category: "*Resources for language practice and use*" covers all the ICT-based tools for learners to practice and improve their linguistic and communicative knowledge and skills. This type of language learning resources implies some kind of interactivity between the learner and the digital resource, which usually includes tasks and exercises whereby the learner uses the interface of the technology to provide some kind of linguistic output, which can be oral or written, although at times the interaction can be more mechanical, for instance in drag-and-drop exercises. Another usual implication of this type of resources is the provision of some sort of feedback or evaluation of the learner's linguistic production or mechanical action. A distinction must be made between interactive resources of this type and text files (e.g. PDF documents with ready-to-print language exercises) that can be downloaded to be completed by learners without any interaction with the technology, which would be classified within the previous category. Another distinction is made between practising the L2 for general language use and carrying out this practice with the integration of specific content, as well as between online and mobile learning. Some subcategories of this type include: (1) Content-based online practice; (2) Content-based practice (through mobile app);

(3) Online language practice; (4) Language practice (through mobile app); (5) Game-based online language practice, and (6) Game-based language practice (through mobile app).

4) 4th category: "*Resources for creativity purposes*" includes resources and tools that allow learners to develop their creative skills, in a very broad sense, by using the target language. In this type, learners practise the L2, either for generating something that is not directly related to the language under study, or for creating a language-based product or output. AI technology is currently very relevant for this type of resources. The major subcategories of this family are: (1) Tool for general creative tasks; (2) Tool for language-based creative tasks, and (3) AI-based creative tool.
5) 5th category: "*Resources for communication and collaboration*" enables communication between the various participants in the language teaching-learning process and facilitate collaborative work and learning. These resources are especially relevant for language learning, since the main purpose and function of language is communication, as well as collaboration in a process of mutual understanding. ICTs have brought about a wealth of tools directly related not only to communicative functions, like the Social Web, but also to an unprecedented potential for collaboration between humans. Within this group, taking these components into consideration, two subcategories may be identified: (1) Communication tool, and (2) Collaborative platforms.
6) 6th category: "*Resources for learning management*" includes tools, resources and platforms that allow teachers and learners to administer and manage the language teaching and learning processes and tasks. The most popular resources of this kind at present are those referred to as Learning Management Systems (LMS), defined as server-based learning technologies for the planning, creation, management and delivery of course material (Turnbull et al. 2021). A distinction should be made between these LMS, which usually require learners to follow a program as designed by the course provider, and the more modern Learner Experience Platforms (LXPs), which use advanced technologies, such as AI, to make the learning experience better adapted to the learner's specific needs (Feffer, 2024; Kirvan & Brush, 2024). Tools and resources used for language proficiency assessment (including testing), as well as those which can be used for self-assessment purposes, are also included here, because language assessment and testing may be considered as a fundamental part of learning and teaching management. Thus, this group of resources comprises the following subcategories: (1) Learning Management Systems (LMS); (2) Learning Experience Platforms (LXPs); (3) Self-assessment tool, and (4) Language proficiency assessment tool.
7) 7th category; "*Resources for notetaking*" facilitates the task of collecting information and content from texts, mostly -yet not necessarily- oral, for study, analysis or interpretation purposes. Notetaking is a major academic skill which may be ideally developed with the help of these digital resources. The two most common subcategories here are: (1) Note-taking application, and (2) Mind map tools.
8) 8th category: "*Resources for vocabulary management*" enables learners to get to know, learn and practice the vocabulary of the language under study. There is a further classification into some subcategories, such as (1) Online dictionary; (2) Dictionary mobile app; (3) Concordancer, and (4) Searchable lexical database.
9) 9th category: "*Resources for translation management*" includes tools that assist the translation process and help in learning the target language. Despite certain criticism, translation plays a major role at all levels of language learning and teaching. Current

ICTs, especially with the advent of AI, have significantly expanded the potential of assistance in translation. The subcategories of this type are: (1) Online translation tool, and (2) Translation mobile application.

10) 10th category: "*Resources for teaching professional development*" allows teachers to improve their teaching and pedagogical skills. ICTs provide an ideal environment for the professional development of teachers, with plenty of specific publications, repositories, collaborative platforms, computer-mediated communication tools, associations and networks. The most important subcategories of this family of resources are: (1) Teaching information tool; (2) Teaching training tool, and (3) Teaching network/association.
11) 11th category: "*Resources for Natural Language Processing*" includes a wide range of tools integrating technologies that allow the synthesis, analysis and simulation of natural language. Currently, Natural Language Processing (NLP) technologies have evolved and improved at a very fast pace, partly due to the development of AI. The use of NLP to handle and treat passages of linguistic input and output in the L2 has many possibilities in language learning and teaching. The technical functionalities of NLP are considered to establish the subcategories of this group of resources: (1) Text-to-speech tool; (2) Speech recognition tool; (3) Speech synthesis tool, and (4) Text analysis tool.
12) 12th category: "*Resources for social and cultural projects*" enables teachers and students to carry out tasks for socialization and for the promotion, acknowledgment, and understanding of the culture and society of the target language. Like in other areas, ICTs, especially the Social Web, are efficient environments to facilitate unparalleled ways of human interaction, engagement in social networks and access to cultural projects and events. Learners can also get involved in communities of practice and a wide range of social and cultural activities. The subcategories within this family of resources are: (1) Social networks; (2) Online communities of practice, and (3) Social and cultural project.
13) 13th category: "*Resources for ICT-based exploration and basic research*" comprises those tools that facilitate conscious and efficient use of the Web and related ICTs with the aim of improving knowledge on a specific topic, through the target language. ICTs are ideal tools to access huge amounts of information and content about virtually any topic, which makes them suitable to carry out basic research tasks by learners, who can improve not only their communicative skills in the target language, but also and simultaneously, a series of relevant digital literacies. It must be noted that the term "research" here does not refer to higher-order research carried out by teachers and researchers, but to more basic tasks related to knowledge building. This is the fundamental principle behind certain pedagogical activities, such as WebQuests and other Web-based tasks. Thus, several relevant subcategories may be identified within this group: (1) WebQuest, and (2) Online resource for basic research purposes.
14) 14th category: "*Resources for immersive learning*" creates virtual environments where language learning and teaching can take place in an immersive manner. ICTs are used to simulate environments where language learners can interact in the target language with the aim of using that language in a natural and authentic, i.e. contextualized, way. Some subcategories of this type are: (1) Virtual world; (2) Virtual Reality tool; (3) Augmented Reality tool, and (4) Mixed Reality tool.
15) 15th category: "*Resources for text review purposes*", i.e. tools that use specific technologies to analyse and evaluate oral or written texts to provide the user with correction feedback and suggest changes at the levels of form or meaning for improve-

ment or error detection and rectification. These tools promote the learner's language awareness. The performance and usability of these resources have been significantly improved with the advent of AI. Some subcategories of this group are: (1) Grammar checker, and (2) AI-based textual review tool.

As can be observed in this classification framework, the most important criteria are related to pedagogical functions, rather than to the technology, although the various technologies are sometimes integrated in the definitions. This classification is an open-ended system in two ways. Firstly, a given digital language learning resource might present features and functions from different types, and, consequently, belong to more than one type in the framework. Secondly, the subcategories included in the second level of the classification may not fully cover or exhaust all the technological possibilities in terms of pedagogical functions, since ICTs evolve at a swift pace, and, in the future, new subcategories may arise to describe the new potential.

5. IMPLEMENTATION AND INITIAL VALIDATION OF THE CLASSIFICATION PROPOSAL

The next step in this research study was to put the classification framework into practice, mainly with three objectives: firstly, to illustrate one possible application of the classification, i.e. conducting educational research; secondly, to incorporate feedback from language teachers with the aim of refining and improving the classification, and, thirdly, to carry out an initial evaluation and partial validation of the classification. To meet these objectives, two questionnaires were used, at different times within the research process.

The first study took place in December 2023, using the questionnaire, called *Uso de herramientas digitales en la enseñanza de Español como Lengua Extranjera (ELE)*. It was completed by 36 teachers of ELE. They came from different geographical locations and most of them had more than 10 years of teaching experience. Regarding the use of technology in their language teaching, the most widely used pedagogical functions and teaching tasks for which teachers preferred to implement technology-based resources were: developing/preparing learning materials, presentation of didactic content, assessment and adaptation of learning materials. According to these results, teachers still seem to prefer using new ICTs for rather "traditional" purposes, instead of incorporating other technology-assisted functionalities, such as course management, simulations or gamification.

The specific functions and categories that were used the least were the following: note-taking, online translation tools, NLP-based tools, Web-based exploration and research tools, resources for immersive learning and social networks. This, together with the fact that the most widely mentioned tools were *Canva*, *Paddlet* and *Kahoot* (with a long tradition in the market), could lead to the conclusion that teachers (at least the participants in the study) do not take full advantage of the many possibilities of ICTs in terms of pedagogical functions within the language learning process. In the last general reflection question, the answers were coded and summarized, and the teachers believe that the most outstanding aspects that provide an added value to ICT-based resources in language learning are dynamism and variety in the learning process, as well as interaction, communication and collaboration possibilities.

The second study, which used the questionnaire in English called *Use of digital resources for learning English as a Foreign Language (EFL),* was conducted in April 2024 and was completed by 35 teachers of English. The size, gender, age range and years of experience of this group were equivalent to those in the first ELE study. Among most teachers, the preferred ICT-based tools were, like in the first study, resources that are well-known and have been available for a long time: *Kahoot*, *Quizlet*, *Moodle* and *YouTube*, which may lead to the same conclusion. The same is true of the functions of ICTs for language teaching that were more significantly

mentioned by teachers in the study, i.e. development and preparation of learning materials, presentation of didactic content, search for learning materials and, unlike in the first study, game-based learning.

The results showed that the functions, types and subcategories that were used the least by teachers were the following: translation apps, note-taking, NLP-based tools, teaching professional development tools, social networks, Web-based research and exploratory activities and tools for immersive learning (VR and AR). These results, consistent with the ELE study, suggest that language teachers tend to use ICTs and their related tools in a rather traditional manner still. The studies showed that the classification can be used to design surveys and draw conclusions on the actual use of ICT-based language learning resources and on whether teachers or learners take full advantage of the pedagogical potential of these resources.

The two studies carried out using the questionnaires were also aimed at carrying out an initial validation of the classification, by incorporating the teachers' point of view. To meet this objective, the questionnaires incorporated two questions about the teachers' opinions and views on whether the classification of resources is adequate and comprehensive. In both studies, as shown in Figure 1, the results were equally positive on this issue, and most teachers (except for 3 participants in each case) considered that the classification framework is comprehensive and adequate to account for such potential.

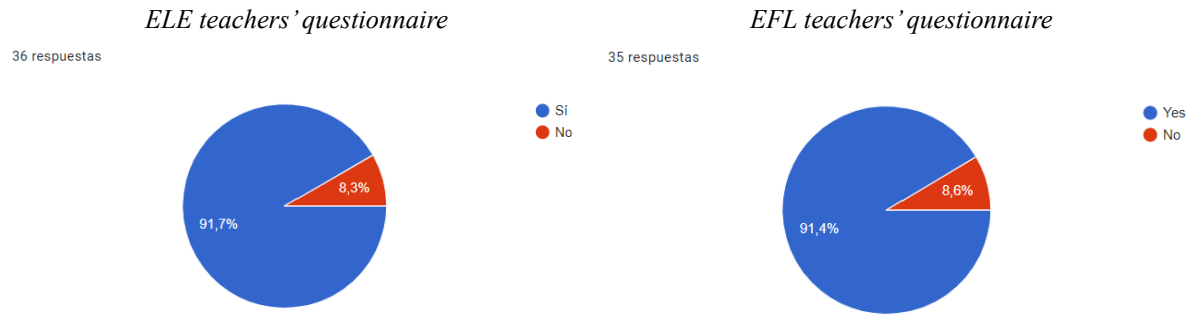

Figure 1: ***Question - Do you consider that they include all the pedagogical possibilities regarding the types of tools that can be found in ICT today***

The answers given by these 6 teachers were analysed and coded, and they coincided in that AI should be integrated into the classification. Consequently, this feedback was provided and incorporated into the classification framework to refine and improve it, as part of the iterative research process. Thus, AI appears in different types and subcategories in the final version of the classification.

6. CONCLUSIONS AND FUTURE WORK

If language teachers and learners are to take full advantage of the great potential of ICTs within the teaching and learning process in terms of pedagogical functions, it is necessary to know exactly not only what relevant resources and tools are available and how they work, but also to ascertain how they can be used in the most pedagogically efficient way when learning or teaching a language, which is the main purpose of the classification proposal presented here.

Constructing a coherent and comprehensive classification of technology-based language learning resources is a very complex endeavour, for different reasons. First, language teaching and learning is a dynamic and multifaceted area in continuous evolution, and the classification criteria and purposes often emerge from heterogeneous sources. Second, the field is subject to

diverse terminology, since the terms used by different researchers to refer to the categories are often diverging or conflicting. Third, the establishment of a typology involves setting boundaries between functions and concepts that are usually overlapping.

In this study, a comprehensive classification of technology-based language learning resources has been proposed and initially validated. All the information from the data, previous educational research, the teachers participating in the two studies and the researchers have been incorporated into the types and categories of the classification framework, in an iterative process of improvement. The result is a classification framework that has great potential from a pedagogical standpoint, both in theoretical and practical terms. Additionally, it can take different formats depending on the context of use: database, software, application, spreadsheet, online platform, repository, template, checklist, and form, among others. It can be useful for instructional designers mostly at two levels: it may be employed to consider which function(s) should be integrated when designing specific language learning materials or courseware, and it can be used to clearly establish the pedagogical function(s) of the tools or to incorporate different didactic possibilities to their development.

Furthermore, it holds distinct possibilities of implementation for language teachers, at least in four areas of their professional practice: teaching management, learning materials development, learning tools use, and professional development. Also, language learners may use the classification for several fundamental purposes in their language learning process. Language learners, like teachers, can implement the classification for two tasks: organizing their learning and ensuring variety in their contact with the L2. Another key purpose of the classification is to adapt the language learning tasks to their individual preferences. At a more general level, the classification framework may serve for creating an organized and searchable library or database of technology-based language learning resources. This would enable a pedagogically coherent integration of technology within that process.

We are conscious that this research has some limitations, especially in terms of the number of teachers that participated in the initial and partial validation and regarding the method to carry out the qualitative coding of the information used in the construction of the classification. Although this coding was systematic, at times some intuitive or more subjective views may have resulted in biased interpretations. Thus, two future research work possibilities may be suggested: carrying out a more systematic validation of the classification and incorporating AI tools and sophisticated big data processing methods to make the classification even more comprehensive and representative of the potential of ICTs in language learning.

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