



Pedagogical and communicative resilience before industry 4.0 in higher education in translation and interpreting in the twenty-first century

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Abstract

Industry 4.0 technological resources are tools used in everyday lives. In Higher Education, instructors need to recognize the value of these information and communication tools (ICTs) and integrate them to support teaching in any field of knowledge. In this study, the evolution of the use of technological resources in Translation & Interpreting education has been analyzed through a diachronic analysis. Taking as an example the innovative teaching macro-project Aula.Int (University of Granada), we have studied some of the most relevant technological resources that have been used to support translation training since the beginning of the twenty-first century. The ACOT model was used to determine the degree of appropriation of each information and communication resource. The results show that translation educators have proven to be resilient to the rapid emergence of technological resources, which, in many cases, have been continuously implemented to support teaching.

Keywords Industry 4.0 · ICTs · Technological resources · Innovative teaching · Translation

1 Introduction

Technological resources in the field of information and communication are tools we use in our daily lives. The term "Industry 4.0" refers to the fourth industrial revolution, which is characterized by the integration of advanced technologies such as artificial intelligence, the Internet of Things, and big data analytics (Oliveira et al., 2023)

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and has great implications in the field of teaching and languages (Sánchez Guzmán, 2019). In educational contexts, these technologies are now being applied (Oliveira et al., 2023), so teachers need to recognize the value of information and digital competences (Sales et al., 2020) and the use of technological resources and support technological resilience (Rossetto & Martin, 2022). These tools are applied in Higher Education to bring students closer to the tools they will need in their professional future, as well as to collaborate to increase student engagement and interpersonal interaction by simulating real work scenarios and providing learning opportunities (Moraes et al., 2022). Nowadays, students already regularly use mobile phone applications for communication and as a substitute for the personal computer. In this sense, Translation and Interpreting studies have been integrating these resources into various subjects to support teaching, especially during the COVID-19 stage, which required virtual teaching (Varela Salinas & Postigo Fuentes, 2022). These technological resources are still used, but the theoretical frameworks on the integration of Information and Communication Technologies (ICTs) in teaching and their degree of adoption change (Cabero Almenara & Martínez Gimeno, 2019; Salas-Castro & Martínez, 2014). In this scenario, our focus is placed on identifying and showing which technological resources are used, their characteristics and what role they play within the communicative actions of teaching in Translation and Interpreting (hereinafter, T&I).

To do so, we start from the teaching innovation projects developed by Aula.Int, a research group founded in 2000 at the University of Granada (Spain). This initiative, formed by a team of teachers and researchers in the field of T&I, is focused on teaching innovation and the incorporation of ICTs in the teaching–learning processes. Researchers in the fields of documentation, languages, terminology, and translation work in the project. In its more than two decades of life, Aula.Int has developed many teaching innovation projects whose central axis is the application of ICT tools and the development of a didactic model, PATT (Professional Approach to Translation Training). This model consists of integrating into the translation classroom a sequence of tasks to be performed by students in teams in which each participant completes a task and fulfils a function that is essential to the whole. Students therefore carry out tasks in consecutive phases: documentation, terminology, translation, revision and layout, and management of the assignment (Olvera-Lobo et al., 2015). Table 1 includes those projects by members of the Aula.Int team in which technological resources played a special role (an English translation of the name of the projects is included).

The knowledge and use of information and communication technology resources by teachers and students involves several levels. Different studies identify these phases, which range from a theoretical and superficial knowledge of the technological resource to an internalization of its use that allows the possibility of creating and innovating (Cabero Almenara & Martínez Gimeno, 2019). In this paper, the ACOT (Apple Classrooms of Tomorrow) project (Salas-Castro & Martínez Castillo, 2014) is used as a model, in which five levels of knowledge of technological resources are established (Table 2). ACOT is a framework developed by Apple in the 1980s to help teachers integrate technology into their classrooms (Kurniawati et al., 2018) and has been proven to be influential in shaping the way that technology is used in education today and for the last decades (Ross, 2020; Ross et al.,

Table 1 Innovative teaching projects by the Aula.Int Team (created by authors)

Innovative teaching project	Date
Aula virtual de traducción: Aula.Int (I, II, III y IV) [<i>Virtual translation classroom: Aula.Int (I, II, III y IV)</i>]	2001–2006
Plataforma Integral de Apoyo a la Formación en TRAducción (PLAFTRA) [<i>Holistic platform to support translation teaching</i>]	2005–2006
Aplicación didáctica de los recursos informativos de una biblioteca digital de traducción (BIDITRAD) [<i>Didactic application of the information resources of a digital translation library</i>]	2006–2007
Tutorial para el autoaprendizaje de la evaluación de recursos electrónicos de carácter terminológico utilizados en los procesos de traducción (TAETRAD) [<i>Tutorial for self-study of the evaluation of electronic terminology resources used in translation processes</i>]	2007–2008
Glosario on-line especializado en comunicación y documentación multilingüe (GloDoc) [<i>Online glossary specialized in multilingual communication and documentation</i>]	2008–2009
Uso de blogs y wikis para la formación en traducción (TradWiki) [<i>Use of blogs and wikis for translation training</i>]	2008–2009
Uso académico de las redes sociales en la formación en traducción (REDTEI) [<i>Academic use of social networks in translation training</i>]	2008–2009
Redes educacionales en traducción: una nueva perspectiva de la implementación de las redes sociales en el nuevo grado de Traducción e Interpretación (REDEDU) [<i>Educational networks in translation: a new perspective on the implementation of social networks in the new undergraduate degree program in Translation and Interpreting</i>]	2009–2010
Las tecnologías de la información y la comunicación en la aplicación de un modelo profesional en la didáctica de la traducción (TICTEI) [<i>Information and communication technologies in the application of a professional model in translation teaching</i>]	2011–2012
Herramientas de software libre en la docencia de la traducción (SOFTEI) [<i>Free software tools in translation teaching</i>]	2012–2013
Gamificación en el grado de Traducción e Interpretación: una nueva perspectiva metodológica en el aula (GAMTRADI) [<i>Gamification in the undergraduate degree program in Translation and Interpreting: a new methodological perspective in the classroom</i>]	2014–2016
Competencias transversales ¿las grandes olvidadas?: actividades formativas y procesos de evaluación en el grado de Traducción e Interpretación (COMTRANSTI) [<i>Cross-curricular competences, the great forgotten ones? training activities and assessment processes in the undergraduate degree program in Translation and Interpreting</i>]	2018–2020
Metodologías disruptivas adaptadas a la enseñanza virtual en el grado en Traducción e Interpretación (MEDITEI) [<i>Disruptive methodologies adapted to e-learning in the undergraduate degree program in Translation and Interpreting</i>]	2020–2022
Uso de vídeos en microlearning para la formación en Traducción e Interpretación (MICRO-TEI) [<i>Use of videos in microlearning for Translation and Interpreting training</i>]	2022–2024

1991). The model has been followed in several studies to assess the digital literacy of teachers through different case-studies, showing that instructors are still in the adaptation stage (Kurniawati et al., 2018).

Table 2 Model for the knowledge of technological resources based on the ACOT project

Levels	Knowledge and use of technological resources
1. Introduction	Theory and basic use
2. Adoption	Rudimentary use
3. Adaptation	Productive use
4. Appropriation	Experimentation in new didactic practices and creation of projects that would not be possible without these technologies
5. Innovation	Projects, creations, and innovation in specific contexts

It is considered that the objective of Higher Education and, especially in T&I studies, is to achieve the levels of appropriation and innovation in the ACOT framework. However, recent studies suggest that there is little integration of technology in translation modules in Higher Education (Sánchez-Castany, 2022, 2023). Indeed, T&I programs include technology and technological resources as separate modules or courses (González Pastor & Rico, 2021; Mellinger, 2018), as auxiliary aids, without seeking to integrate technology into translation lessons (Sánchez-Castany, 2023). Nevertheless, teaching methodologies in translation programs are evolving to better prepare graduates for the job market, with a focus on simulating real-world language industry situations. Integration of translation technologies, such as computer-assisted translation (CAT), machine translation (MT), and post-editing (PE), is being advocated by researchers and trainers to enhance translation practices and formal training (González-Davies & Enríquez-Raído, 2016; Pym, 2014; Sánchez Ramos, 2019).

The motivation behind our research relies on the conviction that it is imperative to adapt to new information and communication technologies in Higher Education and to train future professionals. But what are most relevant industry 4.0 technological resources that have been used to support translation training since the beginning of the twenty-first century? What technological resources are used, what are their characteristics and what role they play within the communicative actions of teaching in Translation and Interpreting? To date, no work has been identified in the preceding literature that addresses the use of ICT in Higher Education in Translation and Interpreting.

The aim of this paper is to analyze the advances and transformations that T&I teaching has undergone at the University of Granada (Spain) within the framework of training in information and digital competences since 2001. The aim is to show the evolution of the technological resources used, the communicative contexts (face-to-face, blended, virtual), the rationale or justification for its application and the opinion or response of the students. To this end, a multidisciplinary analysis of Information and Communication Technologies in the specific context of teaching in Translation and Interpreting is applied. The relevance of the topic is aligned with the main objective. ICTs must be adapted to T&I training, but there must also be mechanisms for their prior analysis to assess their usefulness and their integration into the training contents of the students.

The following sections present the methodology followed to carry out the analysis of the technological resources used during the first two decades of the twenty-first century in the Undergraduate Degree Program in Translation and Interpreting at the University of Granada. The results regarding the levels of appropriation of these resources are then presented. Finally, the conclusions of the study are drawn.

2 Methodology

In this section, a review and analysis of the technological resources used by the members of the Aula.Int team during two decades of developing teaching innovation projects is presented (Fig. 1). These resources are classified by typology and special emphasis is placed on the continuity in the use of these tools, identifying their permanence in their role of supporting teaching.

Next, the assessment criteria on skill acquisition were reviewed and finally the ACOT model was applied to identify whether a given competency had been

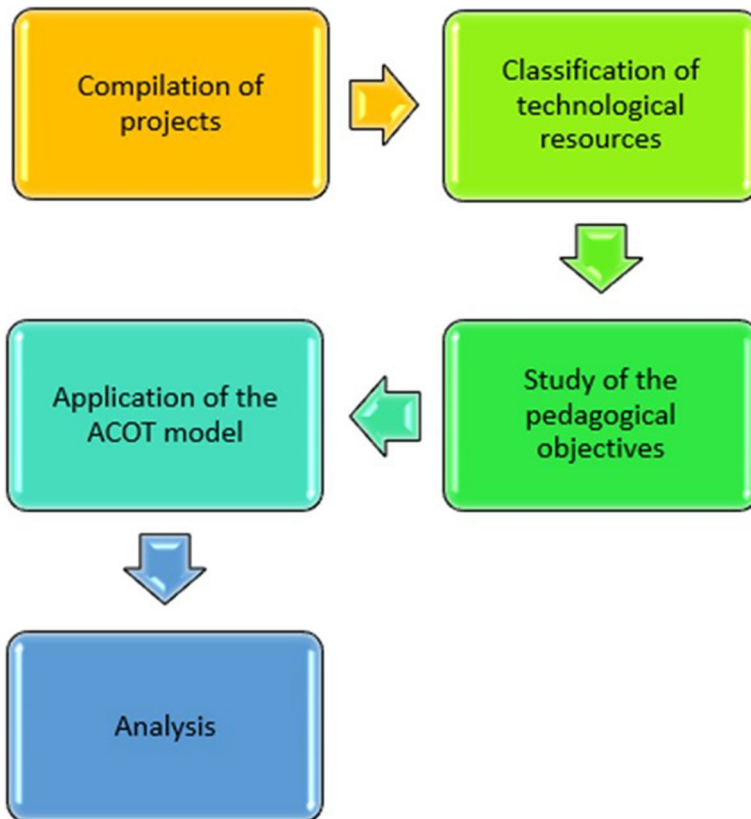


Fig. 1 Research framework

achieved, in this case, the use and exploitation of a given ICT resource (Barak, 2012; Kolvoord et al, 2014; Thompson et al., 2020). Whether a given competency has been achieved has been progressively identified in our work. Each degree of appropriation is conditional on having achieved the lower or previous levels. The ACOT model can be applied as a Likert scale where each level implies a degree of appropriation. The average score of the group of students in each innovation project was identified within the ACOT model. Each project had its own evaluation system, which made it possible to identify whether the set of milestones allowed reaching a certain level in the ACOT model.

Some of the Industry 4.0 tools involved in these projects would be as follows.

2.1 Digital platforms for teaching

These are virtual environments that integrate different teaching support resources (Amin & Sundari, 2020). One of their characteristics is that they enable collaborative work and teleworking, which is clearly aligned with the nature of T&I training (Olvera-Lobo et al., 2015). Notably, two types of platforms have been used: collaborative work platforms and web platforms.

2.2 Collaborative work platforms

Since the first teaching innovation project (Aula.Int I, II, III and IV), developed between 2001 and 2006, the use of this type of resources has been a central part of Aula.Int's philosophy. BSCW (Basic Support for Cooperative Work) platform was the first resource to be used, a place where students could exchange documents and access a calendar to set work meetings. During the 2005–2006 academic year (with the PLAFTRA project), the use of platforms to incorporate the PATT model into teaching continued. This model was even exported to the Italian universities of Trieste and Bologna. In subsequent projects (BIDITRAD, 2006–2007), other collaborative work platforms were explored and analyzed, such as SWAD, WebCT, ProAlfresco, eGroupWare, PhpGroupWare, OpenGroupWare, or HiperGate.

While these types of resources have been used consistently in T&I teaching, they regained special importance during the development of the COMTRANSTI project (2018–2020). This project was born with the aim of promoting the acquisition of cross-curricular competencies among students of the Undergraduate Degree Program in Translation and Interpreting, considering that these competencies were often relegated to a secondary place in Higher Education (Olvera-Lobo et al., 2018). However, the health crisis that began in March 2020 forced a change in the objectives and didactic methods applied. From the moment a lockdown was imposed in Spain, teachers redirected their efforts towards a virtualization of teaching. Thus, the use of the University of Granada's PRADO platform, Moodle, which offers great possibilities for teamwork, increased.

Following that line of action, during the MEDITEI project (2020–2022), the members of the Aula.Int team carried out work to identify and define the pedagogical needs related to the Undergraduate Degree Program in Translation and

Interpreting. This objective was carried out through an extensive literature review focused on disruptive teaching methodologies (Díaz-Millón et al., 2020), and a survey on the satisfaction of undergraduate students with virtual teaching (Díaz-Millón et al., 2023). During the 2020/21 academic year, teaching scenarios were subject to uncertainty. The transition from a semi-virtual to a 100% virtual teaching scenario was a challenge not only for the teaching staff, but also for students. To find out the needs, expectations and experiences of the students, the researchers designed a survey that was disseminated among the groups of the course Computer Tools for Translators and Interpreters. In this survey, they were asked about their perception of the inconveniences generated by virtual teaching, their satisfaction with the teaching support platforms, their experience with the organization of independent work, or their feelings about the interaction with lecturers and with other students. Members of the research group were able to identify that students were particularly dissatisfied with the interaction with lecturers and with other students, but that they valued positively the use of teaching support platforms (such as PRADO). It was decided, therefore, to base teaching in the elements that students valued positively: collaborative work platforms.

In this way, it can be seen how collaborative work platforms have meant a cornerstone of T&I teaching for the Aula.Int team.

2.3 Web platforms

Since its creation, the Aula.Int team focused its efforts on developing a web platform (with the same name as the team), which stores resources to support T&I teaching. This platform, which is still active today, was developed between 2001 and 2007. It includes resources such as a digital translation library (with information on translation support software, translation memories and other resources in Spanish, Portuguese, French, English, Italian and Russian), databases (terminological, bibliographic and multidisciplinary), dictionaries, encyclopedias and other linguistic resources, other useful resources for translation (such as scientific writing standards, or legislation), specialized thesauri or web search tools (such as libraries or documentation centers). In addition, this platform offers students a series of sections designed to provide them with information and tools, both for their training and their professional life, such as lists of translation agencies and companies, T&I associations, blogs, forums and mailing lists, or even global translation platforms. This resource remains an essential support and is updated to this day.

2.4 Web 2.0 tools

The term Web 2.0 is used to refer to a new generation of websites that allow people to collaborate and share information online in ways that were not possible before (Olvera-Lobo et al., 2015). Its use has been recurrent and frequent during all the group's teaching innovation projects. Notably, we have worked with wikis, blogs, forums, social networks, web quizzes and free software tools.

2.5 Wikis

It is a collaborative web space where anyone can add or edit content that has already been published (Olvera-Lobo & Gutiérrez-Artacho, 2014b). Specifically, during the TradWiki project (2008–2009), this resource was employed. The project consisted of the creation of a wiki for translation that was maintained and developed by students with the aim of acquiring theoretical and applied knowledge about this tool within their training as translators in the courses of Documentation Applied to Translation and Information Resources for Translation and Interpreting (García-Santiago, 2016).

2.6 Blogs

These are websites that are easy to create and update and that allow the author(s) to publish instantaneously when this person is connected. Some can be interactive, allowing conversations between students (Olvera-Lobo & Gutiérrez-Artacho, 2014b). That is, they are usually a writing tool for reading and writing either to add or to edit. Blogs were used as tools to encourage participation and interactivity among students. Their use offered quite positive results, and the surveys conducted among students revealed their broad satisfaction, both with the PATT model that was being implemented and with the resources applied (Olvera-Lobo et al., 2015). Special emphasis was placed on the use of this resource during two teaching innovation projects: PLAFTRA (2005–2006) and TICTEI (2011–2012).

2.7 Forums

Digital services that enable synchronous and asynchronous conversation among the members of the forum, where messages are classified thematically (Pérez Sánchez, 2005). Generally, they are usually about a specific subject or a specific course. During the development of the Aula.Int web platform, this resource was used to favor remote communication among students. Although forums were used recurrently during the following years, it was not until the arrival of the COVID-19 crisis (which coincided with the COMTRANSTI project, 2018–2020) that this resource was recovered to support virtual teaching. As communication between students and with lecturers were hindered when moving to a 100% virtual environment, forums became tools that encouraged problem posing and problem solving. Thus, these tools appear recurrently in T&I teaching to encourage remote working.

2.8 Social networks

These are websites for the exchange of personal information between users. Educational networks are used in education, mirroring conventional social networks, but specific to educational contexts (Olvera-Lobo & Gutiérrez-Artacho, 2014a). Two specific projects were carried out in relation to this resource: REDTEI

(2008–2009) and REDEDU (2009–2010). A pilot social network was created on the Ning platform. It was decided to create a specific social network for teaching after a survey of students in which they expressed some reluctance to use their personal social networks for academic work (Robinson & Olvera-Lobo, 2011). Thus, a social network was created to favor communication among students and with lecturers, to encourage the exchange of materials, and to promote remote working. Materials (videos, texts, etc.), profiles and groups were designed, and a set of rules for participating in the educational network were devised. The data and student interventions were compared with those obtained in similar courses using other means of communication, such as the SWAD collaborative work platform. The result was extremely positive as the students in the educational networks were more participative and the final grades were higher.

2.9 Online questionnaires

This evaluation tool has been frequently used in T&I teaching to assess the acquisition of competencies and knowledge by students. Examples of its use can be found from the first projects by Aula.Int (Aula.Int I, II, III and IV), and in several later examples, such as TAETRAD (2007–2008) or COMTRANSTI (2018–2020). It is a resource that favors remote working and interactivity. It is as well a versatile medium that fosters both the collection of student responses and their correction.

2.10 Free software tools

The concept of free software is fundamentally legal; it is software with which it is possible to do certain actions –analyze it, modify it, redistribute it– because its author gives permission to do so (Olvera-Lobo & Gutiérrez-Artacho, 2014c). The project SOFTEI (2012–2013) was developed around these tools. A search and selection of free software tools useful for translation was carried out, and they were organized into four main groups: editing and layout tools, linguistic tools, translation tools, and management tools. The tools developed by the Office for Free Software of the University of Granada were also analyzed. This process coincided with the migration and updating of the Aula.Int web platform, where a section on free software tools was created, providing students and translation professionals with access to a wide variety of tools with descriptions and tutorials in audiovisual format. Lecturers presented to the students the free software tools useful in the field of translation, which were used depending on the needs of the different courses involved.

2.11 ICT tools

The use of remote cooperative work applications (such as Google Drive) or communication applications (such as Zoom or Google Meet) played a leading role during the development of projects that coincided with the COVID-19 crisis (COMTRANSTI and MEDITEI). These tools were essential for teaching courses remotely and for promoting distance cooperative work among students. Although they had already

been used before, it is now when they became essential and indispensable. Nowadays, once face-to-face classes have resumed, teachers continue to encourage their use to promote teamwork and remote working.

2.12 Content generating tools

During the more than two decades of Aula.Int's life, materials and products have been generated to support teaching. For this purpose, three fundamental tools have been used: digital libraries, databases, and videos.

2.13 Digital libraries

One of the initial purposes of Aula.Int was to create a digital library available to students through a web platform. This, although not intended to provide an absolutely exhaustive list of available information sources useful for translation –an impossible task due to its vastness– does fulfill the following purposes: (1) it identifies the information needed in translation processes; (2) it establishes a typology and organization of appropriate information resources; and (3) it incorporates some of the most outstanding information sources selected for their interest and usefulness (Olvera-Lobo et al., 2015). This library is still being updated and maintained today.

2.14 Databases

These are tools for storing large amounts of data that can be consulted. In particular, the GloDoc project (2008–2009) made use of this resource. Students of courses in the area of documentation had to create a multilingual online glossary, to increase their knowledge of terminology in several languages. The results were very positive, highlighting the promotion and good reception of teamwork and communication among all members of the group (García-Santiago & Lozano Carvajal, 2012).

2.15 Video

This resource has been frequently used throughout the teaching innovation projects, as it is a tool that combines image and sound, which encourages communication and student understanding. Aula.Int lecturers recorded videos to create tutorials to guide students in the utilization of useful resources for translation (TAETRAD project, 2007–2008) or free software tools included in the web platform (project SOFTEI 2012–2013).

Likewise, during the virtual teaching periods (MEDITEI, 2020–2022), a series of didactic videos were developed in which lessons and continuous evaluation activities were explained, applying two disruptive teaching methodologies: micro-learning and flipped classroom. Students had to watch the videos before the class so that the lecturers could solve their doubts, especially regarding the more practical aspects of the subject. In this way, the disadvantages (e.g., the less direct communication with students) of semi-virtual and virtual teaching were targeted. Students expressed,

through questionnaires, their satisfaction with the use of videos to support learning. These good results led to the MICROTEI project (2022–2024), which is still ongoing. For this initiative, it is planned that, in the case of 10 undergraduate dissertations supervised by members of the Aula.Int team, the explanatory video will be used by students to present their projects. In this video, students should explain their object of study, objectives and hypotheses, methodology, results, and conclusions, with visual support and oral explanations by students. In this way, the video is presented as a teaching tool, but also as an evaluation method.

2.16 Video games

Specifically, with the GAMTRADI project (2016–2018), video games, defined as entertainment-oriented electronic applications that are visualized through screens (Gutiérrez-Artacho & Olvera-Lobo, 2016a), were used to support teaching. A novel approach was incorporated: gamification, i.e., the use of game elements and game design techniques in non-playful contexts (Flores Figueroa, 2015). This proposal is based on the consideration that, although there are more and better teaching tools available today than in other time in history, these advances are sometimes not effectively reflected in learning outcomes nor in students' competencies acquisition. Engaging students in their courses largely relies on finding the areas that arouse their interest. Games can increase participation because they are attractive, they offer instant rewards, and they facilitate the acquisition of skills used in everyday life. Video games are a prominent type of games applied in teaching settings that can keep students engaged so they are fully immersed in the task at hand.

A pilot study –named Gamification Challenge– was conducted using two video games, League of Legends, and Clash of Clans. The elements of the gamified study included levels, challenges, characters, roles, scoring system, badges, achievements, and rewards (Robinson et al., 2017). The roles assigned to the students/players corresponded to the roles defined for the PATT teaching model, so this model was integrated into the virtual game environment (Gutiérrez-Artacho & Olvera-Lobo, 2016a, 2016b). After participating in the study, students considered that the Gamification Challenge had enhanced and improved their perception and their acquisition of skills such as expression in their native language, knowledge of their own culture, and long-term memory.

3 Results and discussion

Although the authors are aware of the existence of other technological resources, the data presented in this study come from the experiences and projects developed by the Aula.Int team in the undergraduate degree program of the University of Granada. A chronological analysis of the information and communication technologies used in the different training experiences (Fig. 2) shows the role of each of them. Firstly, online questionnaires have been an

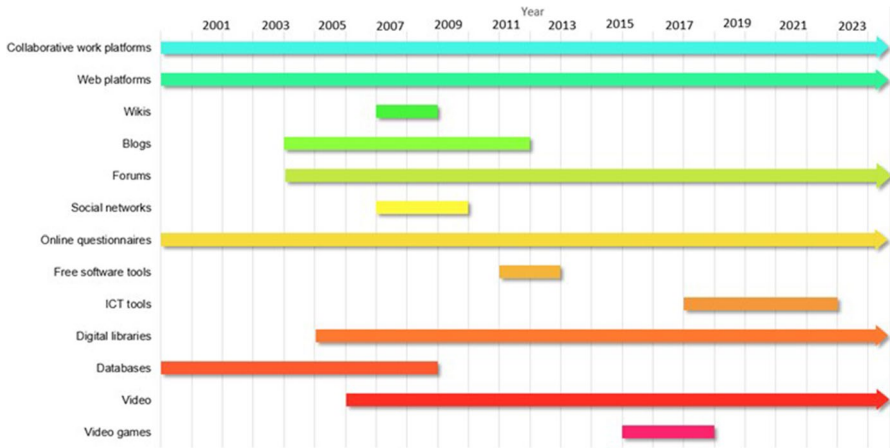


Fig. 2 Timeline on the use of technological resources used in the innovative teaching projects by the Aula.Int Team

essential tool, together with web and collaborative work platforms that have been maintained throughout two decades. Databases are another tool that played a leading role in the first projects and have subsequently been integrated into other resources (such as digital libraries). This integration within web platforms also occurs in the case of wikis, blogs and forums. The latter is a very popular communication resource and widely used in collaborative work platforms. These platforms have had an increasingly widespread use, especially during the health crisis (Almusharraf & Khahro, 2020; Pal & Vanijja, 2020). Occasionally, social networks and video games –with a motivational objective– and free software tools have been used.

The results of this study confirm those obtained by Barak (2012) on the idea that learning materials should be designed, elaborated, and structured in a way that allows the student a blended experience, both reading presentations and texts, watching videos, participating in debates and online forums, and above all participating in challenges that require the completion of tasks that combine technical information and communication skills with translation and interpreting competencies. The pedagogical changes involve, on the one hand, the use of resources (platforms, databases, specialized programs...) as means of support to speed up tasks; and on the other hand, the proposal of teamwork projects that require communication and cooperation among students in the digital space.

The general challenge of being resilient in this industry 4.0 for instructors of T&I is that the future professionals make the most of communication and information services for a better performance and quality of the final product. To this end, the implementation of a pedagogical project requires considering aspects that could be structured in the following steps:

- Work and coordination meetings among faculty members for the development of teaching strategies and projects integrated into the syllabus
- Analysis and selection of Industry 4.0 tools useful in the field of translation and interpreting
- Design of the content structure and elaboration of textual and audiovisual materials to reach the first levels of the ACOT scale
- Design of the project to be carried out by students and breakdown of tasks
- Teacher-student and student–student contact for guidance and support during the learning process
- Evaluation of the experience

Two very different types of information resources have been analyzed. On the one hand, digital libraries, which integrate databases of different types. On the other hand, the use of videos as audiovisual documents transmitting information in the pedagogical communication process. In addition, videos, as contemporary materials that can be adapted to different languages (e.g., by means of subtitling) and as a means of communication, have been useful both as communication vehicle supporting teaching, and as an evaluation tool.

After a macro-analysis of the technological resources used and of the degree of appropriation of each of them, according to the ACOT model (Table 3), all the resources from Industry 4.0 fulfill the first two levels of the model. The tools that reach the adaptation level have an instrumental character, either for communication –like blogs and forums– or for data collection, such as web questionnaires. At the same level are groups of resources, such as free software and ICT tools. These are instruments from commercial platforms (e.g., Google), so they are closed applications of a general type for communicative use and not for specialized collaborative work in T&I. At the appropriation level are specific tools for specific objectives such as games, wikis, and social networks; or communication tools when like videos, which can be transmitted through multiple media.

The objective of Fig. 2 is to show the success in the use of each resource over time, and not so much its learning curve. A learning curve describes the degree of success obtained during learning over time. However, when we talk about digital tools, the learning curve is steep as it is necessary to learn the aim of the tool and the specific buttons and the pipeline to reach any task (Gudoniene et al., 2021). And that learning takes hold with repeated use of the tool (Shail, 2019). Therefore, our objective has been to identify the type of knowledge acquired since our starting point is a minimum learning success such as the level of adoption and adaptation according to the ACOT model.

Finally, web platforms and digital libraries, which also incorporate other ICT resources, allow for versatility to achieve innovation. During the teaching projects developed by the Aula.Int team, innovation has been achieved in the specific context of T&I with these resources. Specific platforms have been created for teaching in these studies and resources have been created and stored in databases and web platforms that have been made available to students and faculty to support teaching. The use of these resources, therefore, has been exploited to the maximum, giving interesting and very positive results. Their ability to incorporate other resources

Table 3 Summary of degrees of appropriation (ACOT model) of technological resources

Technological resource	Innovative teaching experience	ACOT phase
Collaborative work platforms	Aula.Int (I, II, III y IV) (2001–2006) PLAFTRA (2005–2006) BIDITRAD (2006–2007) COMTRANSTI (2018–2020) MEDITEI (2020–2022)	1–5
Web platforms	Aula.Int (I, II, III y IV) (2001–2006) PLAFTRA (2005–2006) BIDITRAD (2006–2007)	1–5
Wikis	TradWiki (2008–2009)	1–4
Blogs	PLAFTRA (2005–2006) TICTEI (2011–2012)	1–3
Forums	PLAFTRA (2005–2006) COMTRANSTI (2018–2020)	1–3
Social networks	REDTEI (2008–2009) REDEDU (2009–2010)	1–4
Online questionnaires	Aula.Int (I, II, III y IV) (2001–2006) TAETRAD (2007–2008) SOFTEI (2012–2013) COMTRANSTI (2018–2020)	1–3
Free software tools	SOFTEI (2012–2013)	1–3
ICT tools	COMTRANSTI (2018–2020) MEDITEI (2020–2022)	1–3
Digital libraries	BIDITRAD (2006–2007)	1–5
Databases	Aula.Int (I, II, III y IV) (2001–2006) Glodoc (2008–2009)	1–5
Video	TAETRAD (2007–2008) SOFTEI (2012–2013) MEDITEI (2020–2022) MICROTEI (2022–2024)	1–4
Video games	GAMTRADI (2016–2018)	1–4

makes them one of the bases for teaching in T&I studies in a globalized world in which technological resources are fully integrated into the teaching and professional areas.

Figure 3 shows a visual representation of the degree of appropriation of technological resources in T&I teaching at the University of Granada during the first two decades of the twenty-first century.

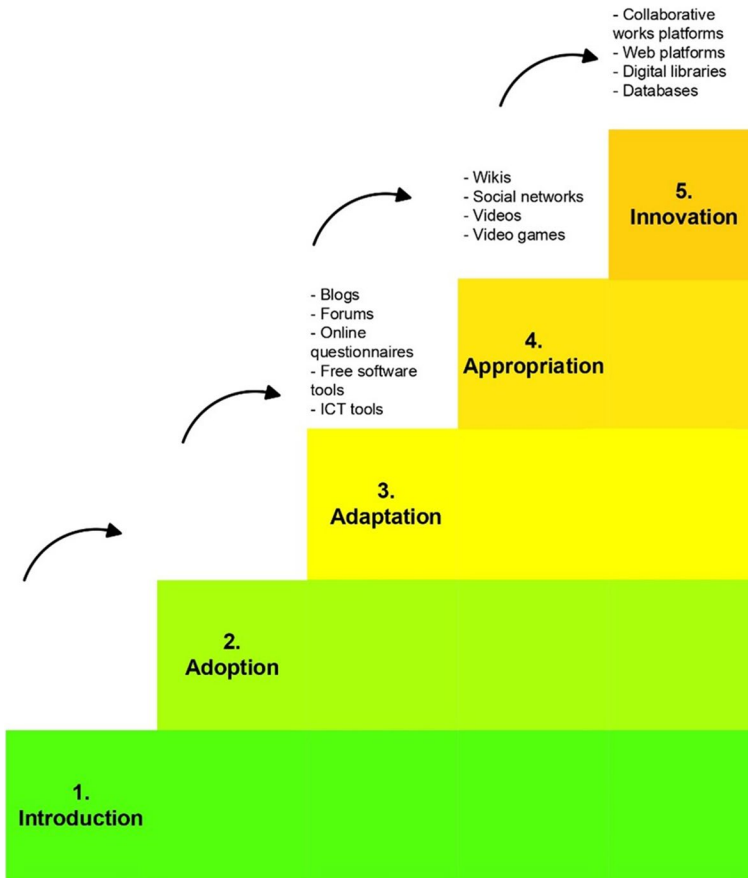


Fig. 3 Levels of appropriation of teaching technological resources in T&I training (ACOT model)

4 Conclusions

In conclusion, it is essential to acquire knowledge about information and communication technologies in the field of T&I to keep the pace with the current social context of the information society in which, as witnessed in recent years, extraordinary situations, such as the health crisis, arise. This review of methodologies confirms the pedagogical and communicative resilience with respect linked to the use and learning of ICTs.

This implies a series of limitations that stand out in these experiences:

- The time and effort of coordinating different courses for the project
- The acquisition of practical knowledge of the resources used in the practice of the profession by the teachers
- The need for empirical validation on a larger scale

Throughout all these experiences, it is clear that it is essential to train students in the general characteristics of these tools and not in the commercial product itself which, over time, may disappear because of the Industry 4.0 market itself. The challenge for teachers and their fundamental pedagogical objective is: a) to transmit to these students which aspects must be taken into account when preparing the content and, in this case, its equivalence in another language: the format (textual with or without images); b) the channel, mainly digital one-way as a website or bidirectional as a social network; and c) the conditions of the communication service (character limit, etc.)

Resilience in teaching communication and in the integration of the most recent ICTs must be a constant. For this reason, the use of data collection through questionnaires tends to be complemented by data analytics. With this method, data is taken directly from the digital environment (platform, website, etc.), which allows for a more exhaustive knowledge of the behaviors and user experiences of students.

In the future it will be necessary to identify not only whether resources are used, but also the intensity of their use, as occurred during the confinement with web platforms and collaborative work platforms, including videoconferencing services.

The products generated from the appropriation, assimilation, and subsequent innovation –level 5 on the ACOT scale– have had different implementation levels and duration over time. From the integration of specific projects, a scalable initiative was built, which have been growing for the past 20 years. This initiative includes resources and products from other projects reviewed in this study and its continuity that lasts until today. It therefore demonstrates the possibility of reaching the level of innovation with information and communication technologies applied to translation and interpreting at both the teaching and professional levels, in the medium and long term.

This cross-sectional study confirms the potential of certain technological tools that are fully incorporated into T&I teaching. This is the new perspective of Industry 4.0, where the more traditional information and communication technologies (e.g., forums or videoconferences) are basic and fundamental tools at the instrumental and communication level. However, it is also clear that, if innovation is sought within T&I, it is necessary to adopt specialized Industry 4.0 tools –such as databases or collaborative work platforms that integrate different tools–. For example, audiovisual technologies –such as videos or videogames, etc.– that can be exploited to foster knowledge and competence acquisition.

It is a fact that the labor market demands translators and interpreters with specialized skills and knowledge but, at the same time, with attitudes and skills for resilience in the professional world that are reflected in the competencies directly connected to Industry 4.0. Along these lines, the highest levels of the ACOT model reflect the potentiality of these tools in the professional field of translation and interpreting. These technological transformations are causing an evolution in the translation and interpreting profession towards lines of work such as web localization, transcreation, multilingual content marketing, and so on.

These skills are also reflected in challenges and opportunities for translation students in their future professional specialties. Some of these are in the field of transcreation and digital marketing with the development of content adapted to new

formats and new channels, with the adaptation to social networking tools where a translation must fit into a communication format. The incorporation of these Industry 4.0 tools will bring about several changes in the way translation and interpreting are taught. These changes include the enhancement of global collaboration and remote learning, as the use of technological resources will enable T&I trainees to collaborate with peers and mentors and will facilitate cross-border training. As well, Industry 4.0 technologies can provide access to vast amounts of language resources, including corpora, translation memories, and terminology databases, helping trainees to improve their language proficiency and translation skills. In addition, as machine translation continues to advance, training programs may focus more on teaching translators and interpreters how to work effectively and ethically with artificial intelligence and post-edit machine-generated translations. This could lead to a shift in the skill set required for professionals in the field.

If there is an impact at the societal level on how multilingual communication has been transformed with the emergence and easy use of machine translators (Vieira et al., 2021), they also impact the translation and interpreting profession. It is a fact that their use allows to streamline tasks (Al-Hemyari, 2023; He, 2021) and to focus the work of the human translator on the post-editing stage, because machine translation requires a correction, editing and revision of the product generated by these artificial intelligence tools to ensure the quality of the message and the target product (Jiang & Lu, 2021; Vela-Valido, 2021). It should be noted in this aspect that Industry 4.0 should be adopted in those tasks that allow it, since attributes such as creativity remain, for the time being, a purely human capacity.

In the immediate future, we can expect to see more integration of these technologies into training programs. However, in the distant future, the role of human translators and interpreters may evolve. For that reason, T&I trainers must keep pace with this evolution and use technology to enhance education. Incorporating Industry 4.0 resources into translation and interpreting training can be a valuable endeavor to prepare students for the evolving landscape of language services. For such reasons, some suggestions for T&I instructors comprise continuously monitoring advancements in this digital era, updating the academic curriculum, providing students with hands-on experience, promoting collaborative learning, and developing assessment methods adapted to these tools. The resources analyzed in this study, and any new ones that appear in the future can (and will) be integrated into the Aula.Int web platform.

The results of this study allow us to formulate a series of recommendations. Teaching methods should focus on simulated projects (Hidayat & Helmanto, 2023), where the design and elaboration of translation tasks based on the professional assignment is addressed. And the rubrics and evaluation criteria must contemplate both the aspects of content, terminology, rhetoric, or formal expression, as well as the digital channel and audience. Hence, a constant challenge is the development and implementation of affordable assessment activities that incorporate disruptive methodologies and Industry 4.0 technologies. These types of challenges require motivated teaching staff, flexibility in the structure and content of the courses to facilitate cooperation between subjects and continuous updating of the teaching staff in technologies that they will integrate in T&I training.

The teaching approach should reflect contemporary social, economic, and technological changes. For this reason, a more digital orientation is recommended, both in the use of e-learning and in the reinforcement of aspects to exercise the profession at a high level of quality, such as post-editing, reducing problems of ambiguity in the message or rhetorical poverty (He, 2021; Sitnic, 2022; Grassini, 2023); the management of textual and audiovisual material (in areas such as virtual reality, augmented reality, metaverse, video games,...), multiculturalism and transculturalism (in areas such as virtual reality, augmented reality, metaverse, video games,...) multiculturalism and transcreation.

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Data availability The datasets and project reports analyzed in this study are available in the institutional repository of the University of Granada: <https://digibug.ugr.es/>

Declarations

Conflict of interest None.

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References

- Al-Hemyari, H. (2023). The future of translation profession in the light of artificial intelligence. *Journal of Reproducible Research*, 2(1). Retrieved from <https://journalrrsite.com/index.php/Myjrr/article/view/46>
- Almusharraf, N. M., & Khahro, S. H. (2020). Students' satisfaction with online learning experiences during the COVID-19 Pandemic. *International Journal of Emerging Technologies in Learning*, 15(21), 246–267. <https://doi.org/10.3991/ijet.v15i21.15647>
- Amin, F. M., & Sundari, H. (2020). EFL students' preferences on digital platforms during emergency remote teaching: Video conference, LMS, or Messenger application? *Studies in English Language and Education*, 7(2), 362–378. <https://doi.org/10.24815/siele.v7i2.16929>
- Barak, M. (2012). Distance education: Towards an organizational and cultural change in higher education. *Journal of Enterprising Communities: People and Places in the Global Economy*, 6(2), 124–137.
- Cabero Almenara J., & Martínez Gimeno A. (2019). Las TIC y la formación inicial de los docentes. Modelos y competencias digitales. *Profesorado, Revista de currículum y Formación del Profesorado*, 23(3), 247–268. <https://doi.org/10.30827/profesorado.v23i3.9421>
- Díaz-Millón, M., Rivera-Trigueros, I., Olvera-Lobo, M. D., & Gutiérrez-Artacho, J. (2020). Disruptive methodologies and cross-curricular competencies for a training adapted to new professional profiles. In S. Palahicky (Ed.), *Enhancing Learning Design for Innovative Teaching in Higher Education*, 83–104. IGI Global. <https://doi.org/10.4018/978-1-7998-2943-0.ch005>

- Díaz-Millón, M., Rivera-Trigueros, I., & Gutiérrez-Artacho, J. (2023). Student satisfaction with a micro-learning approach in distance translation and interpreting training: an empirical investigation. *The Interpreter and Translator Trainer*, 17(3), 434–453. <https://doi.org/10.1080/1750399X.2023.2237322>
- Flores Figueroa, J. F. (2015). Using gamification to enhance second language learning. *Digital Education Review*, 27, 32–54. <https://revistes.ub.edu/index.php/der/article/view/11912>
- García-Santiago, M. D. (2016). El uso de blogs y wikis en la formación del traductor. *Tradumática*, 14, 147–155. <https://doi.org/10.5565/rev/tradumatica.69>
- García-Santiago, M. D., & Lozano Carvajal, A. B. (2012). GLODOC: A multilingual specialized glossary. In L. N. Zybatow, A. Petrova, & M. Ustaszewski (Eds.), *Translation Studies: Old and New Types of Translation in Theory and Practice. Proceedings of the 1st International Conference TRANSLATA "Translation & Interpreting Research: Yesterday – Today – Tomorrow"*. Frankfurt am Main: Peter Lang. <https://doi.org/10.3726/978-3-653-02304-6>
- González Pastor, D., & Rico, C. (2021). Introducing machine translation in the translation classroom: A Survey on Students' Attitudes and Perceptions. *Revista Digital de Investigación en Docencia Universitaria*, 15(1), e1213. <https://doi.org/10.19083/10.19083/ridu.2021.1213>
- González-Davies, M., & Enríquez-Raído, V. (2016). Situated learning in translator and interpreter training: Bridging research and good practice. *The Interpreter and Translator Trainer*, 10(1), 1–11. <https://doi.org/10.1080/1750399x.2016.1154339>
- Grassini, S. (2023). Shaping the future of education: Exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*, 13(7), 692. <https://doi.org/10.3390/educsci13070692>
- Gudoniene, D., Blazauskas, T., Keršienė, V., & Zangrando, V. (2021). Ingame design framework. In *Information and Software Technologies: 27th International Conference, ICIST 2021*, Kaunas, Lithuania, October 14–16, 2021, Proceedings 27 (pp. 291–300). Springer International Publishing.
- Gutiérrez-Artacho, J., & Olvera-Lobo, M.-D. (2016a). Gamificación para la adquisición de competencias en la educación superior: El caso de la Traducción e Interpretación. In G. Padilla Castillo (Ed.), *Aulas virtuales: fórmulas y prácticas* (pp. 297–304). McGraw Hill Education. <https://digibug.ugr.es/handle/10481/48382>
- Gutiérrez-Artacho, J., & Olvera-Lobo, M.-D. (2016b). Gamification in the Translation and Interpreting degree: A new methodological perspective in the classroom. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), *EDULEARN16 Proceedings: 8th International Conference on Education and New Learning Technologies* (pp. 50–58). Iated Academy. <https://doi.org/10.21125/edulearn.2016.1008>
- He, Y. (2021). Challenges and countermeasures of translation teaching in the era of artificial intelligence. *Journal of Physics: Conference Series*, 1881(2), 022086. IOP Publishing.
- Hidayat, A., & Helmanto, F. (2023). Translation Teaching Model in Offline, Online, and Hybrid Mode. *Journal of English Teaching*, 9(1), 44–56.
- Jiang, K., & Lu, X. (2021). Integrating Machine Translation with Human Translation in the Age of Artificial Intelligence: Challenges and Opportunities. *Big Data Analytics for Cyber-Physical System in Smart City: BDCPS 2020*, 28–29 December 2020, Shanghai, China, (pp. 1397–1405). https://doi.org/10.1007/978-981-33-4572-0_202
- Kolvoord, R., Charles, M., & Purcell, S. (2014). What happens after the professional development: Case studies on implementing GIS in the classroom. In J. MaKinster et al. (eds.), *Teaching Science and Investigating Environmental Issues with Geospatial Technology: Designing Effective Professional Development for Teachers* (pp. 303–320). https://doi.org/10.1007/978-90-481-3931-6_18
- Kurniawati, N., Maolida, E., & Anjaniputra, A. (2018). The praxis of digital literacy in the EFL classroom: Digital-immigrant vs digital-native teacher. *Indonesian Journal of Applied Linguistics*, 8(1), 28–37. <https://doi.org/10.17509/ijal.v8i1.11459>
- Mellinger, C. (2018). Problem-based learning in computer-assisted translation pedagogy. *HERMES - Journal of Language and Communication in Business*, (57), 195–208. <https://doi.org/10.7146/hjlc.v0i57.106205>
- Moraes, E. B., Kipper, L. M., Hackenhaar Kellermann, A. C., Austria, L., Leivas, P., Moraes, J. A., & Witczak, M. (2022). Integration of Industry 4.0 Technologies with Education 4.0: Advantages for improvements in learning. *Interactive Technology and Smart Education*, 20(2), 271–287. <https://doi.org/10.1108/itse-11-2021-0201>
- Olvera-Lobo, M.-D., Gutiérrez-Artacho, J., & Robinson, B. J. (2015). Acciones formativas Web 2.0: El Grado en Traducción e Interpretación como banco de pruebas. In J. J. Amigo Extremera (Ed.),

- VI Congreso Internacional de la Asociación Ibérica de Estudios de Traducción e Interpretación (AIETI6): “Traducimos desde el sur”. *Actas*. (pp. 524–539). Universidad de Las Palmas de Gran Canaria. Servicio de Publicaciones y Difusión Científica. <https://digibug.ugr.es/handle/10481/48539>
- Oliveira, L. C., Guerino, G. C., Oliveira, L. C., & Pimentel, A. R. (2023). Information and Communication Technologies in Education 4.0 Paradigm: A systematic mapping study. *Informatics in Education*, 22(1), 71–98. <https://doi.org/10.15388/infedu.2023.03>
- Olvera-Lobo, M.-D., & Gutiérrez-Artacho, J. (2014a). Academic use of custom social networks in translation training. *Perspectives*, 22(2), 282–289. <https://doi.org/10.1080/0907676X.2012.706310>
- Olvera-Lobo, M.-D., & Gutiérrez-Artacho, J. (2014b). Web 2.0 Technologies in the Translator Training: AULAIINT. In *Proceedings of EDULEARN14 Conference 7th-9th July 2014, Barcelona, Spain* (pp. 1562–1569). <https://digibug.ugr.es/handle/10481/35870>
- Olvera-Lobo, M.-D., & Gutiérrez-Artacho, J. (2014c). Herramientas de software libre en la Docencia de la Traducción (PID 12–139). In L. M. Jiménez del Barco Jaldo & M. C. García Garnica (Eds.), *Innovación docente y buenas prácticas en la Universidad de Granada* (Vol. 3, pp. 710–722). Universidad de Granada.
- Olvera-Lobo, M.-D., Robinson, B. J., & Gutiérrez-Artacho, J. (2018). Generic competences, the great forgotten: Teamwork in the undergraduate degree in translation and interpretation. *World Academy of Science, Engineering and Technology*, 12(11), 4190–4194. <http://locweb.aulaint.es/wp-content/uploads/2018/06/Generic-competences-the-great-forgotten-teamwork-in-the-undergraduate-degree-in-translation-and-interpretation-1.pdf>.
- Pal, D., & Vanijja, V. (2020). Perceived usability evaluation of Microsoft Teams as an online learning platform during COVID-19 using system usability scale and technology acceptance model in India. *Children and Youth Services Review*, 119, 105535. <https://doi.org/10.1016/j.childyouth.2020.105535>
- Pérez Sánchez, L. (2005). El foro virtual como espacio educativo: propuestas didácticas para su uso. *Quaederns Digitals Net*, 40(1), 1–18. http://mail.quaedernsdigitals.net/datos_web/hemeroteca/r_1/nr_662/a_8878/8878.pdf.
- Pym, A. (2014). Translation skill-sets in a machine-translation age. *Meta*, 58(3), 487–503. <https://doi.org/10.7202/1025047ar>
- Robinson, B. J., & Olvera-Lobo, M.-D. (2011). Facebook, Twitter or Tuenti? A first look at the academic use of web 2.0 social networks in translator training. In S. Maruenda-Bataller & B. Clavel-Arroitia (Eds.), *Multiple Voices in Academic and Professional Discourse: Current Issues in Specialised Language Research, Teaching and New Technologies* (pp. 367–379). Cambridge Scholars Publishing.
- Robinson, B. J., Arrufat Pérez de Zafra, M. A., & Olvera-Lobo, M.-D. (2017). To play or not to play: Gamifying Moodle for undergraduate trainee translators. In C. Valero Garcés & C. Pena Díaz (Eds.), *AIETI8: Superando límites en traducción e interpretación. VIII Congreso Internacional de la Asociación Ibérica de Estudios de Traducción e Interpretación* (pp. 238–247). Tradulex.
- Ross, S. M. (2020). Technology infusion in K-12 classrooms: A retrospective look at three decades of challenges and advancements in research and practice. *Educational Technology Research and Development*, 68(5), 2003–2020. <https://doi.org/10.1007/s11423-020-09756-7>
- Ross, S. M., Smith, L. S., & Morrison, G. R. (1991). The longitudinal influences of computer-intensive learning experiences on at-risk elementary students. *Educational Technology Research and Development*, 39(4), 33–46. <https://doi.org/10.1007/bf02296570>
- Rossetto, K. R., & Martin, E. M. (2022). It’s always about challenging and supporting”: Communicative processes of resilience in higher education. *Communication Education*, 71(4), 305–326. <https://doi.org/10.1080/03634523.2022.2098351>
- Salas-Castro, R., Lau, J., & Martínez, J. (2014). Aulas Apple del mañana: Resultados empíricos de educación básica (Modelo ACOT). In I. Esquivel Gámez (Ed), *Los Modelos Tecnico-Educativos: Revolucionando el aprendizaje del siglo XXI*, (pp.11–21). <https://bit.ly/3KE1kXw>
- Sales, D., Cuevas-Cerveró, A., & Gómez-Hernández, J.-A. (2020). Perspectivas sobre la competencia informacional y digital de estudiantes y docentes de Ciencias Sociales antes y durante el confinamiento por la Covid-19. *Profesional De La Información*, 29(4). <https://revista.profesionaldelainformacion.com/index.php/EPI/article/view/82472>
- Sánchez Guzmán, D. (2019). Industria y educación 4.0 en México: un estudio exploratorio. *Innovación educativa*, 19(81), 39–64. <https://dialnet.unirioja.es/servlet/articulo?codigo=8858752>.
- Sánchez Ramos, M. M. (2019). Rethinking professional translation roles: the localisation of mobile applications. *Sendeban*, 30, 121–139. <https://doi.org/10.30827/sendeban.v30i0.8490>

- Sánchez-Castany, R. (2022). Teaching translation technologies: An analysis of a corpus syllabi for translation and interpreting undergraduate degrees in Spain. In G. Massey, E. Huertas-Barros, & D. Katan (Eds.), *The Human Translator in the 2020s* (pp. 27–43). Routledge.
- Sánchez-Castany, R. (2023). Integrating Technologies in Translation Teaching: A Study on trainers' perceptions. *The Interpreter and Translator Trainer*, 17(3), 479–502. <https://doi.org/10.1080/1750399x.2023.2237330>
- Shail, M. S. (2019). Using micro-learning on mobile applications to increase knowledge retention and work performance: a review of literature. *Cureus*, 11(8), e5307. <https://doi.org/10.7759/cureus.5307>
- Sitnic, I. (2022). An educational approach to human translation versus machine translation: A case study on the English-Romanian language combination. In *European integration through the strengthening of education, research, innovations in Eastern Partnership Countries* (pp. 60–67).
- Thompson, M., Falck, E., Slama, R., & Reich, J. (2020). The practice based teacher education engagement ladder: A developmental model of adoption, adaptation, and redesign. *Journal of Teacher Education*. <https://doi.org/10.35542/osf.io/entjs>
- Varela Salinas, M. J., & Postigo Fuentes, A. Y. (2022). Percepción por parte del alumnado de la docencia virtual en los estudios universitarios de traducción. *UCMaule*, 63, 96–115. <https://doi.org/10.29035/ucmaule.63.96>
- Vela-Valido, J. (2021). Translation quality management in the AI age. New technologies to perform translation quality management operations. *Revista Tradumática*, 19, 93–111. <https://doi.org/10.5565/rev/tradumatica.28>
- Vieira, L. N., O'Hagan, M., & O'Sullivan, C. (2021). Understanding the societal impacts of machine translation: A critical review of the literature on medical and legal use cases. *Information, Communication & Society*, 24(11), 1515–1532.

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