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EDITAN

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RESUMEN

El volumen *Estudios de Lingüística Aplicada VIII* incluye una colección de contribuciones recientes en el campo de la Lingüística Aplicada. Los ocho capítulos que lo conforman presentan diversidad de temas en torno a la enseñanza y aprendizaje de lenguas, el análisis del discurso, la traducción y el mercado profesional.

Palabras clave: enseñanza y aprendizaje de lenguas; segundas lenguas; análisis del discurso; corpus; semántica; traducción.

OBJETIVOS

Este octavo volumen continúa la línea de investigación sobre Lingüística Aplicada que se presenta en el Seminario de Investigación del Departamento de Lingüística Aplicada anualmente, destinado tanto a investigadores noveles, como a investigadores consolidados.

APORTACIÓN DE LA OBRA

El monográfico recoge una selección de contribuciones en inglés y en español sobre Lingüística Aplicada y, más concretamente, sobre investigaciones en torno a la enseñanza y el aprendizaje de lenguas, el análisis del discurso y la traducción.

EDITORAS

TERESA MOLÉS-CASES es profesora titular en el Departamento de Lingüística Aplicada de la Universitat Politècnica de València. Sus intereses de investigación incluyen estudios de traducción, lingüística de corpus, lingüística cognitiva y adquisición del lenguaje. Ha publicado el libro *La traducción de los eventos de movimiento en un corpus paralelo alemán-español de literatura infantil y juvenil* en Peter Lang y varios artículos en revistas internacionales (algunos ejemplos incluyen *Review of Cognitive Linguistics, Perspectives, Meta, Languages in Contrast, Lebende Sprachen*). Pertenece a los grupos de investigación COVALT (Corpus Valencià de Literatura Traduïda), GALE (Grupo de Análisis de Lenguas de Especialidad) y CLaRe (Grupo de investigación en Lingüística Cognitiva Aplicada). También ha trabajado como investigadora y docente en la Universitat Jaume I y en la Universität Leipzig (Alemania).

ROSA CURRÁS MÓSTOLES es profesora titular de Inglés con fines específicos en el Departamento de Lingüística Aplicada de la Universitat Politècnica de València. Es licenciada en Filiología Inglesa por la Universitat de València (1985-1990) y doctora en Filología por la Universitat Politècnica de València (2009). Posee experiencia docente de inglés con fines específicos en diversas universidades tanto nacionales como internacionales. Su actividad investigadora se centra en la traducción cultural y la internacionalización de la educación superior. Ha participado como investigadora en varios proyectos de investigación, incluyendo el *Joint Research Centre* de la Unión Europea, y colaborado como evaluadora de proyectos europeos para el Servicio Español para la Internacionalización de la Educación Superior (SEPIE) del Ministerio de Universidades.

FRANCESCA ROMERO FORTEZA es doctora en Filología Catalana y profesora del Departamento de Lingüística Aplicada de la Universitat Politècnica de València, donde imparte asignaturas de Catalán para fines específicos en diversas titulaciones de ingeniería. Actualmente es directora de su departamento. Su investigación está centrada en el Aprendizaje de lenguas asistido por la tecnología y, más específicamente, en la modalidad del autoaprendizaje. Otros temas sobre los que versa su investigación son la enseñanza de lenguajes de especialidad y el análisis de errores lingüísticos. Por su tesis doctoral obtuvo el Premio Extraordinario que otorga la Universidad y también ha obtenido el Premio a la Excelencia docente que otorga el Consejo social de la Universitat Politècnica de València.

Mª MILAGROS DEL SAZ RUBIO es Catedrática de Filología Inglesa en el Departamento de Lingüística Aplicada de la Universitat Politècnica de València (https://orcid.org/0000-0002-7535-2903) e integrante del Grupo de Análisis de Lenguas de Especialidad (GALE). Actualmente tiene reconocidas tres evaluaciones positivas de su investigación y cuatro evaluaciones positivas de su docencia. Sus líneas de investigación se centran en el análisis del discurso multimodal desde una perspectiva crítica, especialmente en la publicidad en televisión y en las redes sociales y en su relación con cuestiones como el género y la creación de estereotipos. Ha llevado a cabo estudios pragmáticos centrados en el estudio y codificación de la cortesía lingüística en publicidad, en reseñas de libros y en géneros de ficción y se ha centrado en su expresión desde el punto de vista verbal/visual. Estos trabajos se han visto complementados con estudios recientes sobre descortesía en redes sociales, en especial, a través de la codificación de esta hacia el colectivo de mujeres y niñas. Además, ha trabajado de forma extensa también en el ámbito del discurso académico y en la identificación de patrones retóricos y elementos metadiscursivos en el género del artículo científico en los ámbitos de la Agronomía y la Ciencia y Tecnología de Alimentos. También ha publicado artículos recientes en torno a la agresión en redes sociales mediante la aplicación de teorías de descortesía y valoración para identificar estereotipos de género en mujeres con puestos de visibilidad en el ámbito político o público (celebridades) en revistas tales como *Journal of Language Aggression and Conflict*, *Journal of Pragmatics* o *Discourse & Society*.

Índice

Prólogo

Este volumen presenta una selección de trabajos del decimoquinto Seminario de Investigación del Departamento de Lingüística Aplicada de la Universitat Politècnica de València, que tuvo lugar en mayo de 2025. Los 8 capítulos que incluye ofrecen una visión de los intereses y las tendencias actuales en la investigación en Lingüística Aplicada.

La primera sección, sobre la enseñanza y el aprendizaje de lenguas, incluye cuatro capítulos. El capítulo 1, "Alfabetización docente en IA en América Latina: definiciones, competencias e iniciativas", revisa el estado, las definiciones, las competencias y las brechas en la alfabetización en inteligencia artificial del profesorado de educación superior en América Latina. El capítulo 2, "Internationalisation, sustainability and communication in a STEM virtual exchange", analiza cómo el intercambio virtual en titulaciones STEM impulsa la internacionalización, la sostenibilidad y el desarrollo de competencias comunicativas e interculturales en estudiantes universitarios. Seguidamente, el capítulo 3, "Teacher perspectives on integrating innovative digital technologies in English language teaching", investiga la relación entre el uso de tecnologías digitales innovadoras por parte de profesorado de inglés en Bielorrusia y su crecimiento profesional. Por último, el capítulo 4, "The MOD tool in task-based learning: Feedback and negotiation of meaning", analiza la implementación de la herramienta digital MOD Tool en el aprendizaje de lenguas basado en tareas para fomentar la retroalimentación y la negociación de significado entre estudiantes.

La segunda sección aglutina trabajo de varias disciplinas: análisis del discurso, terminología y traducción. El capítulo 5, "Resisting marriage and parenthood: A corpus-pragmatic analysis of negative comments on Weibo", realiza un análisis pragmático de corpus sobre los comentarios negativos en la red social Weibo para comprender la resistencia social hacia el matrimonio y la paternidad en la China actual. El capítulo 6, "Orthontology: diseño de una ontología en el ámbito ortopédico", describe el diseño y desarrollo de ORTHONTOLOGY, una ontología formal destinada a organizar y estandarizar el conocimiento especializado en el ámbito de la ortopedia técnica y los dispositivos de apoyo. El capítulo 7, "Audio description of motion events: An English - Chinese descriptive study", presenta un estudio descriptivo sobre la audiodescripción de eventos de movimiento en inglés y chino, analizando cómo se traslada la información visual en el discurso destinado a personas con problemas de visión. El monográfico termina con el capítulo 8, "Traductores: entre la alta tecnología y la baja ergonomía", que examina la importancia de la ergonomía en el entorno laboral de los traductores, destacando cómo la falta de condiciones adecuadas afecta a su bienestar y productividad en entornos de trabajo altamente tecnologizados.

El monográfico pretende ser de interés para investigadores y docentes de Lingüística Aplicada, inspirar nuevas investigaciones en esta área y otras relacionadas, y aportar al desarrollo del conocimiento interdisciplinario.

SECCIÓN I

ENSEÑANZA Y APRENDIZAJE DE LENGUAS

Capítulo 1
Alfabetización docente en IA en América Latina: definiciones, competencias e iniciativas

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1.1. Introducción

El lanzamiento de ChatGPT en noviembre de 2022 marcó un momento crucial en la adopción global de la IA Generativa (IA), particularmente en la educación, impulsando a los gobiernos de todo el mundo a establecer marcos regulatorios (CENIA, 2024; Guío *et al*., 2021; Ministerio de Educación Nacional y Universidad EAFIT, 2022) y priorizar el desarrollo de ciudadanos competentes en IA. Las Instituciones de Educación Superior (IES) son ampliamente reconocidas como centrales para este esfuerzo de capacitación, con la formación del profesorado emergiendo como un componente crítico para una implementación efectiva. Si bien esta transformación educativa representa un desafío universal, América Latina se enfrenta a obstáculos únicos debido a la ausencia de una visión regional unificada para la regulación de la IA y la integración curricular (Kalota, 2024), un marcado contraste con los enfoques más coordinados que se observan en Europa. Iniciativas regionales como la Declaración de Santiago (2024) subrayan el papel clave de las IES en la preparación de los ciudadanos para la adopción de la IA. Sin embargo, los estudios revelan importantes lagunas en los conocimientos y habilidades de los docentes latinoamericanos en materia de IA (Tenório *et al.*, 2023), lo que limita su capacidad para integrar pedagógicamente las herramientas de IA y compromete su capacidad para fomentar la alfabetización en IA de los estudiantes. Comprender cómo se desarrolla la alfabetización en IA entre los educadores latinoamericanos es clave para diseñar intervenciones y medidas políticas que aborden eficazmente las necesidades regionales y los desafíos específicos del contexto para avanzar en la preparación de los docentes para la educación impulsada por la IA.

Con este propósito, este estudio realiza una revisión bibliográfica sistemática de las iniciativas de América Latina que evalúan o desarrollan las competencias de alfabetización en IA de los docentes. Específicamente, este estudio examina: (1) cómo se conceptualiza la alfabetización en IA en el contexto educativo latinoamericano, (2) las mediciones y diseños metodológicos empleados en los estudios existentes para estudiar la alfabetización en IA y (3) una evaluación del progreso regional de la alfabetización en IA de los docentes en relación con el «Marco de competencias para docentes en materia de IA» propuesto por la UNESCO (2024).

La investigación existente establece una comprensión fundamental de la alfabetización en IA y su creciente importancia en América Latina, donde los esfuerzos regionales enfatizan cada vez más el desarrollo de estas competencias para permitir a los docentes integrar la IA en las prácticas educativas de manera ética (OEI y ProFuturo, 2023; UNESCO, 2021). Sin embargo, este conjunto de investigaciones revela tres lagunas críticas que requieren atención académica. En primer lugar, aunque las definiciones y los marcos de alfabetización en IA han proliferado a escala global (Mateus *et al.*, 2024), se centran predominantemente en las competencias de los estudiantes, por lo que su aplicación al desarrollo profesional de los docentes está poco explorada. En segundo lugar, la región carece de un análisis exhaustivo tanto de los enfoques de medición para evaluar la alfabetización en IA como de la diversidad metodológica de los estudios que apoyan su desarrollo. En tercer lugar, se carece de un análisis sistemático de la literatura sobre el estado actual de desarrollo de las competencias en IA de los docentes en las IES de América Latina.

El objetivo principal de este trabajo es avanzar en la comprensión del desarrollo de la alfabetización en IA de los docentes en América Latina mediante la revisión de la literatura científica publicada y el análisis de cómo estas competencias se alinean con el «Marco de competencias para docentes en materia de IA» propuesto por la UNESCO. Para lograrlo, este trabajo presenta una revisión sistemática de la literatura que: (1) organiza las definiciones de alfabetización en IA dentro de las conceptualizaciones tecno y humano-céntricas, (2) analiza el tipo de intervenciones e instrumentos utilizados para medir el desarrollo de competencias de los docentes en IA y (3) mapea los hallazgos en relación con el marco de competencias de alfabetización en IA para docentes de la UNESCO (2024). Se abordan tres preguntas de investigación:

1) ¿Cómo conceptualizan los estudios actuales en América Latina la alfabetización en IA, y cuál es el enfoque predominante que emerge cuando se analiza a través de definiciones centradas en la tecnología y centradas en el ser humano?

2) ¿Qué enfoques metodológicos (instrumentos de evaluación, intervenciones pedagógicas y diseños de estudio) caracterizan las investigaciones existentes sobre alfabetización en IA para docentes en América Latina?

3) ¿En qué medida las competencias de alfabetización en IA reportadas entre los docentes latinoamericanos se alinean con las dimensiones del marco de la UNESCO, y qué brechas emergen de este mapeo?

1.2. Alfabetización en IA para docentes: definiciones y marcos de referencia

En los últimos años, el concepto de alfabetización en IA ha recibido una gran atención por parte de los académicos (Tenório *et al.*, 2023). Long y Magerko (2020, p. 2) definen la alfabetización en IA como «un conjunto de competencias que permite a los individuos evaluar críticamente las tecnologías de IA; comunicarse y colaborar eficazmente con la IA; y utilizar la IA como una herramienta en línea, en casa y en el lugar de trabajo». Sin embargo, los debates académicos actuales en torno a este término revelan dos tendencias en la definición de la alfabetización en IA y sus marcos de competencias asociados: las perspectivas centradas en la tecnología y las centradas en el ser humano. Las definiciones tecnocéntricas hacen hincapié en las competencias técnicas a través de una perspectiva centrada en la IA (Wong *et al.*, 2020; Wang *et al.*, 2023). El marco de Ng *et al.* (2021) ejemplifica este enfoque, identificando cuatro competencias básicas: (1) comprender los fundamentos de la IA, (2) aplicar los conocimientos de IA, (3) evaluar y crear soluciones basadas en IA y (4) abordar la ética de la IA. Aunque estos marcos han demostrado ser valiosos para evaluar el desarrollo de la alfabetización en IA en intervenciones de formación técnica, son limitados cuando se aplican a contextos profesionales no técnicos como la formación de docentes. Como señalan Markauskaite *et al.* (2022), estos enfoques a menudo no abordan adecuadamente los conocimientos contextuales y aplicados de la IA esenciales para los profesionales de campos no técnicos. Esta limitación ha impulsado un cambio de paradigma hacia perspectivas centradas en el ser humano. Luckin *et al.* (2022) avanzan en esta perspectiva, proponiendo la noción de «AI readiness», enmarcando la alfabetización en IA como un continuo de desarrollo que progresa «desde el conocimiento básico de la IA hasta la comprensión de sus capacidades e implicaciones en términos accesibles y no técnicos» (Luckin *et al.*, 2022). Este modelo abarca tres dimensiones interdependientes: competencias cognitivas (comprensión conceptual), afectivas (confianza en las herramientas) y socioculturales (compromiso ético) (Kong *et al.*, 2021; Ng *et al.*, 2021; UNESCO, 2021).

El «Marco de competencias para docentes en materia de IA» de la UNESCO (2024) adopta este paradigma centrado en el ser humano, destacando el papel de los educadores en la salvaguarda de la aplicación ética y responsable de la IA en los entornos educativos.

Propone una matriz bidimensional: cinco aspectos de competencia desarrollados en tres niveles de progresión. Las dimensiones de las competencias incluyen: (1) una forma de pensar centrada en el ser humano, que esboza los valores y actitudes hacia la interacción entre el ser humano y la IA; (2) la ética de la IA, que abarca los principios éticos esenciales para el uso de la IA; (3) los fundamentos y las aplicaciones de la IA, que aborda el conocimiento conceptual y la personalización de las herramientas de IA para la educación; (4) la pedagogía de la IA, que se centra en las competencias para la integración eficaz de la IA en la enseñanza; y (5) la IA para el desarrollo profesional, relativa a las habilidades necesarias para aprovechar la IA para el crecimiento del educador. La segunda dimensión, respectiva a los niveles de progresión de las competencias, contempla «adquirir» (docentes con conocimientos mínimos de IA), «profundizar» (aquellos con cierta experiencia en IA) y «crear» (educadores con conocimientos avanzados de IA). Sin embargo, este marco es reciente y, aunque proporciona competencias de referencia para el desarrollo de la IA por parte de los docentes, hasta la fecha ningún estudio latinoamericano lo ha empleado como base conceptual para diseñar intervenciones de formación de docentes en este ámbito.

Analizar si los estudios latinoamericanos emplean predominantemente conceptualizaciones tecnocéntricas o humanocéntricas de la alfabetización en IA y evaluar cómo las competencias desarrolladas por los docentes regionales se alinean con el marco de la UNESCO, puede ayudar a proporcionar ideas para abordar las necesidades de desarrollo profesional de los educadores relacionadas con la IA en toda la región.

1.3. Estudio y desarrollo de la alfabetización docente en IA en América Latina

Según un estudio reciente de la Fundación ProFuturo y la Organización de Estados Iberoamericanos para la Educación, la Ciencia y la Cultura (OEI y ProFuturo, 2023), América Latina percibe la IA como una herramienta transformadora para la educación, que se espera que se integre gradualmente en la sociedad entre 2022 y 2030 a través de iniciativas gubernamentales y centros de formación (OEI y ProFuturo, 2023). El informe, que encuestó a 67 partes interesadas –incluidos académicos, funcionarios públicos y representantes de tecnología educativa del sector privado– destaca la formación de docentes como una prioridad clave para futuras recomendaciones de políticas públicas y subraya la urgente necesidad de agendas de investigación para abordar este desafío (OEI y ProFuturo, 2023, p.22).

A pesar del creciente número de artículos académicos sobre IA y educación, solo encontramos una revisión sistemática que se haya centrado en analizar las competencias de alfabetización en IA entre los docentes de América Latina (De La Torre y Baldeon-Calisto, 2024). Este estudio examinó 25 artículos publicados entre 2021 y 2023 en México, Colombia, Ecuador, Brasil, Perú, Chile, Argentina y Bolivia, abordando tres dimensiones clave: aplicaciones de IA en la educación, percepciones de los educadores sobre la tecnología y desafíos institucionales (De La Torre y Baldeon-Calisto, op. Cit.). Aunque el estudio identifica la insuficiente formación de los docentes como una de las principales barreras regionales para la integración de la IA, no aclara qué competencias específicas se han priorizado en las iniciativas existentes de desarrollo de la enseñanza.

Esfuerzos regionales, como el Índice Latinoamericano de Inteligencia Artificial (ILIA) (CENIA, 2024), han tratado de establecer puntos de referencia para el desarrollo de la IA, incluyendo un subíndice que mide la alfabetización en IA a través de indicadores como «Educación temprana en ciencias», «Educación temprana en IA» y «Dominio del inglés». Aunque valioso para las comparaciones a nivel macro, el marco ILIA carece de especificidad en cuanto a las competencias pedagógicas necesarias para que los docentes apliquen la IA en contextos educativos (Gutiérrez y Restrepo y Floris, 2022).

En consecuencia, no existe una comprensión integral del alcance, la implementación o el impacto de las iniciativas existentes destinadas a mejorar la alfabetización en IA de los docentes en América Latina.

1.4. Material

Realizamos una revisión sistemática de la literatura siguiendo la guía PRISMA (Page *et al.*, 2021) para garantizar el rigor metodológico en la planificación, ejecución y comunicación de nuestros resultados. El proceso de búsqueda se llevó a cabo utilizando

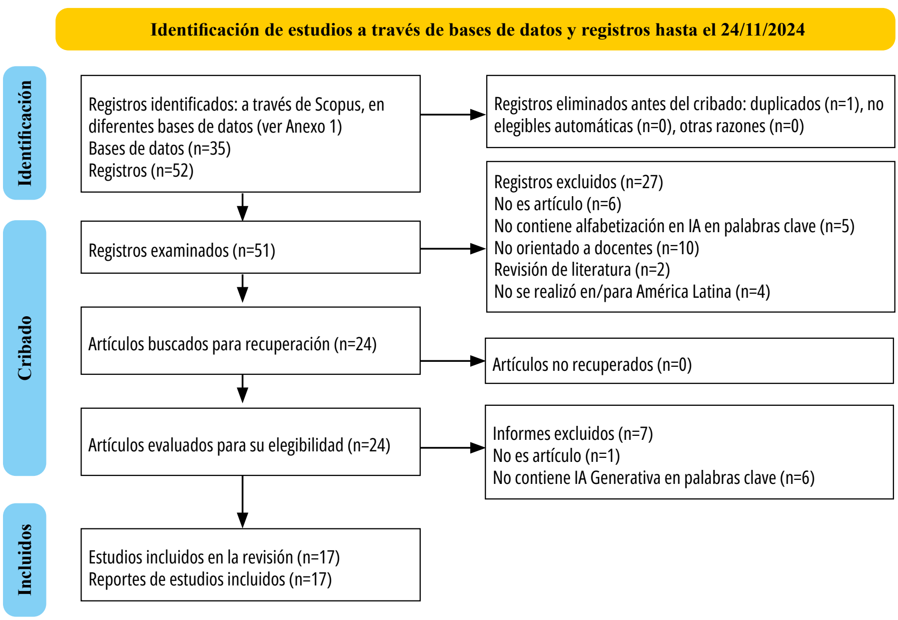

Figura 1.1. Proceso de selección de artículos (diagrama de flujo PRISMA 2020).

Scopus, una base de datos multidisciplinar que incluye literatura revisada por pares de 35 fuentes, incluyendo IEEE Andescon, Advances in Intelligent Systems and Computing y Cogent Education. Nuestra búsqueda abarcó publicaciones desde 2020 hasta 2024, con registros recopilados en noviembre de 2024. Seleccionamos este marco temporal porque el lanzamiento de ChatGPT en 2022 marcó un aumento significativo en la investigación académica sobre IA generativa. La Figura 1.1 describe el proceso de selección completo según las normas PRISMA.

La estrategia de búsqueda empleó una consulta centrada intencionadamente en tres dimensiones clave: Tecnologías de IA (primer segmento), actores educativos (segundo segmento) y contexto geográfico (tercer segmento), con términos buscados en títulos, resúmenes o palabras clave. La consulta final fue: *Artificial Intelligence OR IA OR Generative IA OR GenIA AND Teacher* OR Educator* OR instructor AND Higher education OR high school OR school OR middle school OR K-12 AND Latin America OR Latinoamerica OR Latam OR America Latina OR Mexico OR Argentina OR Chile OR Costa Rica OR Ecuador OR Uruguay OR Paraguay OR Bolivia OR Peru OR Colombia OR Guatemala OR Brazil OR Venezuela OR Honduras OR Dominican Republic OR Cuba OR Panama OR Nicaragua.*

Dos investigadores colaboraron durante todo el proceso, estableciendo conjuntamente las palabras clave, diseñando los parámetros de análisis, revisando los artículos y conciliando cualquier discrepancia mediante discusión.

Respecto al proceso de selección, la búsqueda inicial arrojó 51 artículos, que luego se filtraron en múltiples etapas. En primer lugar, se aplicaron criterios de exclusión para eliminar: (1) estudios centrados en aplicaciones de IA no educativas o exclusivamente en estudiantes (10 artículos); (2) investigaciones realizadas fuera de América Latina (4 artículos); (3) revisiones bibliográficas, actas de congresos, libros o pósteres (8 artículos); y (4) artículos que no incluían «AI literacy» en sus títulos o palabras clave (5 artículos). Este proceso de selección dio como resultado 24 artículos. Tras el análisis de los textos completos, se excluyeron siete artículos más: uno porque no era un artículo de investigación (por ejemplo, un editorial) y seis porque no incluían «AI literacy» en sus palabras clave.

El corpus final se componía de 17 artículos que cumplían todos los criterios de inclusión. Estos estudios compartían varias características clave: todos se centraban en docentes de educación primaria, secundaria y superior, se habían realizado parcial o totalmente en América Latina y representaban investigaciones primarias que empleaban métodos cuantitativos, cualitativos o mixtos. Si bien nuestro objetivo fue lograr una cobertura exhaustiva, reconocemos que algunas publicaciones relevantes pueden haber sido excluidas inadvertidamente debido a limitaciones de la base de datos o a la naturaleza cambiante de los plazos de publicación en este campo en rápido desarrollo.

Los artículos que conforman el corpus final fueron sometidos a un análisis sistemático orientado a dar respuesta a las preguntas de investigación. En primer lugar, se examinó la manera en que los estudios conceptualizan la alfabetización en IA, tomando como referencia la propuesta de Ng *et al.* (2021). En segundo lugar, se analizaron los instrumentos de evaluación y las intervenciones pedagógicas reportadas en los artículos del corpus. Finalmente, los estudios elaborados fueron contrastados con las dimensiones y niveles de desarrollo de competencias establecidos por la UNESCO (2024), con el propósito de situar los hallazgos en el marco de la región latinoamericana.

1.5. Resultados

1.5.1. Conceptualizaciones de la alfabetización docente en IA en América Latina

Nuestro análisis revela que ninguno de los estudios incluidos en la revisión bibliográfica definió explícitamente la alfabetización en IA ni hizo referencia a marcos teóricos establecidos. En consecuencia, derivamos las posiciones conceptuales de los autores analizando sistemáticamente los conceptos y las descripciones del uso y las percepciones de las herramientas de IA por parte de los docentes. Específicamente, analizamos la caracterización de cada artículo sobre el desarrollo de las competencias en IA de los docentes, organizando estas representaciones según su alineación con las dimensiones

Tabla 1.1. Marco de codificación de las definiciones de la alfabetización en IA.

Autores	Conocer y comprender	Utilizar y aplicar	Evaluar y crear	Ética de la IA
Abbasi *et al.*, 2024	X	X		X
Alarcon-Llontop *et al.*, 2023	X	X		X
Alarcón-Llontop *et al.*, 2024	X			X
Aparicio-Izurieta, 2024	X			
Argüelles-Cruz *et al.*, 2021	X			
Cabero-Almenara *et al.*, 2024	X	X		
Charro & Maya, 2021	X			
Santovenia Díaz et al., 2024	X	X		
Fernández-Miranda *et al.*, 2024	X	X	X	
Grájeda *et al.*, 2024	X	X		X
Gutiérrez y Restrepo y Floris, 2022	X	X		
Mateus *et al.*, 2024	X	X		X
Ramírez-Montoya *et al.*, 2024	X	X		X
Rezende y López-Simó, 2024	X	X		
Ruiz *et al.*, 2023	X	X		X
Vera, 2024	X			
Viberg *et al.*, 2024	X	X		X
Número total de artículos	17	12	1	9

del marco de Ng *et al.* (2021) («Conocer y comprender», «Usar y aplicar», «Evaluar y crear» y «La ética de la IA»). A continuación, analizamos si siguen una perspectiva centrada en la tecnología o en el ser humano.

La Tabla 1.1 resume cómo los artículos se refieren a la alfabetización docente en IA. En primer lugar, los resultados muestran que todos los estudios analizados abordan la alfabetización en IA desde la perspectiva del desarrollo de competencias cognitivas relacionadas con la IA, con especial énfasis en los conocimientos técnicos (Gutiérrez y Restrepo y Floris, 2022; Mateus *et al.*, 2024; Rezende Junior y López-Simó, 2024) y la adquisición de conceptos de IA. Por ejemplo, Argüelles-Cruz *et al.* (2021, p.107) destacan la necesidad de desarrollar contenidos en el uso de *Big data* o analítica de datos. En segundo lugar, 12 de los 17 artículos estudian cómo los docentes utilizan y aplican las tecnologías de IA con fines educativos. Esta competencia se refiere a la capacidad de los docentes para interactuar con la IA en diferentes contextos y escenarios con una actitud evaluativa. El artículo de Alarcón-Llontop *et al.* (2023, p.156) ejemplifica este énfasis a través de su estudio, que analiza las percepciones de los docentes sobre la IA en el contexto de su uso académico por parte de alumnos y docentes: «Se observa que los docentes saben poco de ChatGPT y lo usan aún menos, pero coherentemente admiten la necesidad de conocerlo y aún más de usarlo, lo que genera expectativas de que podrán empoderarse de su uso [...]». Asimismo, el trabajo de Ruiz *et al.* (2023) destaca la necesidad de que los docentes «analicen críticamente sus propias prácticas y creen nuevas propuestas didácticas que incluyan nuevos recursos didácticos provenientes de los desarrollos tecnológicos que van surgiendo». En tercer lugar, sólo hemos identificado un estudio en el que se aborda la competencia «Evaluar y crear IA», que implica un dominio y comprensión más profundos de la IA. En este estudio, Fernández-Miranda *et al.* (2024) proponen evaluar de forma crítica y colectiva la autonomía, la toma de decisiones éticas y las preocupaciones, así como las responsabilidades de los docentes en el uso de la IA mediante entrevistas semiestructuradas. Por último, observamos que el concepto de ética de la IA está presente en 9 de los artículos. Destacan las preocupaciones éticas sobre el uso de la IA en la educación, incluyendo «consideraciones en torno a la parcialidad, la privacidad de los datos, así como la integridad académica cuando se utilizan herramientas asistidas por IA relacionadas con la originalidad y la autoría de los contenidos generados por IA» (Ramírez-Montoya *et al.*, 2024).

Este análisis revela tres observaciones principales. En primer lugar, existe un espectro de enfoques conceptuales de la alfabetización en IA que integran perspectivas centradas en la tecnología y en el ser humano. Estos estudios hacen hincapié en los aspectos cognitivos (sobre todo en los conocimientos y habilidades técnicas) con perspectivas centradas en el ser humano que se enfocan en las capacidades aplicadas, especialmente en la dimensión «Usar y aplicar» junto con consideraciones éticas. Esta orientación híbrida concuerda con el marco de «AI Readiness» de Luckin *et al.* (2022), que describe la progresión evolutiva de los educadores «desde no entender qué es la IA [...] hasta ser capaces de entender, en términos no técnicos, lo que la IA es capaz de lograr» (p.1). En segundo lugar, aunque las perspectivas de competencia técnica siguen siendo dominantes en la definición de la alfabetización en IA, identificamos una atención emergente a las dimensiones éticas, lo que sugiere un panorama conceptual en evolución en las iniciativas de desarrollo del profesorado de la región. Y en tercer lugar, los estudios actuales descuidan estas habilidades de orden superior en sus conceptualizaciones del desarrollo de la alfabetización en IA de los docentes, a pesar de reconocer la importancia de las competencias de «Evaluar y Crear».

1.5.2. Instrumentos de evaluación e intervenciones pedagógicas implementadas en América Latina para medir y fomentar la alfabetización en IA entre los docentes

Para responder a la pregunta de investigación 2, analizamos los artículos seleccionados centrándonos en: (1) caracterizar los diseños de investigación utilizados para investigar el desarrollo de la alfabetización en IA de los docentes y (2) catalogar las metodologías de evaluación empleadas en los estudios.

Nuestro análisis de los diseños de investigación revela que todos los estudios, excepto tres, se centran exclusivamente en evaluar las competencias existentes de los docentes en IA, en lugar de desarrollarlas mediante intervenciones específicas. Estos tres estudios ilustran cómo las intervenciones de los investigadores pueden tener un impacto positivo en el desarrollo de las competencias de los docentes en IA, lo que también repercute en los niveles de alfabetización en IA de los alumnos. El primer estudio (Alarcón-Llontop *et al.*, 2024) incluyó tres sesiones de grupos focales en línea (de 90 minutos cada una) con seis docentes de física brasileños. Los participantes debatieron sobre los actores, las actitudes y las funcionalidades relacionadas con ChatGPT en la enseñanza de la física. A través de la reflexión colaborativa, identificaron aspectos positivos y negativos de la herramienta, incluyendo preocupaciones sobre la fiabilidad de las respuestas, y llegaron a una comprensión compartida de su uso en el aula. En el segundo estudio (Abbasi *et al.*, 2024) participaron 22 docentes de comunicación de México, Perú y España y se llevó a cabo en tres fases. En primer lugar, los docentes seleccionaron un ejercicio académico para ser procesado por ChatGPT y revisaron los resultados. A continuación, se realizaron entrevistas semiestructuradas. Los participantes destacaron la importancia de un uso de la IA centrado en el ser humano en la enseñanza, reconocieron los retos del diseño instructivo y subrayaron la necesidad de alfabetización en IA tanto entre docentes como entre alumnos. El tercer estudio (Díaz y Fernández, 2024) siguió un enfoque de investigación-acción con ocho docentes. Tras las entrevistas individuales iniciales, se observó a dos docentes durante un mes mientras llevaban a cabo tres ejercicios basados en IA en sus aulas. El estudio concluyó con entrevistas a grupos de alumnos. Los resultados destacaron el impacto transformador de implicar a los docentes en la investigación-acción, apoyando la práctica reflexiva y el desarrollo profesional.

Nuestro análisis de las medidas de evaluación revela que la mayoría de los estudios se basan en enfoques cuantitativos, principalmente mediante el uso de cuestionarios. En concreto, 8 de los 17 trabajos adoptaron una metodología cuantitativa (Alarcón Llontop *et al.*, 2023; Argüelles-Cruz *et al.*, 2021; Cabero-Almenara *et al.*, 2024; Fernández Miranda *et al.*, 2024; Jin *et al.*, 2024; Ramírez-Montoya *et al.*, 2024; Ruiz *et al.*, 2023; Viberg *et al.*, 2024), mientras que 4 estudios siguieron un enfoque cualitativo (Abbasi *et al.*, 2024;

Alarcón-Llontop *et al.*, 2024; Díaz y Fernández, 2024; Grájeda *et al.*, 2024) y 2 emplearon métodos mixtos (Aparicio-Izurieta, 2024; Vera, 2024). Solo 5 estudios informaron de la utilización de instrumentos cualitativos: cuatro aplicaron entrevistas semiestructuradas (Abbasi *et al.*, 2024; Aparicio-Izurieta, 2024; Díaz y Fernández, 2024; Grájeda *et al.*, 2024), uno recurrió a grupos focales (Alarcón-Llontop *et al.*, 2024), dos pusieron en práctica experimentos de enseñanza en un marco de investigación-acción (Abbasi *et al.*, 2024; Díaz y Fernández, 2024) y uno incluyó la observación participante con diarios del profesor y hojas de observación (Díaz y Fernández, 2024). Además, identificamos que la mayoría de los estudios se centran en examinar las autopercepciones de los docentes sobre el desarrollo y el uso de la IA, a menudo sin proporcionar una validación interna o externa de los instrumentos de evaluación utilizados.

1.5.3. Alfabetización en IA de los docentes latinoamericanos

Para responder a la pregunta de investigación 3 y caracterizar las competencias en IA de los docentes que surgen de la bibliografía, analizamos los 17 estudios utilizando el «Marco de competencias para docentes en materia de IA» de la UNESCO (ver detalles del marco en la Sección 1.1). El análisis se resume en la Tabla 1.2. Dado que ninguno de los estudios hacía referencia explícita a este marco, realizamos una interpretación y un mapeo sistemáticos de los resultados comunicados en relación con: (1) las competencias esbozadas en el marco y (2) los niveles de progresión, basándonos en las pruebas empíricas de cada estudio y en los resultados declarados.

Nuestro análisis indica que todos los estudios se mantienen en el nivel de progresión «Adquirir», sin casos que alcancen las etapas «Profundizar» o «Crear». Además, los estudios abordan principalmente los temas de la «IA que permite el aprendizaje profesional permanente» y las consideraciones éticas. En concreto, 9 de los 17 artículos examinaron la «Capacidad de acción humana», 11 abordaron los «Principios éticos», 3 se centraron en las «Técnicas y aplicaciones básicas de la IA», 10 exploraron la «Enseñanza asistida por IA» y 13 consideraron la «IA que permite el aprendizaje profesional a lo largo de la vida». Este énfasis sugiere una fuerte orientación hacia el desarrollo de los conocimientos de IA de los docentes como componente clave de su crecimiento profesional continuo.

1.6. Discusión de resultados

De esta revisión bibliográfica se desprenden varias recomendaciones que pueden orientar a los responsables de la toma de decisiones en el ámbito de la educación superior a la hora de dar forma a las políticas y prácticas relacionadas con la IA, al tiempo que ofrecen orientaciones a los investigadores que pretendan explorar futuras líneas de investigación en el campo de la alfabetización en IA de los docentes.

Definir la alfabetización en IA a través de una lente centrada en la tecnología o centrada en el ser humano determina significativamente la forma en que se conceptualiza, los tipos de intervenciones diseñadas para los docentes y las políticas institucionales relacionadas

Tabla 1.2. Estructura de alto nivel del marco de competencias de IA adaptado: aspectos y niveles de progresión (basado en UNESCO, 2024).

	Adquirir	Profundizar	Crear
Una forma de pensar centrada en el ser humano	Capacidad de acción humana, 9 artículos (Fernández-Miranda *et al.*, 2024; Cabero-Almenara *et al.*, 2024; Viberg *et al.*, 2024; Ramírez-Montoya *et al.*, 2024; Mateus *et al.*, 2024*; Alarcon-Llontop et al., 2023; Rezende & López-Simó, 2024; Abbasi *et al.*, 2024; Grájeda *et al.*,2024)	Rendición de cuentas, 0 artículos	Responsabilidad social, 0 artículos
La ética de la IA	Principios éticos, 11 artículos (Fernández-Miranda *et al.,* 2024; Cabero-Almenara *et al.*, 2024; Viberg *et al.*, 2024; Alarcón-Llontop *et al.*, 2024; Ramírez-Montoya *et al.*, 2024; Mateus *et al.*, 2024*; Alarcon-Llontop *et al.*, 2023; Santovenia *et al.,* 2024;Abbasi *et al.*, 2024; Ruiz *et al.*, 2023; Grájeda *et al.*, 2024)	Uso seguro y responsable, 0 artículos	Cocreación de reglas éticas, 0 artículos
Los fundamentos y las aplicaciones de la IA	Técnicas y aplicaciones básicas de la IA, 3 artículos (Viberg *et al.*, 2024; Alarcón-Llontop *et al.*, 2024; Gutiérrez y Restrepo y Floris, 2022*)	Habilidades de aplicación, 0 artículos	Creación con IA, 0 artículos
La pedagogía de la IA	Enseñanza asistida por IA, 9 artículos (Cabero-Almenara *et al.*, 2024; Ramírez-Montoya *et al.*, 2024; Gutiérrez y Restrepo y Floris, 2022*; Aparicio-Izurieta, 2024; Mateus *et al.*, 2024*; Rezende & López-Simó, 2024; Abbasi *et al.*, 2024; Ruiz *et al.*, 2023; Vera, 2024*)	Integración de la IA y la pedagogía, 0 artículos	Transformación pedagógica potenciada por la IA, 0 artículos
La IA para el desarrollo profesional	IA que permite el aprendizaje profesional a lo largo de la vida, 13 artículos (Fernández-Miranda *et al.,* 2024; Viberg *et al.*, 2024; Ramírez-Montoya *et al.*, 2024; Argüelles-Cruz *et al.*, 2021; Gutiérrez y Restrepo y Floris, 2022*; Aparicio-Izurieta, 2024; Mateus *et al.*, 2024*; Alarcon-Llontop *et al.*, 2023; Santovenia *et al.,* 2024;; Abbasi *et al.*, 2024; Ruiz *et al.*, 2023; Grájeda *et al.*, 2024; Vera, 2024*)	IA para mejorar el aprendizaje organizacional, 0 artículos	IA para potenciar la transformación profesional, 0 artículos

Nota: La referencia sola (por ejemplo, Ruiz et al., 2023) indica que la fuente analiza información relacionada con esa competencia, mientras que un número con un asterisco (por ejemplo, Vera, 2024) significa que la fuente desarrolla activamente esa competencia.*

con la integración de la IA. Las IES deberían adoptar una perspectiva global de la alfabetización en IA que abarque ambos enfoques (Gu y Ericson, 2025). Mientras que las perspectivas tecnocéntricas son útiles para identificar los conocimientos y habilidades técnicas necesarias para utilizar la IA como apoyo educativo, las perspectivas centradas en el ser humano son esenciales para comprender cómo ayudar a otras partes interesadas a adoptar de forma significativa estas tecnologías en la práctica; esto coincide con el trabajo previo realizado por Stolpe y Hallström (2024). Esta visión dual se alinea con el concepto de «AI readiness» propuesto por Luckin *et al.* (2022), que subraya la importancia de reflexionar sobre las necesidades reales de las partes interesadas para orientar el diseño y la aplicación de iniciativas relacionadas con la IA.

Las definiciones y marcos de alfabetización en IA existentes en la bibliografía pueden utilizarse tanto para garantizar la responsabilidad interna en el seguimiento del desarrollo de la alfabetización en IA de los docentes dentro de las instituciones como para servir de herramientas de evaluación comparativa para compartir las mejores prácticas entre contextos educativos. Las IES deberían adoptar marcos integrales –como el «Marco de competencias para docentes en materia de IA» de la UNESCO– y combinarlos con instrumentos validados de recogida de datos, como el cuestionario GLAT (*The Generative IA Literacy Assessment Test*) (Jin *et al.*, 2024), para definir parámetros claros que permitan evaluar los niveles de alfabetización en IA de los docentes y su progresión a lo largo del tiempo. Estos parámetros también podrían servir para realizar comparaciones entre instituciones y países, facilitando el intercambio de estrategias eficaces y fomentando la colaboración regional en torno a la integración de la IA en la educación.

Se necesitan más esfuerzos para apoyar el desarrollo de la alfabetización en IA de los docentes en niveles avanzados de competencia. Todos los estudios analizados en este trabajo se centran principalmente en fomentar las competencias en el nivel inicial de progresión. Aunque esto coincide con las conclusiones de la Fundación ProFuturo y la Oficina de Educación Internacional (OIE) de la OCDE (OEI y ProFuturo, 2023), que reconocen y prevén una evolución gradual de la alfabetización en IA de los docentes hasta 2030, el rápido ritmo de los avances tecnológicos exige un enfoque más proactivo, como reconocen Tadimalla y Maher (2024). Las instituciones deben responder rápidamente estableciendo mecanismos para acelerar el desarrollo de competencias de IA de orden superior y garantizar que los docentes estén equipados no solo para adoptar, sino también para comprometerse críticamente con la innovación educativa impulsada por la IA y liderarla.

Este estudio muestra que el «Marco de competencias para docentes en materia de IA» propuesto por la UNESCO puede ser una herramienta valiosa para analizar el progreso en el desarrollo de la alfabetización en IA del profesorado. Sin embargo, se necesita más investigación para explorar su aplicabilidad y adaptabilidad en diversos contextos educativos, especialmente en aquellos con diferentes condiciones culturales, institucionales y tecnológicas, tal y como subraya Biagini (2025). Examinar su transferibilidad ayudará a garantizar que las iniciativas de alfabetización en IA tengan en cuenta el contexto y sean equitativas a escala mundial.

1.7. Conclusiones

Esta revisión sistemática de la literatura analizó 17 trabajos que abordan la alfabetización en IA de los docentes en América Latina para avanzar en la comprensión del desarrollo de competencias en la región. El análisis revela tres conclusiones principales. En primer lugar, con respecto a las conceptualizaciones de la alfabetización en IA, identificamos tres patrones clave: (1) si bien los autores no adoptan explícitamente definiciones específicas, emplean enfoques que combinan perspectivas centradas en la tecnología o en el ser humano; (2) las competencias tecnológicas y éticas tienen particular importancia en las concepciones regionales de la alfabetización en IA; y (3) la mayor parte de la literatura enfatiza las habilidades de orden inferior en sus marcos de alfabetización en IA para docentes. En segundo lugar, con respecto a las metodologías de investigación, observamos que (1) la mayoría de los estudios se centran actualmente en medir las competencias en lugar de desarrollarlas, (2) emplean predominantemente enfoques de medición cuantitativos y (3) se concentran en las autopercepciones de los estudiantes y docentes en lugar de en los patrones de uso reales. En tercer lugar, la alineación con el «Marco de competencias para docentes en materia de IA» de la UNESCO muestra que los estudios se quedan en los niveles fundacionales (Adquirir y Aplicar), con una atención mínima a los niveles de progresión avanzados (Profundizar o Crear).

Respecto a las limitaciones de esta investigación, reconocemos que el alcance puede ser acotado, tomando en consideración la cantidad de artículos que han podido ser incluidos. También tomamos en consideración que se podrían haber consultado otras bases de datos para ampliar el resultado obtenido. Ya que este campo de investigación avanza rápidamente, la cantidad de artículos ha aumentado recientemente y una nueva revisión sistemática podría tener un alcance más amplio.

En resumen, esta revisión sistemática de la literatura busca aportar al campo de la alfabetización en IA en la educación, ofreciendo una aproximación estructurada a cómo se conceptualizan, evalúan y desarrollan actualmente las competencias docentes en América Latina. Al señalar algunas tendencias recurrentes —como el énfasis en el desarrollo de habilidades de orden inferior, la escasa atención a la implementación pedagógica y el compromiso limitado con niveles más altos de alfabetización en IA— el estudio pretende llamar la atención sobre aspectos que podrían ser relevantes en investigaciones futuras. La integración de las lecciones recogidas, a partir del marco de la UNESCO puede servir como una orientación inicial para responsables políticos, líderes institucionales e investigadores educativos. Este trabajo aspira a resaltar la necesidad de un enfoque más equilibrado, que considere tanto las perspectivas tecnológicas como las centradas en el ser humano, y a mostrar cómo los marcos internacionales y los instrumentos validados podrían ser de utilidad para evaluar los avances. En última instancia, estas reflexiones buscan abrir el camino para seguir repensando cómo se apoya la alfabetización en IA de los docentes, invitando a futuras investigaciones a explorar intervenciones culturalmente pertinentes, con un anclaje práctico y sensibles a la progresión, capaces de responder al papel cambiante de la IA en la educación.

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Anexo 1

Registros identificados para la revisión sistemática de la literatura en las siguientes bases de datos

Bases de datos	Registros
12th International Symposium on Digital Forensics and Security Isdfs 2024	1
2022 IEEE Andescon Technology and Innovation for Andean Industry Andescon	1
2023 South American Conference on Visible Light Communications Sacvlc	1
ACM International Conference Proceeding Series	1
Acta Scientiae	1
Advances in Intelligent Systems and Computing	3
Bibliotecas Anales de Investigacion	1
Cogent Education	4
Communications in Computer and Information Science	3
Computacion y Sistemas	1
Computers and Education Artificial Intelligence	1
Contributions of Behavior Analysis to Reading and Writing Comprehension	1
Digital Education Review	1
Education and Information Technologies	1
Education Sciences	1
Electronic Journal of e-Learning	1
European Public and Social Innovation Review	2
IEEE Access	1
IEEE Journal of Translational Engineering in Health and Medicine	1
International Journal for Educational Integrity	1
International Journal of Artificial Intelligence in Education	1
International Journal of Interactive Multimedia and Artificial Intelligence	1
Journal of Physics Conference Series	2
L@s 2024 Proceedings of the 11th ACM Conference on Learning @ Scale	1
Lecture Notes in Educational Technology	3
Lecture Notes in Networks and Systems	4
Proceedings of the 2023 IEEE 3rd International Conference Icalter	1
Proceedings of the Laccei International Multi Conference	1
Revista de Ciencias Sociales	1
Revista de Gestao Social e Ambiental	1
Risti Revista Iberica de Sistemas e Tecnologias de Informacao	1
Sapienza	1
Smart Innovation Systems and Technologies	2
Sustainability Switzerland	2

Capítulo 2
Internationalisation, sustainability and communication in a STEM virtual exchange

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2.1. Introducction

In the rapidly changing landscape of new technologies and the emergence of Industry 6.0, technical and applied education has taken on a crucial role in building capacities and promoting sustainable values. Hence, it is essential to rethink university curricula and to encourage collaboration among various stakeholders. This process involves connecting European institutions, uniting educators, and bringing together learners from diverse cultural backgrounds.

As global challenges grow increasingly complex, undergraduates in STEM—Science, Technology, Engineering, and Mathematics—are expected to develop their ability to collaborate in digital environments that span diverse countries and cultures. Besides, there is a rising acknowledgement of the importance of digital advancements and the necessity to integrate "global and cross-cultural viewpoints"(Khalid et al., 2025, p. 112) into STEM training.

Therefore, based on these priorities, we propose to implement a Virtual Exchange (VE) for creating a collaborative environment and connecting young individuals from different locations to collaborate and engage through common technology

(Stevens Initiative, 2023). The influence of VE on culture, communication and global citizenship in the digital era highlights the values of pluricultural societies (Potolia & Derivry-Plard, 2023). Furthermore, Virtual Exchange also enables students from diverse backgrounds to collaborate on problem-solving tasks, enhancing both internationalisation and employability (Jager et al., 2019).

By integrating sustainability themes and Agenda 2030 principles, VE fosters a more holistic approach to learning that aligns with both educational and societal needs (Lenkaitis, 2022). Through the lens of active student participation, digital collaboration, and intercultural dialogue, we view how virtual learning environments not only enhance sustainability awareness but also promote translanguaging and professional development (Polyakova & Klyatskina, 2025).

Drawing from the findings of the academic project "Sustainable Higher Education in Action: Exploring the Didactic Transversal Competences and Communication Skills among STEM Students", this chapter explores how Virtual Exchange serves as a transformative didactic tool in non-humanities higher education. Consequently, the research questions that will be answered by this chapter include:

- RQ 1. How do Virtual Exchange programmes in higher education institutions improve students' understanding of sustainability?
- RQ 2. How does participation in Virtual Exchange programmes affect the development of transversal communication competence and interculturality among STEM students?
- RQ 3. What challenges and possibilities exist for applying sustainability-focused virtual exchange approaches in higher education STEM programmes?

2.2. Theoretical background

2.2.1. Sustainability and Agenda 2030 values

The Sustainable Development Goals (SDGs), as voiced in the United Nations resolution (2015), represent a critical framework for facilitating global transformation. This comprehensive action plan is designed to enhance our economic, social, and environmental conditions on a national scale, thereby serving as a significant catalyst for advancing Sustainable Development within tertiary education. By moving from theoretical discourse to the proactive promotion of sustainable knowledge and capacity building (Berchin et al., 2021), we can cultivate a robust academic environment committed to focusing on the challenges of sustainable development.

This study is further grounded in the framework of Education for Sustainable Development (ESD), which encourages integrating sustainability concepts into teaching to prepare students for addressing global issues (Kopnina & Meijers, 2014). While fostering social responsibility, environmental stewardship, and global awareness in addition to sharing knowledge, we prepare learners to handle challenging global issues like social equality, technological innovation, and climate change (UNESCO, 2020).

Therefore, the recommendations of some scholars that go from discussions to the promotion of sustainable knowledge and capacity building are truly aligned with this study's purposes. Here, Virtual Exchange provides a thriving ground for implementing inclusive and quality education of SDG 4, partnering for intercultural collaboration of SDG 17 and encouraging awareness of climate action and sustainability (SDG 13) through themed activities and discussions.

2.2.2. Transversal competences

Generally speaking, transversal competences are essential abilities that transcend specific disciplines, enabling individuals to apply knowledge and abilities across various contexts (Sá & Serpa, 2018). Modern workplaces and dynamic professional environments require graduates to pursue solid but agile capacities of applied knowledge management (Belchior-Rocha et al., 2022).

In higher education, particularly within technical and applied disciplines, integrating transversal competences (TC) into the curriculum is crucial for preparing students to meet the modern workforce's demands (Polyakova et al., 2020; Tsankov, 2018). The lack of a consolidated TC framework among EU industry-oriented students has two major consequences. First, it creates serious challenges for highly educated graduates trying to enter the job market. Second, it limits their ability to grow and succeed in their careers.

Because of this, employers need "more than technical experts"(Munir, 2022:294) and repeatedly call on universities to focus more on developing multidisciplinary professionals —persons who have both deep knowledge in their field and strong transversal competences. Since 2002, the Universitat Politècnica de València (2024), with dimensions such as Social and environmental commitment, Innovation and creativity, Teamwork and leadership, Effective communication or Responsibility and decision-making, has been a valid answer to the needs and challenges of our society.

For the current study, we will focus on the specific dimension of Effective communication rooted in the above guidelines. As the original UPV document defines (*ibid,* p.4), this capacity prioritises "Comunicar y argumentar eficazmente, adaptando la organización de contenidos y el uso del lenguaje, verbal y no verbal, a diversas situaciones y/o ante diversas audiencias". In other words, the competence enables learners to transfer ideas, knowledge, or information clearly, both orally and in writing, by adapting verbal and non-verbal language to the situation and audience, while fostering an inclusive and diverse exchange of meanings.

Finally, a key expectation is their competence in utilising digital communication tools and diverse visual aids effectively, always considering the specific situation and audience.

2.2.3. English for Specific Purposes

Since the 1970s, foreign language education has increasingly focused on developing communicative competence through authentic interaction. The communicative approach emerged in response to the limitations of grammar-based methods, promoting the practical use of language in real-life situations (Canale, 2014; Canale & Swain, 1980; Hymes, 1972).

Over the years, emphasis shifted toward learners' ability to convey meaning effectively, considering the motivational, social, and contextual dimensions of language use. The communicative approach laid the groundwork for pedagogies that accept a degree of linguistic inaccuracy in favour of meaningful exchanges, while encouraging the use of real-world texts and shared communicative goals, as proposed by early theorists in applied linguistics (Hyland, 2022).

Specifically, in STEM education, we heavily rely on English for Specific Purposes (ESP). In other words, the process of teaching and learning English seeks to address social demands through the lens of applied contexts by offering a course tailored to specific purposes. Hence, the methodological implications of ESP extend beyond those of a general English course focused merely on acquiring broad language skills. As noted by Anthony (2018, p. 1),

> English for Specific Purposes (ESP) is an approach to language teaching that targets the current and/or future academic or occupational needs of learners, focuses on the necessary language, genres, and skills to address these needs, and assists learners in meeting these needs through the use of general and/or discipline-specific teaching materials and methods.

Consequently, the four main principles of ESP identify learners' needs when designing courses and programs, define clear learning objectives, choose appropriate materials and instructional methods, and carry out comprehensive evaluations of students, instructors, courses, and ESP programs (Anthony, 2018).

For the current research, the theoretical grounding in English for Specific Purposes provides a robust framework for designing pedagogies that prepare students not only to understand content but also to actively engage in global academic and professional dialogues in virtual exchanges.

2.3. Methodology

2.3.1. Study design

Next, we motivate our study architecture for verifying that non-humanities learners are building new capacities in sustainability and communication during online interactions.

The design for this system consists of two interconnected components: Participatory Action Research and Sustainable Virtual Exchange.

The first component, Participatory Action Research (PAR), is a collaborative research approach that actively involves community members in investigating issues directly affecting their lives, with the dual aim of generating practical knowledge and fostering personal and social transformation (Schneider, 2012). Besides, PAR emphasises the active involvement and leadership of individuals directly affected by the issues under investigation, combining systematic inquiry with collective action (Cohen et al., 2018).

Following Cornish et al. (2023), the Participatory Action Research is structured around six core elements where (1) Building relationships among participants and researchers, (2) Establishing collaborative working practices that support shared leadership, (3) Developing a common understanding of the issue being studied, (4) Collecting and generating data through participatory observation and creative methods, (5) Conducting collaborative analysis that integrates multiple perspectives and (6) Planning and implementing action based on findings guide the practitioners.

PAR methodology also acknowledges and addresses typical challenges such as institutional mismatches, risks of co-option, power imbalances, and the decentralisation of control. To navigate these, the research process incorporates critical reflexivity, promotes power redistribution, and builds supportive networks that align with the values of participatory research.

The second component, Sustainable Active Virtual Learning (SAVL), is a pedagogical model designed to foster the development of transversal, communicative, and intercultural competences in the context of second language learning. As outlined by SAVL practitioners (Polyakova et al., 2024; Polyakova & Galstyan-Sargsyan, 2022), this exchange model underlines active student engagement through collaborative tasks in virtual environments, integrating sustainability-related themes and intercultural interaction as core elements of language practice. The SAVL approach aligns with current demands for meaningful, context-aware language education that prepares learners for global communication and cooperation.

In the current study, this social practice is aimed at innovating collaboration in the organisation (coordination of the initiative), teaching (didactic cooperation), and learning parties (observation and pre- and post-study perceptions of students). The researchers could track, envision and solve issues raised by students during the virtual exchange process. To picture the research process, we compiled the following process information (see Figure 2.1).

On the left, this visual presents the SAVL model —a comprehensive pedagogical framework used to structure the virtual exchange (VE) methodology in this research. It integrates four key dimensions: (a) Sustainability for embedding global challenges into the content of VE tasks, (b) Active learning for promoting student-centred learning through collaborative project work, (c) Virtual exchange for using digital platforms and tools to support intercultural teamwork across institutions, (d) Learning process for targeting the development of communicative and transversal abilities in second/third languages.

Figure 2.1. Study methodology.
Source: own elaboration.

On the right, in line with the SAVL areas, we detail the research design and implementation process. A collaborative virtual exchange was implemented among three partner universities in Spain, Poland, and Finland between September and December 2024, establishing an inter-university framework that promoted cross-cultural and interdisciplinary learning. Students participated in four synchronous online sessions, working in internationally mixed teams to address real-world sustainability challenges while developing key transversal competences such as intercultural communication, collaboration, and problem-solving. To evaluate the educational impact of this initiative, a mixed-methods research design was adopted, combining systematic observations with pre- and post-study surveys. These assessments focused on students' progress in language proficiency, teamwork dynamics, and global awareness, providing evidence of the effectiveness of virtual exchange as a transformative pedagogical model in higher education.

Together, the SAVL model and these methodological steps provide a robust foundation for fostering STEM-based, intercultural, and sustainability-oriented competences in higher education.

2.3.2. Participants and setting

The study engaged a total of 50 students from three partner institutions: the Universitat Politècnica de València (Spain), Warsaw University of Technology (Poland), and LAB University of Applied Sciences (Finland). All technical undergraduates were enrolled in the virtual exchange (VE) project rooted in English for Specific Purposes (ESP) coursework at local faculties.

Each session incorporated intercultural teamwork, language tasks, and reflection activities based on sustainability themes. Students were grouped according to universities (each group had each university represented) and assigned tasks such as collaborative presentations on individual SDGs, discussions on climate-related engineering challenges, and digital peer reviews to encourage intercultural communication and active engagement as seen in the breakout rooms.

The fact of successfully completing the VE initiative was evaluated as part of the speaking and computer lab practicum tasks. The additional 1 ECTS certificate served as valid proof of cooperation, which could later be included in the participants' CVs.

2.3.3. Implementation

Beforehand, participants were informed about the goals of the study, and consent was obtained prior to data collection and the first online session. Anonymity was preserved in all reports and dissemination activities, and participation was voluntary without any academic penalty for non-participation. We structured the project around three key phases, beginning with preparation, followed by engagement, and finishing with assessment and feedback:

1) Preparation: Coordinators from three universities collaborated to design the exchange's structure. They selected relevant Sustainable Development Goals (SDG) themes and created instructional materials that aligned with course objectives. Besides, UPV educators tutored the student-researcher with the educational research basics for positioning the study in line with PAR principles.

2) Engagement: Students participated in four virtual sessions using the Microsoft Teams platform. At the beginning of this phase, participants completed a pre-test survey. Each session focused on a specific area of interest, including sustainability dimensions, effective communication, project development, and presentations, fostering both topic exploration and intercultural exchange. During these sessions, students utilised breakout rooms to facilitate peer-to-peer discussions and worked collaboratively in groups to create presentations on their chosen SDG, using Trello to organise and streamline their workflow. PAR approach supported the necessary adjustments of the VE progress and gave voice to students' needs, such as extra time or internal group dynamics.

3) Assessment and feedback: Following the exchange, students completed a post-test survey and submitted personal reflections. Observational notes and session materials were also reviewed to assess competence development.

2.4. Results

The Virtual Exchange initiative, integrated into the English for Specific Purposes course, effectively improved students' communication and teamwork competences, intercultural collaboration, and sustainability awareness. 50 STEM undergraduates from three countries took part in the experiment. To capture both quantitative and qualitative data, the following tools were used:

- Pre-and post-test questionnaires: they included 5-point Likert-scale (1 being the lowest and 5 - the highest levels of perceptions) questions assessing student perceptions of their communication competence, sustainability awareness, and teamwork skills before and after the virtual exchange.
- Student reflections and feedback: open-ended responses provided insight into learners' individual experiences, challenges, and growth.
- Researcher observation: throughout the sessions, classroom observations focused on student engagement, collaboration, use of digital communication tools, and participation in intercultural dialogue.

Below, we measured these outcomes using a validated pre- and post-test survey, qualitative student reflections, classroom observation notes, and the digital outputs produced by the students. The table beneath provides an overview of the qualitative results.

Specifically, the data presented in Table 2.1 show that the Virtual Exchange programme improved students' perceptions of sustainability, communication, and interculturality. The pre- and post-test results reveal a considerable increase in students' understanding of

Table 2.1. Learners' opinions, pre-/post experiment questionnaires (1-5 Likert scale).

Area	Pre-test (41 participants)	Post-test (33 participants)
1. Sustainability (Familiarity with Sustainability concepts)	5 - Definitely: 20 % 4 - Very probably: 24 % 3 - Possibly: 32 % 2 - Probably not: 15 % 1 - Not familiar: 9 %	5 - Definitely: 32 % 4 - Very probably: 46 % 3 - Possibly: 19 % 2 - Probably not: 3 % 1 - Not familiar: 0 %
2. Effective communication (Importance)	5 - Extremely important: 59 % 4 - Very important: 39 % 3 - Moderately important: 2 % 2 - Slightly important: 0 % 1 - Not at all: 0 %	5 - Extremely important: 73 % 4 - Very important: 21 % 3 - Moderately important: 6 % 2 - Slightly important: 0 % 1 - Not at all: 0 %
3. Intercultural awareness (Importance)	5 - Extremely important: 27 % 4 - Very important: 49 % 3 - Moderately important: 17 % 2 - Slightly important: 7 % 1 - Not at all: 0 %	5 - Extremely important: 58 % 4 - Very important: 24 % 3 - Moderately important: 12 % 2 - Slightly important: 3 % 1 - Not at all: 3 %

Source: own elaboration.

sustainability values and a marked shift in their attitudes regarding the importance of intercultural collaboration. Additionally, the development of effective communication abilities was particularly notable, achieving its highest levels.

2.4.1. Sustainability

Many students began the exchange with limited understanding of the Sustainable Development Goals (SDGs) and their relevance to STEM or technical education. Through project-based tasks and discussion around specific SDGs, they developed a more positive appreciation for sustainability in their professional context.

Data from Figure 2.2. present a comparative analysis of participants' self-reported sustainability familiarity levels before and after an intervention, as measured through a pre-test and post-test. The data is categorised across five ordinal levels of familiarity from 5–Definitely to 1–Not familiar, with the y-axis indicating the percentage distribution of responses.

A clear upward shift in sustainability perception is evident following the intervention. The proportion of respondents selecting the highest familiarity level, "Definitely", increased from 20 % in the pre-test to 32 % in the post-test, while those choosing "Very probably"rose markedly from 24 % to 46 %. These gains suggest a sizeable improvement in the first area of interest.

Conversely, the middle category, "Possibly", saw a notable decline from 32 % to 19 %, indicating that many participants transitioned from uncertainty to higher levels of certainty. The lower familiarity levels, "Probably not"and "Not familiar", experienced sharp reductions—from 15 % to 3 % and 9 % to 0 %, respectively—underscoring the effectiveness of the intervention in minimising unfamiliarity.

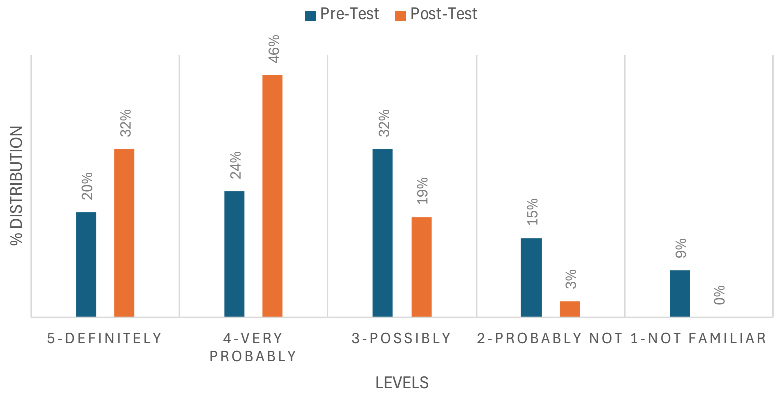

Figure 2.2. Pre-and post-test perceptions of students on sustainability.
Source: own elaboration.

Interestingly, the chart illustrates a positive shift in participants' self-assessed familiarity, with a clear redistribution from lower to higher categories, reflecting enhanced comprehension or awareness following VE activities.

2.4.2. Effective communication

The results revealed that many students initially viewed the interaction process as a very significant part of the programme. By the end of the Virtual Exchange, post-test responses indicated significant improvement. Therefore, this visual representation enables a direct comparison of shifts in perception, offering insight into the effectiveness of the intervention in varying participants' interaction abilities. In Figure 2.3., a notable trend observed is the substantial increase in the proportion of participants who rated the item as "Extremely important,"rising from 59 % in the pre-test to 73 % in the post-test. This upward move suggests a heightened recognition of the item's significance following the intervention.

Conversely, the percentage of responses categorised as "Very important"decreased from 39 % to 21 %, indicating a possible reclassification of importance toward the highest category. The slight increase in "Moderately important"responses, from 2 % to 6 %, may reflect a nuanced change among a minority of participants. Importantly, the absence of responses in the "Slightly Important"and "Not important at all"categories across both tests underscores a baseline consensus regarding the item's relevance.

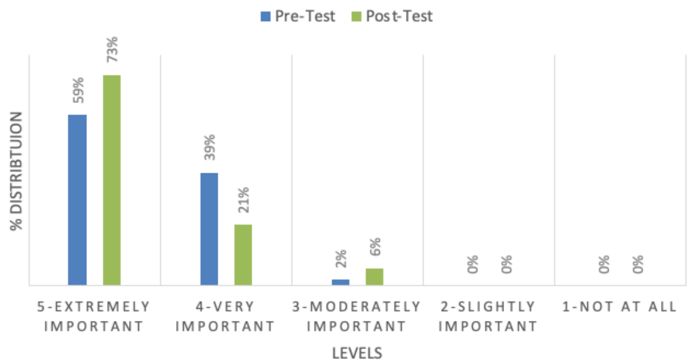

Figure 2.3. Pre-and post-test perceptions of students on communication.
Source: own elaboration.

On average, the changes in importance ratings from the pre- to post-test suggest that the intervention significantly impacted participants' perceptions. This increase likely indicates heightened awareness and understanding of the effective communication in VE. Thus, the figure serves both as a descriptive tool and a basis for analysis of the intervention's success in achieving its objectives.

2.4.3. *Intercultural awareness*

Collaboration in culturally mixed groups was initially marked by hesitation at the beginning. However, through structured tasks such as SDG-themed discussions and presentations, students gradually developed stronger intercultural dynamics. Hanse, the graph illustrates a comparative analysis of participants' perceptions of importance across five ordinal levels, measured before and after an intervention.

A remarkable upward shift is observed at the highest level of importance. The proportion of respondents who rated the subject as "Extremely important"more than doubled, rising from 27 % in the pre-test to 58 % in the post-test. This substantial increase suggests a significant enhancement in the perceived value of the topic following the intervention.

Conversely, the "Very important"category experienced a notable decline, dropping from 49 % to 24 %, indicating that many participants who initially rated the topic as very important may have reassessed it as extremely important after the intervention. The "Moderately important"and "Slightly important"categories also saw modest decreases—from 17 % to 12 % and 7 % to 3 %, respectively—further reinforcing the rising trend in perceived importance.

Interestingly, the "Not important at all"category, which was absent in the pre-test, appeared at 3 % in the post-test, suggesting a small minority of participants reassessed the topic as entirely unimportant.

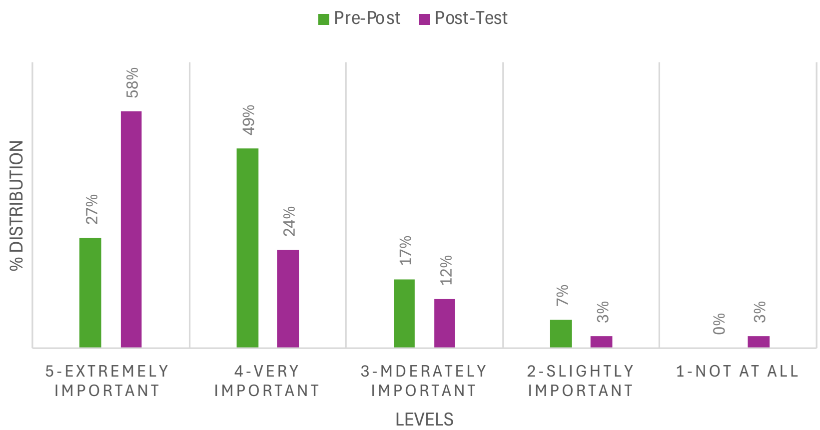

Figure 2.4. Pre-and post-test perceptions of students on interculturality.
Source: own elaboration.

Overall, the chart reflects a clear and compelling shift toward higher levels of perceived importance, highlighting the intervention's effectiveness in elevating participants' valuation of the subject matter.

2.4.4. Challenges and opportunities

In designing the exchange process, we drew on existing work from a number of distinct areas: Education for Sustainability, English for Specific Purposes and Virtual Exchanges, among others. Continuing with this rationale, we simultaneously developed Participatory Action Research within the Sustainable Active Virtual Learning setting. Instead of barely running an exchange across three universities, we enriched this context by giving voices to the partakers, a student-researcher and educators-mentors. This had a profound influence on the overall quality of the online learning experience.

Two major sources of qualitative information play a crucial role in the educational research progress: the feedback of the participants and the notes taken by the student-researcher. Here, we offer the initial set of evidence:

Table 2.2. Learners' opinions, open-ended questions.

Question	Before the VE (41 participants)	After the VE (33 participants)
1. Have you participated in virtual exchange programs before?	"No"- 40 answers "No. This is my first virtual exchange and I›m really hoping to strengthen my communication by interacting with other students through this program. It also an opportunity to practice speaking beyond cultural dynamics " "No, it is a good idea to improve our english level and know more about Other countries and universities"	"I expected mostly just international communication and widening my horizons in terms of sustainability" "I expected to find out how an international group from all different places would work together in a language that is not the mother tongue of any, I believe it was a reasonable expectation, and a well met one. It was a lot of fun"
2. What challenges do you face when communicating across cultures in digital environments?	"Language barriers Assumptions and stereotypes Technology access and familiarity Time zones and scheduling conflicts Ethnocentrism and lack of awareness" "I get nervious as I prefer the face-to-face talk rather that doing it online" "Cant describe it, maybe some sort of fear to be judged" "Technical/language problems" "Language issues, because not everyone knows English which is a common language"	"Technological divide Language barriers Time differences Cultural dynamics" "mostly only the time difference and our current exam period, but we were able to overcome these obstacles and complete the task" "Finding a common ground in communication where conversations and tasks may run smoothly, which takes a little time and engagement" "language barrier and cultural clash" "cultural misunderstandings and varying communication styles"
3. What improvements would you suggest for this learning experience to enhance your communication competence? [After the VE]	"Use of Group discussions Project based learning Checking on the availability of internet and adequate resources" "More projects like this to meet other students and work as well" "I think that all was perfect, people is very kind and friendly" "Improve my confidence" "To increase engaging and participation activities during the program". "Oblige everyone to turn on their cameras" "i think it is a very good idea so i don›t know what you can improve in this project, it›s fantastic!!"	

Source: own elaboration.

Henceforth, the data collected before and after the Virtual Exchange (VE) program offers a rich narrative of participants' evolving experiences, challenges, and reflections. Presented in three thematic areas—prior experience, intercultural communication challenges, and suggestions for improvement—the responses reveal both the transformative potential and the practical complexities of virtual intercultural learning.

Prior experience with Virtual Exchange

Before participating in the VE, nearly all respondents (40 out of 41) reported no previous engagement with virtual exchange programs. Their comments reflect a strong sense of anticipation and optimism. Many viewed the programme as an opportunity to enhance their communication skills, particularly in English, and to engage with peers from diverse cultural backgrounds. Expectations ranged from broadening international perspectives to exploring collaborative dynamics in multilingual settings. These reflections underscore the participants' openness to intercultural learning and their desire to connect meaningfully across borders.

Challenges in intercultural digital communication

Participants identified a range of challenges associated with communicating across cultures in digital environments. Commonly cited issues included language barriers, technological limitations, and time zone differences. Several respondents also mentioned emotional and psychological hurdles, such as anxiety about being judged or discomfort with online communication compared to face-to-face interaction. Cultural misunderstandings, stereotypes, and differing communication styles further complicated interactions. Despite these challenges, many participants demonstrated resilience, noting that with time and engagement, they were able to overcome obstacles and collaborate effectively.

Suggestions for Improvement

Post-exchange reflections offered constructive suggestions for enhancing future virtual exchange experiences. Participants advocated for more interactive formats, such as group discussions and project-based learning, as well as improved access to digital resources. Some emphasised the importance of fostering engagement through activities and encouraging the use of webcams to create a more personal connection. Others highlighted the need for extended group interaction time and expressed a desire for more opportunities to build confidence. Notably, several participants expressed high satisfaction with the programme, describing it as "fantastic"and "perfect,"indicating that the VE successfully met or exceeded their expectations.

The second piece of qualitative evidence comes from the student-researcher's (also a VE participant) notes taken at the end of every online session. Specifically, this active participation resulted in a string of arrangements that supported the training process within each strategic area of the exchange.

Table 2.3. Student-researcher notes.

Area	Observations and Participatory Action Research (PAR)
1. Sustainability	Even though we acknowledge the significance of sustainability in higher education, initial observations indicated that students' understanding of its application to STEM fields varied widely, with some expressing strong awareness and others showing limited familiarity. This gap provided an opportunity to integrate practical examples and discussions into the course content. PAR promoted a discussion of the Agenda 2030 values applied to STEM training, encouraging students to connect global sustainability goals (such as SDG 4, SDG 13, and SDG 17) with their academic and professional contexts.
2. Communication	Communication skills were strengthened through structured session activities, oral presentations, and collaborative assignments, although some students initially expressed low confidence in addressing diverse audiences. Over time, there was noticeable improvement in clarity, audience engagement, and use of technical vocabulary. PAR prompted specific information on communication challenges faced by students and incorporated feedback to design more interactive and inclusive speaking and listening activities.
3. Interculturality	While the participant group was relatively homogeneous in terms of cultural background, discussions and group work simulated intercultural collaboration by exposing students to diverse perspectives and problem-solving approaches PAR supported big/small group dynamics oriented towards inclusion, ensuring equal participation opportunities and fostering respect for varied opinions and learning styles.
4. Other factors	Time constraints during exam periods led to reduced response rates and limited engagement in the post-test phase, although more than half of the participants still contributed, providing valuable data for the study. PAR: together with the course educators, student-researcher sent several gentle reminders once the exams were over.

Source: own elaboration.

In sum, the data reveals a journey from initial curiosity and uncertainty to meaningful engagement and reflection. The VE programme not only facilitated intercultural communication but also empowered participants to navigate and overcome the inherent challenges of digital collaboration across cultures. Across the learning, the voices of students became a major source of inspiration.

2.5. Conclusions

This study explored how virtual exchange and sustainable didactic approaches integrated into the Professional English for Engineering course at the Universitat Politècnica de València (UPV) contributed to the development of transversal competences—specifically language learning, communication, teamwork, and sustainability awareness—among STEM students. The findings from pre- and post-test surveys, open-ended responses, researcher observations, and classroom artefacts (presentations) help address the core research questions.

RQ 1. How do Virtual Exchange programmes in higher education institutions improve students' understanding of sustainability?

Virtual Exchange (VE) programmes enhance students' understanding of sustainability by inserting global issues into collaborative, project-based learning experiences. In particular, endeavours grounded in the United Nations Sustainable Development Goals (SDGs) help students engage with real-world challenges, reflect on diverse perspectives, and cultivate a deeper appreciation for the interconnectedness of sustainability issues. The VE format also promotes interdisciplinary dialogue, allowing STEM students to explore sustainability beyond technical solutions, incorporating ethical, cultural, and social dimensions.

RQ 2. How does participation in Virtual Exchange programs affect the development of transversal communication competence and interculturality among STEM students?

Participation in VE programmes significantly contributes to the development of transversal communication competence and intercultural awareness among STEM students. By working in culturally diverse teams, students are exposed to varied communication styles, languages, and cultural norms, which fosters adaptability and empathy. Specialised language interactions, peer collaboration, and reflective tasks help bridge the gap between technical education and essential capacities such as active listening, negotiation, and conflict resolution. Moreover, the use of digital collaboration tools simulates real-world professional environments, preparing students for global teamwork.

RQ 3. What challenges and opportunities exist for applying sustainability-focused virtual exchange approaches in higher education STEM programmes?

Consequently, the findings of the study highlight several promising avenues for enhancing engineering education through innovative, sustainability-focused pedagogical strategies. Project-based learning, particularly through group EDUSCRUM setting aligned with the Sustainable Development Goals (SDGs), was shown to deepen students' understanding of global challenges while simultaneously fostering collaborative communication.

Despite these positive outcomes, the research also uncovered several practical challenges that impacted the overall effectiveness of the virtual exchange experience. Technical difficulties, such as unstable internet connections, occasionally disrupted communication. Furthermore, language barriers posed initial obstacles for students with lower confidence in English. However, the implementation of breakout rooms allowed for peer-supported language practice and mentoring, which significantly improved participation and engagement over time. These insights underscore the importance of addressing logistical and linguistic barriers to fully realise the potential of virtual, intercultural learning environments.

The findings of this study support the view that virtual exchange, combined with sustainable didactic practices, can significantly enhance engineering education by integrating language learning, communication skills, and global awareness into technical curricula. The English for Specific Purposes scenario served as a model for how meaningful, cross-cultural interactions can foster the transversal competences required by 21st-century engineers.

While some logistical and technological barriers remain, the overall success of this initiative highlights the value of embedding interdisciplinary, international, and intercultural learning in STEM education. Virtual Exchange not only strengthens students' ability to work in diverse environments but also helps them see the relevance of sustainability to their future careers, thus preparing them to be both competent engineers and responsible global citizens.

2.6. Recommendations and best practices

To build upon the findings of this study and address the challenges identified, several strategic recommendations are proposed for educators, institutions, and programme designers.

First, Virtual Exchange (VE) should be integrated into STEM curricula, rather than being treated as an optional or supplementary activity. Embedding VE within formal course outcomes ensures sustained student engagement and academic recognition. Second, multiphase projects spanning multiple stages or semesters are encouraged, as they promote deeper learning and allow for the gradual development of both technical and interpersonal competencies. Third, flexible scheduling with buffer periods should be adopted to avoid conflicts with exam weeks and to provide adequate time for post-exchange reflection and feedback collection, thereby enhancing the overall learning experience.

In addition to the above recommendations, the study identified several effective practices that can be replicated or adapted in future implementations. The use of Sustainable Development Goals (SDGs) as thematic anchors provided a globally relevant framework for collaborative tasks, fostering meaningful engagement with issues such as education, climate action, and global partnerships. Project-based and collaborative learning activities, including SDG presentations, peer reviews, and group reflections, stimulated both cognitive and social engagement, aligning well with active learning principles.

Furthermore, the application of blended assessment tools, combining pre- and post-test surveys with qualitative reflections and classroom observations, enabled a comprehensive evaluation of student growth. Finally, feedback loops between educators and learners, facilitated through a participatory action research approach, allowed for real-time instructional adjustments, enhancing responsiveness and learner involvement. These practices collectively contribute to a more inclusive, dynamic, and impactful virtual exchange experience.

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Capítulo 3
Teacher perspectives on integrating innovative digital technologies in English language teaching

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3.1. Introduction

Teachers will not be replaced by technology,
but teachers who don't use technology
will be replaced by those who do.
Sheryl Nussbaum-Beach

This study shows the relation between the use of innovative digital technologies and tools by English language teachers in Belarus and their professional growth. English is an international language and acquiring good knowledge of English is in high demand in Belarus, especially in a fast-growing industry of IT. It is the most popular foreign language taught at schools, colleges, universities and language schools in Belarus. The context of this study is particularly significant. As Belarus continues to integrate into the global economy, with a growing IT sector that demands high English proficiency, the pressure on language teachers to modernize their methods is intensifying. This demand requires the use of innovative technologies in English teaching, or it is enough to use traditional approaches to provide good knowledge. This research provides a timely snapshot of their readiness and challenges in meeting this demand. Teachers' readiness to use innovative digital technologies and its influence on their professional growth was studied via a survey in April 2022 with one hundred and six English language teachers working at schools, colleges, universities, language schools and companies.

Considering that research focuses on teachers with a Belarusian background who face a high demand for their profession when there is no need to compete with others and struggle in searching for the job the study promise to give an amazing outcome. The world is surrounded by technology nowadays, so in our research we are going to look at the aspect digital or technological innovations in the field of English language teaching.

Dehghan (2021) investigated the relationship between language teachers' innovation and their professional development. The study posits that professional development can be initiated through two primary pathways: system-driven mandates or self-directed initiatives by the teacher. Furthermore, Dehghan (2021) offers practical suggestions for fostering innovation and professional development within the specific context of Iranian schools. However, a gap in the literature remains, as the perspectives of English language teachers in Belarus on their professional growth are not yet explored.

3.2. Innovative digital technologies in English language teaching

Innovation in education means doing the best for all students. Teachers, lessons, and curriculum have to be flexible. Innovation also means finding the best possible ways to reach out to the students. Technology can be one of the best possible solutions.

"Technology has become an important aspect of society, helping students understand the world more broadly than what they are taught in schools and teachers in the classroom" declares Warschauer (2000). Digital technologies are electronic system tools, devices and resources that produce, store or process information. Notable examples include social media, online gaming, multimedia, and mobile phones. Digital education is any type of education that uses technology. According to Abdurahimovna (2020) this can happen in all areas of the curriculum.

Computer technology has helped to introduce a number of innovations into foreign language instruction. The widespread use of methods, activities and tools of Computer Assisted Language Learning (CALL) enabled many teachers all over the world, including Turkey, to enhance their teaching and maximize learning opportunities for their students. Fortunately, more and more schools on the one hand and households on the other have computers and Internet access to make technology-assisted learning possible.

Bekešová & Romanová (2019) say that six innovations – whiteboard, smartphone, Skype, blogging, podcasts and online games which have mostly changed English language teaching and learning. Their research showed that a whiteboard and online games are frequently used within English lessons either at primary or secondary schools. Teachers find the whiteboard helpful, easy to control, and although it has been in use for years, it is still more interesting than using a traditional blackboard. The opinions of primary and secondary teachers do not differentiate, which was also confirmed by the students. On the other hand, smartphones and podcasts are rarely used for teaching English while Skype or blogging are not used et all. The survey also showed that teachers would like to try or experience new technology innovations and forms of teaching English, but they are maybe afraid. The reason can be, for example, finances, lack of equipment or fear of losing control while using smartphones within lessons.

According to Irudayasamy et al. (2021), the progression of mobile technology has led to a tremendous increase in mobile applications, a trend significantly accelerated during the COVID-19 pandemic. These applications have been widely exploited for teaching and learning, transforming the strategies used in English language education. The mobile learning strategies identified in their research underpin ubiquitous learning, enabling seamless English language instruction to occur anytime and anywhere. The specific context and implementation of this learning are ultimately determined by students' unique desires, needs, and characteristics.

For instance, the COVID-19 pandemic, which forced widespread school closures, demonstrated the critical role of mobile applications as an alternative learning platform. In this context, online learning consisted of activities that supported both synchronous online classes and asynchronous onsite/offline work. Irudayasamy et al. (2021) state that the principles for using mobile applications in ubiquitous English language learning are characterized by adaptability, accessibility, interactivity, immediacy, permanency, mobility, and context-awareness.

However, despite the positive contribution of mobile application in teaching and learning English, teachers and students face challenges in designing and implementing activities, posting materials and resources for mobile learning. Teachers face challenges in supporting ubiquitous learning because of the lack of reliable real-time multimedia-rich communication and physical distance. Learning is a dynamic process, and any problems arising require quick resolution, which is less achievable in mobile-based learning.

Vocabulary learning is constantly being explored by researchers to identify how to develop the best strategy for improving vocabulary. One of the effective vocabulary learning methods is online-based game vocabulary instruction according to Aboualya et al. (2021). Bytheway (2014) states that game-based and online role-playing vocabulary learning promotes imagination, reduces anxiety, strengthens engagement, increases motivation, and rewards curiosity. The game-based teaching style could be applied in learning processes both in group and individual practice. Many English learners use games as an informal learning technique.

The interesting data were gathered by Indonesian researchers. According to ASROPAH (2020) the results show that 65% of language teachers had used digital technology in teaching, but 35% of language teachers used traditional way in teaching (not using technology in language teaching and learning). Moreover, the data findings also reveal the teachers' obstacles in using technology in language teaching classrooms such as limited school's digital technology facilities, time-consumed preparation in using digital technology, and teachers' technology illiterate. These facts point to the conclusion that language teachers need more attention from government to realize the digital technology based-language class.

In the era of communication and information technologies, one of the most important needs of language learners is e-learning which can result in innovative techniques in teaching a second/foreign language and motivate learners. It is a fact that e-learning can become extremely boring if it lacks innovation but extremely motivating if the teacher utilizes different innovative features. In contrast to the past when preparing teaching materials using different teaching software and applications was a difficult task and lacked needed motivation for teachers and students today, different software, applications and online and offline platforms such as Storyline Articulate, and Moodle. Using different facilities such as images, sound, gifs, animations, dictionaries and videos have made it possible for teachers to produce innovative language learning materials in a much easier way and with much better efficiency. Moreover, according to Dehghan (2021) blended learning techniques can also provide an innovative and exciting environment for language teaching.

In summary, technological innovation is a powerful catalyst for modernizing English language teaching, enabling more dynamic, accessible, and student-centered learning. Tools such as mobile applications, digital games, and interactive platforms have redefined educational strategies, particularly highlighted by the shift to ubiquitous learning during the COVID-19 pandemic. However, the successful integration of these technologies is not a given; it is hindered by significant practical challenges including insufficient infrastructure, the demand for teacher training, and the inherent complexities of digital instruction. Therefore, harnessing the full potential of educational technology requires dual commitment: from teachers, who must proactively engage in their own professional development to adopt innovative practices, and from institutions, which must provide the necessary support, resources, and policy frameworks. These studies constitute the base to examine what English language teachers in Belarus might use during their lessons.

3.3. Professional development and innovation

Rich (2010, as cited in Education Week, 2010) defines 21st-century skills as "certain core competencies such as collaboration, digital literacy, critical thinking, and problem-solving that advocates believe schools need to teach to help students thrive in today's world." The cultivation of innovation is so critical that it is considered a central goal of modern education, with teachers positioned as the primary agents of this change. This raises important questions regarding the role of professional development in training innovative teachers and whether such development should be reserved only for those deemed innovative or extended to all educators. This is particularly true in the dynamic fields of education and, more specifically, language teaching, where continuous teacher development is essential.

Dehghan (2021) outlines two distinct approaches to professional development: a prescriptive, institutional, top-down model and a personal, transformational, bottom-up model. The prescriptive approach involves teachers waiting for their institutions to mandate change through revised curricula, in-service training, and directives from administrators. In contrast, the transformational approach positions teachers as the initiators of change. Through critical reflection on their beliefs, knowledge, and practices informed by their past experiences as learners and their present realities as teachers they enact small-scale innovations in their own classrooms that can ultimately lead to broader systemic transformation. This bottom-up process is inherently self-oriented and shapes their future professional goals and abilities.

A teacher's inclination toward one approach over the other is a complex issue, interrelated with core constructs such as beliefs, perceptions, self-determination, self-efficacy, and creativity. This inclination is also significantly influenced by the teacher's environment, which shapes their professional identity and their capacity to act. Ultimately, Dehghan (2021) concludes that transformational, self-oriented professional development is a key driver of innovation in language teaching.

Innovation is also a process which, though dependent on personality and individual differences, is not a static and definite entity and can have a dynamic and incremental nature, for its actualization and development training and teaching play an important role. Setting attainable goals while paying attention to the social, cultural and institutional conditions can help teachers in their innovative teaching of a foreign language using all available tools. In other words, a synergistic interaction between innovation and teachers' transformative decisions causes more professional development which in turn leads to more creativity and innovation in the language classroom. However, Dehghan (2021) emphasizes thet all this depends on the key role of a teacher's decision to take a different route for his/her professional development and innovation.

A synergistic interaction between innovation and teachers' transformative decision causes more professional development which in turn leads to more creativity and innovation in a language classroom. However, all this depends on the key role of teachers' decision to take a different route for their professional development and innovation.

Consequently, the professional development of language teachers can be initiated by two distinct agents: the external educational system (a top-down approach) or the teachers themselves (a bottom-up approach). This article investigates the latter, arguing that the self-directed adoption of innovative teaching tools is a significant factor influencing the professional growth of English language teachers in Belarus.

3.4. Research methodology

This study employs a questionnaire survey as the primary empirical tool. It provides a quick and massive way to collect thematic information. Respondents read the questions on their own and express their opinion directly. An interview was used as a second means of gathering information. The teachers optionally provided their e-mails in the survey as a means of selecting a willing participant for an interview.

a) Participants: English language teachers of various age and gender, with Belarusian background, working at schools, universities, English language schools, IT companies, private and public organizations, as freelancers, etc.

b) Data collection: survey (questionnaire) and semi-structured interviews. The questionnaire is based on the survey suggested by Hapanovich-Kaidalova (2014). It is a closed-type questionnaire with one end-open question. The interview consists of 15 questions. The questions are created according to the research aim and reflect some of the controversial topics found during the literature review. The interviews were held in English online and offline and further converted into scripts for their analysis.

c) Procedure: the link to the questionnaire (Google form) was sent to the participants via messengers and social networks. The semi-structured interviews were carried out online.

d) Data analysis: quantitative analysis (descriptive statistics) and qualitative analysis (content analysis method and comparative method) were used.

e) Ethics: the participants of the research were informed about the topic of the study, the research aim, and any potential benefits; participation was voluntary and anonymous.

f) Limitations: the data relies on self-reported perceptions of innovation and professional growth, which may be subject to social desirability bias (where participants provide answers they believe are favorable); the researcher's questions are ambiguous; and the participants could show unwillingness to participate.

The interviewees were informed that the interview was the part of the research on the usage of innovations in English language teaching and their impact on the teacher's professional growth.

3.5. Results and discussion

We have conducted 106 surveys and 10 interviews. We tried to find out how English language teachers in Belarus see the application of technological innovations and its influence on their professional growth.

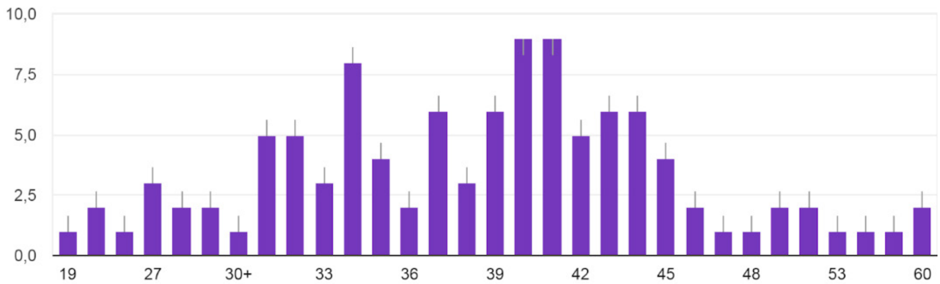

Figure 3.1. Participants' age.

The vast majority of participants (96%) were employed in Belarus, with the remaining respondents working in Russia, China, and Ukraine. The age of the participants ranged from 19 to 60 years. The most frequently represented ages were 40 (8.9%), 41 (8.5%), and 34 (7.5%) years. The sample was predominantly female, with only four male participants, constituting 3.8% of the total respondents.

As illustrated in Figure 3.2, the most common employment status among respondents were self-employed (34%) and working at a public university (31.1%). A smaller proportion of participants were employed at public schools (10.4%) or private schools (9.4%). Other reported employment contexts included IT companies, international corporations, lyceums, corporate in-house training, and doctoral studies. Some of them were self-employed.

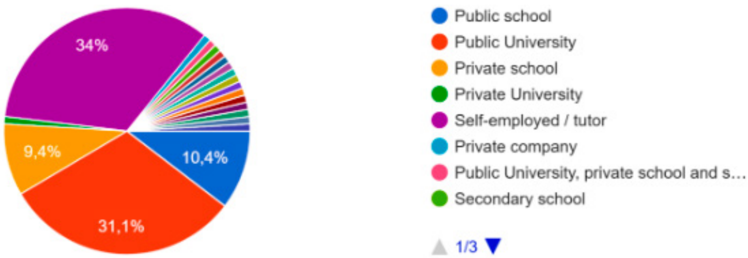

Figure 3.2. Survey participants' primary form of employment.

To ensure accuracy, responses indicating similar employment types were consolidated. Two respondents who specified "state university" were grouped with the public university category, increasing that total to 35 respondents (35.0%). Similarly, one respondent who indicated "secondary school" was added to the public school category, resulting in a revised total of 12 respondents (11.3%) for that sector.

The data collection employed a mixed-methods approach, comprising a survey and a follow-up interview. The survey consisted of 12 questions designed to gather demographic data (e.g., age, gender, place of work) and to determine participants' attitudes toward innovation and their perceived level of innovativeness. Sample questions included: *"Are you always ready to use innovative technologies in your work?"* and *"When you use innovative digital tools, does it influence your professional growth?"*

The subsequent interview contained 15 questions that explored these themes in greater depth, while also collecting additional professional background information such as teaching experience, scientific degrees, and possession of international teaching certificates. An example question was: *"Give your opinion on the statement: 'The more experienced the teacher is, the more innovative he/she is.'"*

Figure 3.3 shows the frequency of using different innovative digital technologies. One participant mentioned that he/she never tried to classify them. As we can see from the diagram the most frequently used digital/technological tools are online communication, online authentic materials and digital platforms. An interesting fact is that 4 respondents indicated virtual reality technology. So, it can illustrate the tendency to start using the latest technologies in teaching English but not on everyday basis.

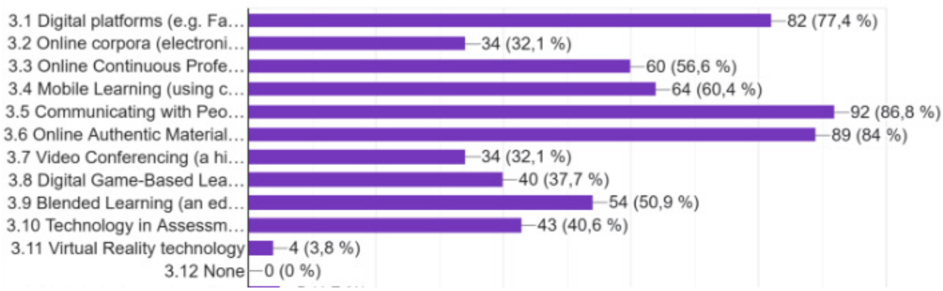

Figure 3.3. Technological innovations used in work according to survey results.

In the interviews there is a similar tendency among the participants. They choose Zoom, Miro, Quizlet as the top tools for their lessons. And one participant named platform Edvibe as the ever-best tool and platform.

The most popular reasons for such a choice are that the teachers use these tools for online teaching because they are easy to use, free of charge, convenient and available. These digital tools save time, make teaching more interesting and motivate students to study.

They are very suitable for one-to-one teaching and are a necessity in distant learning. Besides, they are effective in teaching and learning, help to work with authentic materials and make the learning environment up-to-date and diverse. The interviewees choose a particular tool according to the goals of the lesson and learner's interests and needs.

Considering the question of what it depends on when you choose a particular tool a lot of interviewees mentioned goals of the lesson and learner's interests and needs. Moreover, the factors of saving time, simplicity, usability, and personal interest are mentioned.

Analyzing the interview's question about professional growth, we received the following results: all the interviewees (100%) agreed that application of innovative technologies influences their professional growth.

Taking into account the approach developed by Derhghan (2021) and discussed above, teachers mention both approaches (prescribed and personal), but mostly their inner desire to learn something new to grow professionally and to be a good teacher as well.

The analysis of responses to the interview question, *"When you use innovative digital tools, does it influence your professional growth?"* revealed unanimous agreement on its positive impact, though the perceived nature of this influence varied. The responses highlighted several key motivations and challenges.

A predominant theme was the necessity of innovation for maintaining professional relevance. As one participant briefly stated, *"You have to keep up with trends in teaching. You can't avoid it. You should match progress"* (P1). This opinion was often coupled with a focus on methodological enhancement, where teachers actively seek to upgrade their skillset; one respondent noted it involved *"upgrading and extending my set of tools"* (P3), while another explained it *"makes you think out of the box to adapt innovative digital tools to your study program"* (P7).

For many, this process is driven by strong **i**ntrinsic motivation, including both personal and professional development. Participants reported that they use new tools *"to entertain and develop myself"* (P2) and believed that *"learning something new always leads to a positive result!"* (P4). This aligns with the core principle of continuous learning, summarized by the assertion that *"as soon as you stop learning new things, you stop developing"* (P9).

However, participants acknowledged that professional growth is often contingent on independent initiative, which can be hampered by practical constraints, as one teacher said, *"it is always about self-education and because of big workload I do not always have time for it"* (P5).

Based on the findings from 106 surveys and 10 interviews, it can be concluded that English language teachers in Belarus broadly recognize the positive impact of technological innovations on their professional growth, primarily driven by a personal desire to remain relevant, enhance their methodological toolkit, and engage in continuous learning, though this development is often self-directed and challenged by practical constraints such as high workloads.

3.6. Conclusion

This study set out to investigate the perspectives of English language teachers in Belarus on the integration of innovative digital technologies and its influence on their professional growth. The findings from 106 survey responses and 10 in-depth interviews paint a clear picture: there is a strong, unanimous consensus among educators that technological innovation is not only beneficial but essential for their professional development.

The research confirms that the drive for innovation among Belarusian English teachers is predominantly intrinsic and self-directed, aligning with Dehghan's (2021) transformational, bottom-up model of professional development. Teachers are primarily motivated by an internal desire to remain professionally relevant, enhance their methodological toolkit with tools like Zoom, Miro, and Quizlet, and engage in continuous learning to better serve their students' needs. They perceive the use of digital tools as directly contributing to their growth by forcing them to "think out of the box" and continuously upgrade their skills.

However, this path to innovation is not without significant obstacles. The study identifies a critical tension between teachers' strong motivation and the practical realities they face, including high workloads, a lack of time for self-education, and an over-reliance on personal initiative. This suggests that while the individual desire to innovate is present, systemic support such as institutional training, allocated resources, and a reduction in administrative burdens is often lacking.

Therefore, the successful integration of innovative digital technologies in Belarus's English language teaching ecosystem cannot rest on teachers' enthusiasm alone; it requires a synergistic partnership where teachers continue their proactive, bottom-up pursuit of growth, while institutions and policymakers provide more robust top-down support through targeted professional development, improved infrastructure, and frameworks that incentivize innovation. The results of this research not only highlight this critical need but also provide a foundation for further investigation into the application of innovative technologies in English language teaching. Moreover, the obtained data is significant for creating new educational programs and seminars for the English language teachers and for supporting systems specifically designed to foster the professional growth of English language teachers in Belarus, ensuring the full potential of digital tools is realized for both educator development and student success.

This study opens several directions for further investigation. A longitudinal study could track how teachers' innovation practices and perceptions change over time with the introduction of targeted support. Comparative research between Belarus and other

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post-Soviet or Eastern European countries could reveal common structural challenges and unique cultural factors affecting technology integration. Finally, action research projects, designed in collaboration with teachers, could develop and test specific professional development models that effectively combine top-down support with bottom-up initiative.

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Capítulo 4
The MOD tool in task-based learning: Feedback and negotiation of meaning

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4.1. Introduction

This study investigates the pedagogical viability of the Multimodal Online Device (MOD Tool) as an assessment instrument within Virtual Exchange (VE) contexts. The MOD Tool is designed to capture both linguistic performance and metacommunicative phenomena, with particular attention to negotiation of meaning (NoM), a construct central to Second Language Acquisition (SLA) (Varonis & Gass, 1985). By integrating symbolic competence (Kramsch & Uryu, 2020b) and multimodal pedagogy, the tool provides a framework for analysing oral interactions in diverse intercultural settings.

The research is situated within the Faculty of Economics at the Universitat Politècnica de València and focuses on a cohort of Erasmus students enrolled in a Business English module. Adopting a Task-Based Language Teaching (TBLT) approach, the study employs three scaffolded tasks, a structured interview, a digital video narrative and a synchronous business pitch, which vary in linguistic control and cognitive complexity. This design enables a comparative analysis of learner output across modalities and highlights the adaptability of language use in intercultural exchanges. The objectives of the study are threefold:

- To evaluate the MOD Tool's diagnostic capacity in capturing communicative and metacommunicative competence.

- To analyse how learners adapt their language to use scaffolded tasks.
- To provide recommendations for refining the MOD Tool for future applications in multilingual VE environments.

4.2. State of the art

Virtual Exchange (VE) has evolved from its initial role as a language-learning tool into a comprehensive pedagogical framework that fosters intercultural dialogue, internationalisation of the curriculum, and symbolic meaning-making (De Wit, 2016; Kramsch & Uryu, 2020b; O'Dowd, 2012). Within the field of Second Language Acquisition (SLA), assessment paradigms have shifted from structuralist models to dynamic approaches that emphasise learner agency, communicative performance, and formative feedback (Canale & Swain, 1980; Bachman, 1990; Lantolf, 2004).

Despite the development of automated scoring systems such as SpeechRater, VOPI, and LPAT, these tools often fail to capture metacommunicative nuances and intercultural sensitivities (Akiyama & Saito, 2016; Hauck & MacKinnon, 2016). Their limitations highlight the need for multimodal assessment frameworks that integrate linguistic output with symbolic interaction. The Virtual Oral Proficiency Interview (VOPI) is an online adaptation of the traditional Oral Proficiency Interview used in language assessment. It is typically conducted via video-conferencing platforms and evaluates a learner's speaking ability through structured prompts and interactive questioning. The virtual format enables remote administration, standardised scoring, and increased accessibility for learners who are unable to attend in person. The Language Proficiency Assessment Tool (LPAT) is a standardised instrument designed to measure learners' overall language competence across skills such as listening, speaking, reading, and writing. It provides diagnostic information about proficiency levels, often aligned with frameworks like the CEFR, and is used to track progress, compare cohorts, or validate instructional outcomes. In telecollaboration contexts, LPAT results can help identify how online exchanges contribute to measurable gains in language learning.

The Multimodal Online Device (MOD Tool) was designed to respond to this need. Grounded in interactionist SLA theory and informed by frameworks of communicative competence (Canale & Swain, 1980; Savignon, 2004), the MOD Tool captures not only linguistic output but also symbolic and intercultural dimensions of exchange. By combining quantitative scoring with qualitative indicators such as negotiation of meaning, scaffolding, and affective factors, it provides a more holistic picture of learner performance in telecollaborative contexts.

Negotiation of Meaning (NoM), introduced by Varonis and Gass (1985), remains a cornerstone of SLA pedagogy. It refers to the interactive process of clarifying and reformulating meaning, which fosters communicative resilience and interlanguage development. Empirical studies confirm its relevance in online task-based learning (Guo & Möllering, 2016), although many rely on quantitative metrics that overlook deeper cognitive-social processes.

This theoretical landscape underscores the necessity of innovative tools that can evaluate oral performance beyond traditional linguistic measures, incorporating dimensions of communicative function, strategic intent, and intercultural reflection.

4.3. Methodology

4.3.1. Context and participants

The study took place during the Autumn semester of the 2022–2023 academic year as part of the Business English III module at the Faculty of Economics, Universitat Politècnica de València. The participant group included 69 Erasmus students from 13 countries, namely Spain, Italy, France, Germany, the Netherlands, Georgia, Romania, Serbia, Poland, Belgium, Vietnam, the UK, and Norway. All students had an intermediate to advanced level of English (B2–C1 CEFR), as confirmed by institutional placement tests.

4.3.2. Task design

The study investigates how students engage in reflective practice during synchronous online interviews, prompted by MOD Tool (Multimodal Online Device) indicators designed to activate metacognitive and communicative awareness. Set within a Business English module at the University of Valencia, Erasmus students participated in a three-stage project: structured interviews, creative video presentations, and a collaborative business pitch. These tasks were scaffolded in complexity and linguistic control following established CLIL and task-based learning models (Ahmed & Bidin, 2022; Coyle et al., 2010)

While the MOD Tool encompasses seven categories for evaluating oral discourse, the interview stage elicited more prominent engagement with indicators tied to motivation, agency, and critical positioning. These constructs are understood as essential to metacommunicative competence (Canals, 2021; Kramsch & Uryu, 2020c), and students demonstrated varying degrees of reflective depth in response to targeted prompts and interactional modifications. Other MOD dimensions were recorded but did not present a central analytical focus during this initial phase.

The MOD Tool consists of seven language categories. These categories view the VE language interactions from three perceptual positions: the students' (St), the teachers' (T), and the communicative process (C). The categories are:

0) Practicality
1) Complexity of utterances

2) Language functions
3) Learner fit
4) NoM (Negotiation of Meaning)
5) Language skills
6) Cognitive skills
7) Competences.

Each category contributes a maximum of 50 points to the overall score of 350. Within each category, several items are scored based on both the frequency and the quality of their implementation throughout the discourse, ensuring that the assessment reflects not only the presence of communicative strategies but also their effectiveness.

The MOD device has four main objectives:

1) Raise language and cognitive awareness.
2) Guide students into the dynamics of NoM.
3) Promote systematic reflections on the conditions that favour SLA.
4) Create one's version of an independent language user (Kohn, 2018).

These objectives align with developing communicative and metacommunicative competences (van der Veen et al., 2017).

The study group was formed by 69 Erasmus students who belonged to the following countries:

Table 4.1. Demographic Distribution of Erasmus Participants by Country and Gender.

Country	Female	Male	Total
Spain	11	8	19
Italy	7	5	12
France	8	4	12
Germany	5	1	6
Holland	4	2	6
Georgia	1	1	2
Romania	1	0	1
Serbia	2	2	4
Poland	2	1	3
Belgium	1	1	2
Vietnam	1	1	2

The research design followed a TBLT (Task-Based Language Teaching) progression model, comprising three sequenced tasks:

- *Task 1: Interview with an entrepreneur*. A synchronous oral activity in which students conducted structured interviews with local entrepreneurs. Questions were selected from a teacher-curated bank and rehearsed in advance, allowing for controlled linguistic input and scaffolded interaction.
- *Task 2: Digital video narrative*. An asynchronous multimodal task requiring students to collaboratively script, record, and edit a promotional video for a hypothetical business product. This task emphasised creative language use, symbolic framing, and audience awareness.
- *Task 3: Business pitch (zoom debate)*. A synchronous oral defence of the video project, conducted via videoconference. Students presented their business ideas and responded to peer feedback, engaging in spontaneous negotiation of meaning and strategic reformulation.

The three activities are arranged from controlled language to free creation. For example, interviews are a highly controlled activity. The students prepare the questions beforehand and submit a draft to the teacher for proofreading.

The video presentation is also supervised, but it allows students to add personal insights and opinions. In the video, they must persuade the audience about their products;; consequently, students must display a wide array of language functions, making the output much freer than the first activity.

The online business pitch conference is the ultimate goal of this research. It attempts to emulate authentic use of language by expressing personal opinions that students would have to reframe and paraphrase depending on their peers' answers and insights. This stage is the final step of a scaffolded process that begins with a group interview and culminates in the individual exposition of students' opinions during the business pitch.

Using the MOD device to assess the three activities, the research aspires to evaluate the tool's validity in heterogeneous synchronous and asynchronous oral interactions and provide participants with feedback on their performance and improvement. The analysis will also allow for comparison of language performance across students from different countries, potentially offering critical insights into the effectiveness of their national educational frameworks. The conclusions of this analysis could help raise students' awareness of their communicative performance (O'Dowd & O'Rourke, 2019).

4.3.3. Task 1: Interview with an entrepreneur

The first activity was to interview someone who is an example of an entrepreneur, whether successful or not. This activity is the first step in a more extensive task whose final objective is the presentation of a digital video explaining a newly created business and its subsequent oral defence in a business pitch. Ana Sevilla Pavón, PhD, at the University of Valencia, created the task. The activities exemplify the content and language scaffolding model, as each step builds on the achievements of the previous one. The initial activities—personal profile presentation and interviews—have a more extensive language framework than the final ones, such as the digital video presentation and business pitch.

The language frameworks provided by teachers are scaffolded from LOTS (Lower Order Thinking Skills) to HOTS (Higher Order Thinking Skills) (Ahmed & Bidin, 2022). These terms, originally introduced by Benjamin Bloom and later refined by Lorraine Anderson, describe a hierarchy of cognitive processes. LOTS involve basic recall and comprehension, while HOTS encompass more complex skills such as analysis, application, evaluation, and creation. In second language acquisition (SLA), HOTS are often associated with deeper language acquisition, whereas LOTS align more closely with surface learning. Recognising this distinction helps educators design tasks that support progression from knowledge recall to higher-level communicative competence. Activities such as rehearsing questions, practising interviews, and editing videos provide a safe environment that lowers the affective filter and encourages learners to engage with both LOTS and HOTS (Rahman et al., 2019). Although the interview activity is partly controlled through the language framework, it also allows for student autonomy, as learners must select seven questions from a twenty-question store. This guided selection process supports language input and fosters autonomy in the task (Ibáñez & Polyakova, 2019).

The dynamic began with a pre-task activity involving a personal-profile presentation on Padlet. Students introduced themselves by sharing personal and professional backgrounds, hobbies, expectations, and five or six questions they wanted others to answer. Padlet instructions included:

- Padlet-Based Pre-Task: Building a Community of Practice
- Create a Padlet Username & Profile by completing the" About me" section:
- Basic Information b) Education, c) Communities, d) Links, e) Story, f) Work/ Hobbies, g) Places, h) Contact Information, i) Photo/avatar/image
- Join the Business English III Padlet: LAB 1 and LAB 2
- Post 5–6 ice-breaking questions
- Record and post a 30-second introductory video
- View partners' profiles and videos, and respond to their questions

This pre-task aimed to develop a community of practice through task-based design using questions that encourage interpersonal engagement and symbolic self-representation (Kerme, 2023a). Its deeper aim was to support the intercultural "us and them" process by triggering extimacy (Potolia & Derivry-Plard, 2022), fostering co-constructed written dialogues, and reinforcing the concept of "oneness–otherness" in a third multimodal space. The Padlet activity effectively increased intercultural awareness and helped form international groups. After two discussion sessions, students uploaded their interviews to Padlet for peer review.

The Padlet-based pre-task thus functioned as a scaffold for subsequent oral activities, providing students with a safe environment to experiment with identity construction and intercultural positioning. By engaging in profile creation, video introductions, and peer responses, learners not only rehearsed linguistic structures but also activated symbolic competences that prepared them for more complex communicative tasks.

This preliminary stage established a community of practice that facilitated trust and reciprocity, lowering the affective filter (Krashen, 1982) and enabling students to approach the interview activity with greater confidence. Moreover, the multimodal affordances of Padlet—combining text, image, and video—allowed participants to negotiate meaning through diverse semiotic resources, reinforcing the pedagogical rationale for integrating digital platforms into task-based learning.

The outcomes of this pre-task highlight the importance of designing activities that blend interpersonal engagement with intercultural reflection. By situating learners in a third multimodal space, the task promoted symbolic fluency and prepared the ground for the subsequent stages of the project, where negotiation of meaning and strategic language use would become central to performance.

4.3.3.1. Evaluating oral exchanges with the MOD tool

Building on the foundations outlined earlier, the study examines how oral exchanges in Virtual Exchange (VE) environments can be evaluated through both established and emergent tools. Widely recognised systems such as SpeechRater, the Virtual Oral Proficiency Interview (VOPI), and the Language Proficiency Assessment Tool (LPAT) provide structured approaches to assessing L2 speaking skills. While effective in measuring pronunciation, fluency, and grammatical accuracy, these instruments often rely on predefined formats and fail to capture the dynamic, interactional nature of VE contexts.

Such limitations underscore the need for complementary frameworks that attend to qualitative dimensions of oral performance, particularly those involving metacognitive awareness and social negotiation. Negotiation of Meaning (NoM), introduced by Varonis and Gass (1985), remains central to this endeavour, encapsulating strategies such as clarification, reformulation, and approximation. Its relevance to SLA is well documented, and studies in virtual settings (e.g., Guo & Möllering, 2017) demonstrate its potential to enhance learner engagement and skill integration.

Extending this line of inquiry, the present study applies the Multimodal Online Device (MOD Tool) to a cohort of 69 third-year students at the Faculty of Economics, Universitat de València. Within a task-based framework, participants engaged in three sequenced activities designed to vary in linguistic control and cognitive complexity. This structure enabled a nuanced analysis of how scaffolding influences oral output, particularly in terms of communicative resourcefulness and strategic adaptation.

Beyond performance metrics, the MOD Tool provides insight into learners' metacommunicative behaviour—how they navigate meaning-making in multimodal environments. By aligning analytic categories with real-time interactional data, the tool captures the interplay between cognitive engagement, learner fit, and communicative competence (Chapelle, 2001b; Kirschner, 2002a). In this way, VE is reaffirmed as a third multimodal space for expression and intercultural growth (Blackmore et al., 2022b; Kramsch & Uryu, 2020c), where participants engage in identity negotiation and epistemic repositioning. The MOD Tool thus not only evaluates performance but also illuminates the transformative potential of VE as a pedagogical space.

4.3.3.2. MOD tool results: Interview stage

The following table illustrates the results and feedback of two participants from different groups—one Italian and one Dutch. Due to space constraints, only these two examples are presented; the complete dataset is available in Annexe 1 (Table 4.2.).

In the interview stage, the MOD Tool evaluated oral performance across seven categories—complexity of utterances, language functions, learner fit, communicative resources/negotiation of meaning (NoM), language skills, cognitive skills, and competences. The scores and qualitative feedback highlight participants' engagement with the task and the activation of metacommunicative indicators.

Although the two selected interviews received similar overall scores, their outcomes reveal meaningful differences that shed light on the communicative processes captured by the MOD Tool. Several interactional modifications were observed, understood here as adjustments in communicative structure, participant roles, or exchange dynamics aimed at enhancing clarity and collaboration.

One interview, conducted with the Vice-President of the Erasmus Student Network (ESN) in Valencia, exemplifies this process. The interviewer, a 21-year-old Italian student, posed questions following a structured introduction that outlined ESN's goals and achievements. Careful preparation contributed to a supportive atmosphere that lowered the affective filter (Rahman et al., 2019) and fostered a safe communicative space. Under these conditions, the interview unfolded smoothly, with questions and answers flowing naturally and minimal need for reformulation. The interactional modifications observed thus reflected a high level of communicative competence.

Detailed scoring and feedback for this stage are provided in Annexes 2 (Table 4.3) and 4 (Table 4.5).

4.3.4. Task 2: Digital video narrative

Study 2 extends the findings from the initial interview phase by moving toward a cognitively demanding and interactionally complex communicative situation. In this stage, students engaged in asynchronous interviews with entrepreneurs, requiring them to manage nuanced oral exchanges and adapt to diverse intercultural dynamics. The aim was to observe how participants responded to communicative challenges, particularly those involving negotiation of meaning (NoM), as theorised by Varonis and Gass (1985) and further explored in virtual contexts by Guo and Möllering (2016).

This phase underscored the importance of metacommunicative strategies in addressing comprehension breakdowns. For instance, one Dutch participant employed paraphrasing, phatic functions, visual cues, and reduction techniques to overcome linguistic and conceptual barriers. Such strategies highlight the relevance of creating multimodal spaces in virtual exchanges, fostering not only communication but also affective and epistemic repositioning (Blackmore et al., 2022a; Kramsch & Uryu, 2020a).

The MOD Tool's analytic framework was instrumental in assessing performance across categories such as communicative resources, learner fit, and cognitive engagement. It enabled researchers to trace micro-interactional shifts—explicit statements of misunderstanding, scaffolded prompts, and adaptive strategies—that signal deeper metacognitive activity (Chapelle, 2001a; Kirschner, 2002b).

Beyond oral interaction, Study 2 introduced a multimodal production task in which participants collaboratively scripted, recorded, and edited a digital video to promote a business plan and product. This asynchronous format allowed for greater planning, narrative structuring, and audience awareness, while also integrating semiotic resources such as gesture, layout, and editing effects. The task demanded not only linguistic precision but also symbolic coherence and performative engagement.

Overall, Study 2 reinforces the diagnostic validity of the MOD Tool in capturing the interplay between intercultural awareness, reflexive positioning, and multimodal adaptation. It demonstrates that asynchronous formats, far from diminishing communicative richness, provide distinct opportunities for sustained reflection and strategic modulation of output.

4.3.4.1. MOD tool categories implemented in activity 2: Business plan digital video

Since the activity was asynchronous, participants were able to select from the communication skills store and, following a higher order thinking process of evaluation, culminated the cognition scale with the creation of a new product that was both personal (at the group level) and socially constructed (Kohn, 2020). Among the resources employed were visual prompts, music, effects, camera focus, rhetorical devices such as alliteration and repetition, and strategies including reduction, paraphrasing, and free creation. These multimodal elements align with the MOD Tool categories, as detailed in Annexe 5 (Table 4.6).

To ensure consistency with the thesis design, the analysis focused on the same two students examined in the first activity. This longitudinal approach provides more reliable data by tracing performance across varied tasks with the same participants. Six categories of the MOD Tool were selected, encompassing 16 features identified through script and video analysis.

Visual prompts were aligned with script excerpts to scaffold both input and output, facilitating multimodal expression and enhancing communicative impact. Annexes 6–7 and 8 (Tables 4.7–4.8 and 4.9) present detailed scoring and feedback.

Comparative results reveal nuanced differences in how each participant approached the digital video task. Both achieved "Very Good" overall ratings, though the Dutch participant slightly outperformed the Italian participant, particularly in Learner Fit and Competences. This suggests stronger alignment between task demands and the participant's linguistic and cognitive profile, as well as more strategic use of language structures.

Interestingly, both participants received a "Fair" rating in Communicative Resources and Negotiation of Meaning (NoM), reflecting the constraints of asynchronous formats, which limit opportunities for spontaneous clarification and repair. This highlights the trade-off between symbolic creativity and real-time interaction.

Overall, the results confirm the MOD Tool's capacity to capture subtle variations in multimodal output and differentiate stylistic, strategic, and structural dimensions of learner performance. They also reinforce the broader claim that asynchronous formats, when scaffolded effectively, foster high-level cognitive engagement and communicative sophistication.

4.3.5. Task 3: Business pitch (zoom debate)

Study 3 examines the final stage of the Business English task-based sequence: a synchronous online pitch conducted via Zoom, in which students presented and defended their business proposals. This activity required high levels of autonomy, improvisation, and strategic interaction, marking a shift from controlled output to spontaneous discourse. Following the principles of output-based instruction and performative task design (Swain, 2005; Kohn, 2018), the pitch foregrounded real-world communicative performance and reflexive positioning.

Unlike the previous stages, the pitch entailed dynamic turn-taking, rapid negotiation of concepts, and adaptation to diverse accents, perspectives, and rhetorical styles. Students synthesised prior input, presented arguments convincingly, responded to peer challenges, and engaged in cross-cultural communicative practices. The task thus served as a litmus test for the development of metacommunicative competence and intercultural pragmatics (O'Dowd & O'Rourke, 2019; O'Rourke, 2011; Kramsch & Uryu, 2020c).

The MOD Tool provided granular feedback on categories such as cognitive depth, interactional flexibility, and negotiation strategies, enabling instructors to assess not only fluency and accuracy but also agency, critical thinking, and discourse management. Speakers exhibited markers of higher-order thinking, epistemic stance-shifting, and non-verbal scaffolding to support comprehension. This phase confirmed that pedagogical telecollaboration can culminate in transformative performance when scaffolded effectively from LOTS to HOTS and embedded within a demanding yet supportive communicative ecology (Ahmed & Bidin, 2022; Blackmore et al., 2022c).

The "Business Pitch" was the final synchronous activity in the Task-Based Project (TBP), designed to assess students' ability to present, defend, and reflect on their digital video productions. A total of 69 Erasmus students participated across two 180-minute sessions; this study focuses on the session involving 24 participants. As in previous tasks, *Italian_female_21* and *Dutch_male_21* were selected for longitudinal analysis.

To ensure equitable participation, the teacher provided detailed instructions five days before the exchange. The session followed a three-round structure: two rounds of prepared three-minute speeches on assigned topics, followed by a final twenty-minute segment for spontaneous contributions. Students were informed of the assessment criteria in advance. Detailed scoring and feedback are provided in Annexes 8 and 10 (Tables 4.9–4.11).

4.3.6. Assessment instrument: The MOD tool

The MOD Tool evaluates oral performance across seven categories:

- complexity of utterances
- language functions
- learner fit
- communicative resources/negotiation of meaning (NoM)
- language skills
- cognitive skills
- competences

Each category combines qualitative descriptors with a numerical score (out of 50), enabling both diagnostic feedback and comparative analysis. The instrument integrates teacher, student, and process perspectives, aligning with Vygotsky's Zone of Proximal Development (ZPD) and principles of formative assessment (Vygotsky, 1978).

4.3.7. Data collection and analysis

Data were collected through recorded interviews, asynchronous video submissions, and synchronous pitch sessions. Transcripts were analysed using the MOD Tool rubric described before, with triangulation by two independent raters to ensure reliability. Scores were aggregated and compared across tasks to trace communicative development. Descriptive statistics and qualitative feedback were employed to interpret learner performance and identify recurring patterns in negotiation of meaning and metacommunicative strategies.

4.4. Results

The analysis of learner performance across the three task stages—interviews, digital video production, and synchronous pitch—revealed both commonalities and distinctive features in oral and multimodal output. Scores were examined using the seven categories of the MOD Tool, with triangulation by two independent raters ensuring reliability. Detailed scoring and feedback are available in Annexes 8–10.

4.4.1. Results of task 1: Interview

The MOD Tool analysis of the interview task revealed distinct communicative profiles between participants. *Italian_female_21* scored 258.39/350, while *Dutch_male_21* achieved 310.95/350. Both demonstrated strong performance in the Complexity of Utterances and Learner Fit, but diverged in Language Functions and Language Skills.

Italian_female_21 showed effective use of paraphrasing and scaffolding but relied on surface-level functions and limited rephrasing.

Dutch_male_21 exhibited deeper communicative engagement, frequent evaluation, and high command of self-generated language.

Interactional modifications were minimal in the Italian interview, suggesting a well-prepared framework with low cognitive demand. In contrast, the interview with the Dutch participant involved explicit negotiation of meaning, including clarification requests and adaptive scaffolding, indicating higher metacognitive activation. These findings confirm the relevance of negotiation of meaning strategies in sustaining communicative flow (Varonis & Gass, 1985; Guo & Möllering, 2016).

4.4.2. Results of task 2: Digital video narrative

In the asynchronous video task, both participants improved in Language Functions and Cognitive Skills. *Italian_female_21* scored 272.2/350, while *Dutch_male_21* scored 283.95/350.

Italian_female_21 demonstrated strong structural accuracy and multimodal awareness, integrating poetic phrasing and visual prompts.

Dutch_male_21 excelled in symbolic coherence and audience targeting, with frequent use of triggers, paraphrasing, and free creation.

Despite the asynchronous format, both participants activated metacommunicative strategies through script design and visual framing. The MOD Tool captured these shifts, particularly in the use of multimodal functions and higher-order thinking skills (Swain, 2005).

The results also show a notable increase in Language Functions—5.76% for the Italian participant and 1% for the Dutch participant. Asynchronous activities allowed students to explore a wider range of functions that typically emerge in synchronous oral exchanges, including appellative, poetic, metalinguistic, and multimodal strategies. These resources helped structure messages and facilitated free creation, though NoM scores dropped significantly due to the absence of real-time interaction.

Competence scores increased by 6% for the Italian participant and 7% for the Dutch participant, attributed to efforts in social interaction and language awareness. These elements are more accessible in scaffolded asynchronous environments. Overall, the MOD Tool results suggest that asynchronous mediated communication fosters free creation strategies and supports language acquisition by offering a safe, reflective space for learners. It also stimulates artistic expression and activates multiple intelligences, contributing to both interpersonal and independent learner profile development (Kohn, 2020).

4.4.3. Results of task 3: Business pitch

The synchronous pitch yielded the highest overall scores: *Italian_female_21* achieved 301.55/350, while *Dutch_male_21* scored 291.25/350. Both participants excelled in Learner Fit, Language Skills, and Competences, confirming the effectiveness of scaffolding in preparing learners for cognitively demanding tasks.

Italian_female_21 demonstrated strong group-building, spontaneous reformulation, and strategic use of phatic and evaluative functions.

Dutch_male_21 maintained high linguistic precision but showed less interactional flexibility during peer exchanges.

Negotiation of meaning was more evident in this task, with participants adapting to real-time feedback and reframing contributions. The MOD Tool identified increased use of metacognitive markers and symbolic positioning, reinforcing the progression from controlled to autonomous language use.

Scores reflected significant improvement compared to previous tasks: the Italian participant's score was 12.8% higher than in Activity 3, and 9% higher than in Activity 2. The Dutch participant's score was his second-highest, 3% below Activity 1 but 4% above Activity 2. These results highlight the pitch's strong learner fit and the impact of scaffolding, which enabled participants to prepare thoroughly and deliver structured, extended utterances.

Expressive functions were frequent, while poetic and phatic functions were rare. Metacognition emerged as the most prominent skill, driving high scores in cognitive categories. Quasi-formative competencies—such as samples, comparisons, repetitions, Target Language Equivalent (TLE), and cultural references—were common, likely due to extended speaking time. Social Integration scores were also high, as participants aimed to engage the audience with warmth and clarity.

Despite these strengths, the activity's structured nature led to minimal communicative conflict. Consequently, the Negotiation of Meaning category received the lowest score of all three activities. Nevertheless, the Business Pitch demonstrated the MOD Tool's ability to capture high-level communicative and cognitive performance in synchronous settings, confirming the pedagogical value of output-based instruction and performative task design (Swain, 2005; Kohn, 2018).

4.4.4. Comparative analysis of the three activities

The comparative analysis highlights the MOD Tool's diagnostic capacity to capture both quantitative scores and qualitative strategies across tasks.

Task 1 (Interview): High scores did not always correspond to communicative success. Interactional modifications were present but did not overcome breakdowns, reflecting the tool's formative nature. Bidirectional efforts to scaffold interaction are aligned with Vygotsky's ZPD (Vygotsky, 1978), narrowing the gap between language, cognition, and learner fit (Jamieson & Chapelle, 2010).

Task 2 (Video): Asynchronous formats fostered wider use of language functions (poetic, metalinguistic, multimodal) and competence gains, but reduced opportunities for negotiation of meaning. These findings support constructivist approaches to language learning (Kohn, 2020).

Task 3 (Pitch): Synchronous exchanges elicited higher metacognitive engagement and complex language structures, though negotiation of meaning remained limited due to strong scaffolding. Nevertheless, the pitch confirmed the MOD Tool's ability to capture high-level communicative and cognitive performance in real-time contexts.

Overall, the results demonstrate that asynchronous tasks foster planning, symbolic creativity, and audience awareness, while synchronous tasks stimulate improvisation, negotiation, and intercultural sensitivity. Together, the findings confirm that scaffolded task sequences can move learners from lower-order to higher-order thinking skills, culminating in transformative communicative performance when embedded in supportive yet demanding telecollaborative ecologies (Ahmed & Bidin, 2022; Blackmore et al., 2022c; Kramsch & Uryu, 2020c).

4.4.4.1. Script samples by category: Business pitch

The following table presents selected excerpts from the Business Pitch activity, organised according to the analytic categories of the MOD Tool. These samples illustrate how each participant—Italian_female_21 and Dutch_male_21—mobilised specific communicative, cognitive, and strategic functions during the synchronous exchange. Detailed scoring and feedback for this stage are provided in Annexe 10, Table 4.11.

4.5. Discussion

The present analysis has examined the implementation of the MOD Tool across a sequence of scaffolded communicative tasks within a telecollaborative Business English project. Each study revealed distinct affordances for capturing language performance, interactional flexibility, and metacognitive engagement through multimodal analysis.

The findings confirm that the MOD Tool is an effective instrument for identifying specific characteristics of Virtual Exchange (VE) interactions. By analysing the same two participants under varying conditions, the tool generated differentiated results that highlight the impact of contextual variables. These variations can be attributed to three key factors: the synchronous versus asynchronous format of the tasks, the degree of scaffolding provided, and the quality of the content, particularly within a CLIL framework.

In this way, the MOD Tool not only offers diagnostic insights into learner performance but also underscores the importance of task design and pedagogical context in shaping communicative outcomes.

As shown in Figure 4.2., the MOD Tool yields slightly different scores for the two participants. While *Dutch_male_21* participant achieved higher results in the previous asynchronous activity, the *Italian_female_21* participant's performance in language functions and competences highlights the value of assessment tools that capture diverse aspects of language use in the synchronous activity. The tool makes it possible to identify participants' strengths and weaknesses across different linguistic domains and to provide opportunities for targeted skill development through the sensitive feedback that the MOD Tool offers.

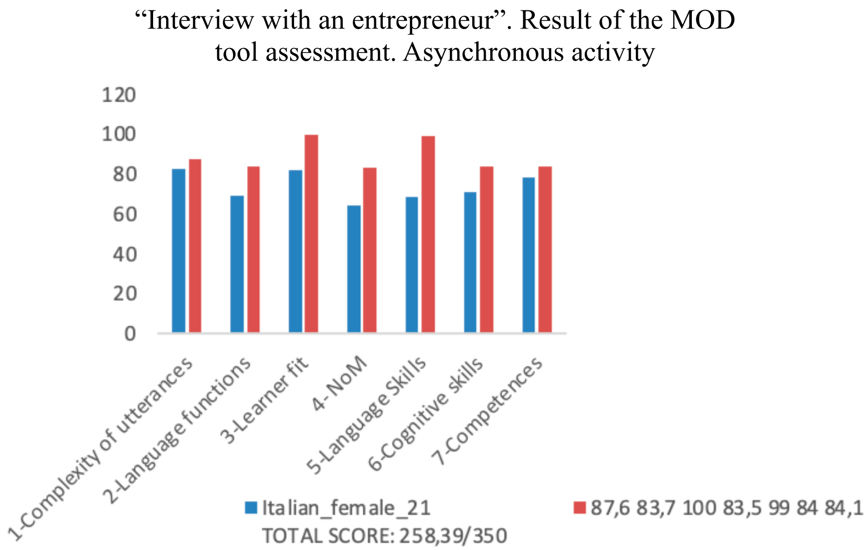

Figure 4.1. Interview with an entrepreneur. Result of the MOD tool's first two interview assessments without feedback.

Source: own elaboration.

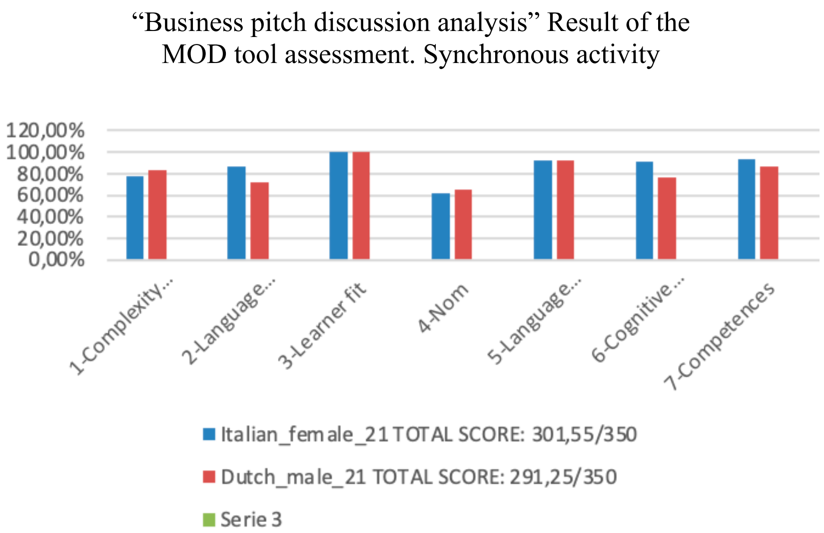

Figure 4.2. Business Pitch Discussion Analysis – Result of the MOD Tool's Assessment. Synchronous Activity.

Source: own elaboration.

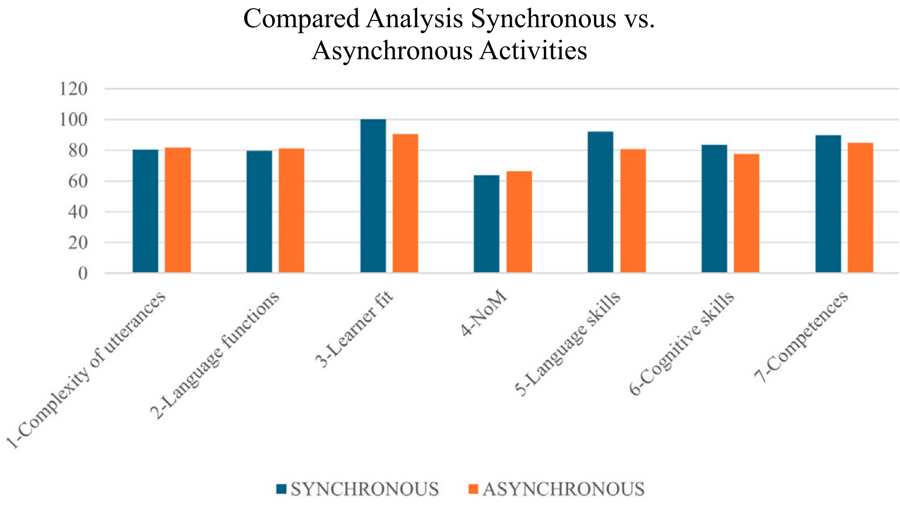

Figure 4.3. Business Pitch Discussion Analysis – Result of the MOD Tool's Assessment. Synchronous Activity.
Source: own elaboration.

The MOD Tool gathered relevant data, allowing us to identify which categories were most frequently implemented in both synchronous and asynchronous Virtual Exchange (VE) interactions.

Figure 4.3. illustrates which MOD features are most prominent in asynchronous and synchronous exchanges. A notable finding is the coherent trend identified across both participants, with parallel tendencies observed in all categories. In particular, both the *Italian_ female_21* and the *Dutch_male_21* achieved high scores in the synchronous Learner Fit category, reflecting their extensive use of linguistic and paralinguistic resources in real-time communication. The scaffolded design of the task facilitated a progression from controlled language in the asynchronous phase to creative, spontaneous production in the synchronous phase. High scores in competencies and language skills further confirm the participants' communicative success in the final synchronous activity.

4.6. Conclusions

The analysis demonstrates that learner fit—particularly the role of scaffolding—positively influences cognitive skills as well as structural and quasi-communicative competences (Figures 4.1 - 4.3). The MOD Tool also provided accurate insights into Negotiation of Meaning (NoM), showing that NoM occurs more frequently under dialogical texts, task-based problems, and collaborative quests. As observed in Figure 4.3, the oral presentation format was primarily unidirectional, which explains the absence of communication breakdowns.

Competence outcomes were especially conclusive in the Business Pitch activity, where scores in competencies and metacognition were significantly higher (Figure 4.3). This increase can be linked to the clear instructions provided by teachers, which enabled participants to construct a supporting framework for their speeches. This scaffolding acted as a trigger that was gradually removed through paraphrasing and teacher prompts, thereby activating free creation.

The results also indicate that asynchronous Virtual Exchange (VE) favours the implementation of varied language functions (Figures 4.1 - 4.2). This is largely due to the suitability of pre-planned activities as scaffolding resources, which serve as essential steps in language acquisition. Conversely, synchronous VE emerged as a meaning-making third multimodal space, contributing to the development of metacommunicative competence. As Figure 4.3 shows, synchronous VE fostered Social Interaction Competences (SI), enabling intercultural positioning through processes such as “extimacy” (Potolia & Derivry-Plard, 2022).

The study further suggests that, for synchronous VE exchanges, a reduced version of the MOD Tool—focusing on categories 3 to 7 (Learner Fit, Communicative Resources/NoM, Language Skills, Cognitive Skills, and Competences)—would be more versatile and easier to apply, since categories 1 and 2 (Complexity of Utterances and Language Functions) proved less relevant in synchronous contexts.

- Study 1 confirmed that synchronous interviews, when heavily scaffolded, support emotional safety and surface-level fluency. However, the limited need for spontaneous negotiation of meaning highlighted the risk of over-structuring tasks, potentially curbing deeper communicative engagement (van Lier, 2004; Rahman et al., 2019).

- Study 2 revealed the complexities of asynchronous interaction, where comprehension breakdowns were addressed through rich negotiation strategies such as paraphrasing, visual scaffolding, and phatic cues. These strategies activated participants’ Zone of Proximal Development (ZPD), illustrating the interplay between cognitive challenge and communicative adaptation (Vygotsky, 1978; Canals, 2021).

- Study 3 culminated in learner agency and strategic discourse management. Participants synthesised prior learning and responded to unscripted challenges during the business pitch. This spontaneous multimodal performance provided evidence of higher-order thinking, intercultural sensitivity, and metacommunicative competence (Kramsch & Uryu, 2020c; O’Dowd & O’Rourke, 2019). The MOD Tool proved particularly valuable in tracking moment-to-moment shifts in epistemic stance, rhetorical positioning, and pragmatic negotiation.

Taken together, these studies validate the MOD Tool as a robust analytic device capable of capturing nuanced communicative phenomena across modalities. Its integration into CLIL and VE contexts reinforces the importance of scaffolded progression, third multimodal space construction, and multimodal literacy in L2 learning environments (C; Blackmore et al., 2022b).

In conclusion, the MOD Tool facilitates a layered understanding of learner output—not only in terms of linguistic competence but also by revealing the cognitive, affective, and intercultural dimensions of telecollaborative language use. Its implementation offers educators a flexible framework for formative assessment and pedagogical intervention, ultimately fostering deeper learner reflection and adaptive communicative competence.

The insights drawn from the three studies suggest multiple avenues for future exploration. Research could further examine how the MOD Tool fosters learner agency across disciplines and age groups, particularly in contexts where multimodal output intersects with intercultural narratives. Longitudinal studies might investigate how learners evolve reflexively across semesters or in co-designed telecollaborative scenarios.

From a curriculum design perspective, the MOD Tool invites educators to embed metacommunicative scaffolding within mainstream syllabi—aligning reflective output with content goals and digital literacy benchmarks. Its diagnostic precision also holds promise for formative assessment frameworks that emphasise growth and interactional competence over static language metrics.

Finally, expanding teacher training programs to include MOD-facilitated reflective praxis may support sustainable pedagogical innovation in digitally mediated learning environments.

4.7. Limitations

Despite the chapter's methodological and theoretical background, several limitations suggest consideration. First, the sample size—while diverse in nationality—remains relatively small (n=69), which may constrain the validity of the findings across broader VE contexts. Although triangulation was employed, the reliance on only two participants for longitudinal analysis may introduce potential bias. This is because their performance may not reflect the full spectrum of learner variability, leading to a skewed interpretation of the results.

Furthermore, while the MOD Tool captures nuanced communicative and metacommunicative phenomena, its application remains partially interpretive, particularly in asynchronous tasks where real-time negotiation of meaning is absent. This fact may raise questions about the tool's capacity to assess spontaneous interactional strategies, a core component of SLA. The asynchronous format, rich in symbolic output as it is, inherently restricts opportunities for clarification, repair, and adaptive scaffolding—key indicators of communicative resilience. However, the chapter's emphasis on multimodal creativity, which is not only a limitation but also a pedagogically valuable aspect, may inadvertently privilege learners with stronger digital literacies, potentially resulting in unclear competence scores. In addition, the interpretation of multimodal cues may be subject to cultural bias, as gestures, intonation, and symbolic strategies can carry different meanings across cultural contexts, which may affect the consistency of competence scoring. Another limitation lies in the absence of a control group or comparative baseline, which would strengthen claims about the MOD Tool's diagnostic validity. Finally, while the study foregrounds intercultural awareness and symbolic competence, it does not systematically account for affective variables such as anxiety, motivation, or prior VE experience, which may influence learner performance.

It is worth noting, however, that one of the tool's current limitations, its manual and interpretive nature, is being addressed in the author's forthcoming thesis. In this thesis, the MOD Tool is reconfigured as part of an AI-human blended assessment process. This next phase introduces automation and algorithmic scoring, enhancing reliability and scalability while preserving the pedagogical richness of multimodal analysis. The thesis, to be published shortly, marks a significant step toward operationalising the MOD Tool for broader application in multilingual VE environments, offering a promising future for the tool.

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Annexe 1 - Table 4.2

Practicality: 9/10

Participants:

- Italian_female_21 — Total Score: 287.39/350
- Dutch_male_21 — Total Score: 305.8/350

Table 4.2. MOD's Device Analysis of the First Task: Asynchronous Mediated Activity "Interview." Two Students' Scoring and Feedback Samples.

Category	Italian_female_21	Dutch_male_21
1. Complexity of Utterances	Score: 41.44 – VERY GOOD. Communication succeeds most of the time at deep levels. Paraphrasing and synonyms are common. Goes beyond the task with personal insights. Uses agreement/disagreement, summarising, and recapping. Should attempt more creative language use and hypothesis structures.	Score: 43.8 – VERY GOOD. Deep communication, paraphrasing, and personal insights. Encouraged to use hypothesis structures and creative language.
2. Language Functions	Score: 34.7 – FAIR. Communication succeeds at surface levels. Uses phatic, exhortative, referential, and appellative functions. Emotions expressed, suggestions sporadic. Needs work on synonyms/antonyms for paraphrasing.	Score: 41.85 – VERY GOOD Deep-level communication. Frequent evaluation and suggestions. Paraphrasing and personal insights evident.
3. Learner Fit	Score: 41 – VERY GOOD. Intentional use of scaffolding: key vocabulary, visuals, graphs, repetition, checking understanding. Code switching supports output.	Score: 50 – EXCELLENT. Full use of scaffolding resources. Wide and varied strategies. Includes free creation, follow-ups, and student- generated material.
4. Communicative Resources / NoM	Score: 32.25 – VERY GOOD. Use of diverse triggers and interactional modifications. Effective and lively interactions. Includes corrections and suggestions. Negotiation of meaning is successful.	Score: 41.75 – VERY GOOD. Rich use of triggers and modifications. Successful negotiation of meaning.
5. Language Skills	Score: 34.25 – FAIR. Use of expansion, reduction, and acknowledgements. Repetitions occur less frequently. Some rephrasing and free creation.	Score: 49.5 – EXCELLENT. High command of rephrasing and paraphrasing. Language is mostly self-generated. Models for others. Evidence of skill transference.
6. Cognitive Skills	Score: 35.5 – VERY GOOD. Integration of LOTS and HOTS. Applies, analyses, and evaluates new solutions.	Score: 42 – VERY GOOD. Applies, analyses, and evaluates new solutions within task- based activities.
7. Competences	Score: 39.25 – VERY GOOD. Task execution was mostly successful. Uses repetition, visuals, and cultural references. Builds group atmosphere.	Score: 42.05 – VERY GOOD Strong group-building and cultural referencing.

Source: Paper authors. (*AMA = Asynchronous Mediated Activity).

See Annexe 2, Table 4.3 For Detailed Scoring And Feedback.

Annexe 2 - Table 4.3

Table 4.3. Transcript of the Interview Between an Italian Female and ESN Vice-President.

Turn	Participant	Intervention
1	Italian female	*"What do you think is the ESN advantage compared to other students' organizations because there are a lot of them here in Valencia?"*
2	ESN Vice- president	*"I think is what I said before because we are students helping students and they feel close to us and we are friends and that is what gives us an advantage, they feel more comfortable with us and also the relationship with the University."*
3	Narrator	*The interviewee's response does not seem to be influenced by the interactional modification. The interviewer continues with her original plan.*
4	Italian female	*"What do you expect from the future? Do you think there will be more members, more volunteers, more people will be interested?"*
5	ESN Vice- President	*"It depends cos' some people come here, we obviously grow and leave university, have other responsibilities. I think we are growing not only in this university but also in other universities and we are getting involved with more people."*
6	Italian female	*"Finally, if you could change some aspect of ESN what would it be?"*
7	ESN Vice- President	(Pauses to reflect.) *"Hmmmm. You know that this is volunteer, but I would like the university to recognise us with credits. You are also studying and you put a lot of time on this."*
8	Italian female	*"Thank you for your time."*
9	Narrator	Broad smiles, friendly manners, bonding, intimacy, "us and them," oneness vs. otherness.
10	Narrator	As shown in the excerpt above, three interactional modifications were carried out. Each opened and closed an information gap. Since the task was cognitively undemanding and the participants had prepared a language framework, no communication breakdown occurred. Therefore, questions and answers flowed quickly, with no need for negotiation of meaning.

See Annexe 3, Table 4.4 For Detailed Scoring And Feedback.

Annexe 3 - Table 4.4

Table 4.4. Transcript of the Interview Between a Dutch Male and a Spanish Entrepreneu**r.**

Turn	Participant	Intervention
1	Dutch male	*"Are you aware of the sustainable development goals? Do you know what they are? Are you implementing any of them in your business?" (Appellative Function/APF. Trigger as questions/TQ)*
2	Narrator	*The interaction begins with a direct trigger question that the interviewee struggles to understand. (3 seconds of silence. Hesitation)*
3	Spanish Entrepreneur	*"I don't understand really good this question. Can you be more specific with that?"* (Explicit Statement of non-understanding/EXPN. Expressing wishes and opinions/EWO. Phatic intentions/ Phi. Metacognition/MCG. Social Interaction/SI)
4	Narrator	The interviewee's explicit statement reflects metacognitive awareness and initiates social bonding.
5	Dutch male	*"The sustainable development goals. Do you know them?" (Paraphrasing/PPH. Repetition/RP. Phatic intentions/Phi)*
6	Spanish Entrepreneur	*"Yeah." (Trigger as answer. Acknowledgement)*
7	Narrator	*The interviewer paraphrases and simplifies the question. The interviewee attempts to maintain interaction, though comprehension remains partial.*
8	Dutch male	*"Do you use them in your business?"* (Rising intonation. Reduction/RD. CULDIS)
9	Narrator	The interviewer scaffolds the input using body language and simplified phrasing, prompting a more elaborate response.
Turn	Participant	*Intervention*
10	Spanish Entrepreneur	*"Yeah. We try to put everything in our business. How do we do that? We put the hardware, software, 'domotic,' everything that can control our store. We develop that with our engineering. We put that to be our store itself. Automatically. Only by phone. By phone you can do whatever you want. . . in your laundry service store you can do whatever. . . you can turn the machines on, turn the lights off, you can open the doors, you have cameras. . . the technology we are using right now is the high technology you can find in 'domotic.' " (Repetition/RP. Echoing/ EC. Phatic function/Phi. Overextended response, lacks precision)*
11	Narrator	*The interviewee still does not fully grasp the question, but the interviewer's modification activates NoM techniques and moves the exchange into the Zone of Proximal Development (ZPD).*
12	Dutch male	*"So focusing on sustainability is very important for your business, making it more green. . . thinking about carbon neutral is very important to you?"* (Paraphrasing/PPH. Reduction/RD. Target Language Equivalent/TLE. CULDIS)

Table 4.4, continued on next page.

Table 4.4, continued from previous page.

13	Spanish Entrepreneur	*"Yeah, Business is very important to me. . . We are worried about that; we are worried about that. Our machines they are ecologic, using a little bit energy, a little bit electricity, a little bit water, just only the necessary. What is more, also with the chemicals we use ecologic products for the detergents that we use in our stores. We are trying to be in the best way trying to participate with our work in a green world for the future."* (Acknowledgement/ACK. Explicit agreement. Repetition/RP. Target language equivalent. TLE)
14	Dutch male	"Ok. Thank you." (*Active listening posture. Interactional Modification Closed)*
15	Narrator	Despite structural similarities, the two interviews yield different outcomes in terms of negotiation of meaning, as assessed by the MOD Tool.

See Annexe 4, Table 4.5 For Detailed Scoring And Feedback.

Annexe 4 - Table 4.5

Table 4.5. Comparative Analysis of the MOD Tool's First Two Interview Assessments (Activity 1).

Assessment Category	Italian_female_21	Dutch_male_21
Total Score	258.39 / 350	310.95 / 350
Complexity of Utterances	Score: 41.44 – VERY GOOD	Score: 43.8 – VERY GOOD
Language Functions	Score: 34.7 – FAIR	Score: 41.85 – VERY GOOD
Learner Fit	Score: 41 – VERY GOOD	Score: 50 – EXCELLENT
Communicative Resources / Negotiation of Meaning (NoM)	Score: 32.25 – VERY GOOD	Score: 41.75 – VERY GOOD
Language Skills	Score: 34.25 – FAIR	Score: 49.5 – EXCELLENT
Cognitive Skills	Score: 35.5 – VERY GOOD	Score: 42 – VERY GOOD
Competences	Score: 39.25 – VERY GOOD	Score: 42.05 – VERY GOOD

Source: Paper authors. (*AMA = Asynchronous Mediated Activity).

See Annexe 5, Table 4.6 For Detailed Scoring And Feedback.

Annexe 5 - Table 4.6

Table 4.6. Comparative Analysis of the MOD Tool's First Two Interview Assessments (Activity 1).

Assessment Category	Italian_female_21	Dutch_male_21
Total Score	258.39 / 350	310.95 / 350
Complexity of Utterances	Score: 41.44 – VERY GOOD	Score: 43.8 – VERY GOOD
Language Functions	Score: 34.7 – FAIR	Score: 41.85 – VERY GOOD
Learner Fit	Score: 41 – VERY GOOD	Score: 50 – EXCELLENT
Communicative Resources / Negotiation of Meaning (NoM)	Score: 32.25 – VERY GOOD	Score: 41.75 – VERY GOOD
Language Skills	Score: 34.25 – FAIR	Score: 49.5 – EXCELLENT
Cognitive Skills	Score: 35.5 – VERY GOOD	Score: 42 – VERY GOOD
Competences	Score: 39.25 – VERY GOOD	Score: 42.05 – VERY GOOD

Source: Paper authors. (*AMA = Asynchronous Mediated Activity).

See Annexe 6, Table 4.7 For Detailed Scoring And Feedback.

Annexe 6 - Table 4.7

Table 4.7. MOD Tool Categories Implemented in Activity 2: Business Plan Digital Video.

MOD Tool Category	**Criteria Assessed by Feature Code**
Complexity of Utterances	**Not stated**
Language Functions	1-AF: Appellative Function; 2-EWO: Expressing Opinions and Wishes; 3-PF: Poetic Function; 4- MCG: Metacognition; 5-MMF: Multimode Func- tion
Learner Fit	6-CULDIOS: Cognitively Demanding / Linguistically Undemanding; Input/Output Scaffolding
Negotiation of Meaning (NoM)	7-TQ: Triggers as Questions
Language Skills	8-RP: Repetition; 9-RD: Reduction; 10-PPH: Paraphrasing; 11-FC: Free Creation
MOD Tool Category	Criteria Assessed by Feature Code
Cognitive Skills	12-AP: Apply; 13-EV: Evaluate; 14-CR: Create
Competences	15-ST: Awareness and Accurate Use of Language Structures; 16-SI: Group Atmosphere Creation

See Annexe 7, Table 4. 8 For Detailed Scoring And Feedback.

Annexe 7 - Table 4.8

Table 4.8. MOD Tool Analysis of Digital Video: ITALIAN_FEMALE_21.

Script Segment	Visual/Audio Prompt	MOD Tool Features Identified
Parking Spot Finder is a new app designed for drivers for quickly finding a parking spot just by selecting your destination with a simple click. You just need to download the App, register, subscribe, choose your destination and your parking spot will be localized in the blink of an eye.	Background music, app logo animation	1-AF: Appellative function PF: Poetic function (aesthetic phrasing) MCG: Metacognition (language awareness) MMF: Multimodal function CULDIOS: Visual prompt, music 10-SI: Social interaction (group tone) 14-CR: Create (HOTS) 15-ST: Structural accuracy
How does it work? Parking Spot Finder uses an advanced system of satellites to draw a precise map of all the existing parking spots and to constantly monitor which ones are available.	Satellite imagery, ani- mated map	1-AF: Appellative function 3-PF: Poetic function (technical elegance) MCG: Metacognition MMF: Multimodal function CULDIOS: Visual prompt, music 8-RP: Repetition CR: Create (HOTS) ST: Structural accuracy SI: Social interaction
You will be able to know all the available parking spots near your destination, both paid and free, and how far they are from where you are at the moment of the research. Moreover, you can buy parking tickets directly from the app.	App interface demo, ticket purchase animation	1-AF: Appellative function MCG: Metacognition MMF: Multimodal function CULDIOS: Visual prompt, music 8-RP: Repetition CR: Create (HOTS) ST: Structural accuracy SI: Social interaction

Table 4.8, continued on next page.

Table 4.8, continued from previous page.

One of the many advantages of downloading Parking Spot Finder is that it is an optimal to save money and do something for the environment. *As a matter of fact, this app helps to reduce pollution by avoiding useless driving with your car around the city.*	Eco-friendly icons, green city visuals, and background music.	1-AF: Appellative function 2-EWO: Expressing wishes and opinions 3-PF: Poetic function (aesthetic phrasing) 4-MCG: Metacognition 5-MMF: Multimodal function 6-CULDIOS: Visual prompt, music 12-AP: Apply (HOTS) 14-CR: Create (HOTS) 15-ST: Structural accuracy 16-SI: Social interaction

See Annexe 8, Table 4.9 For Detailed Scoring And Feedback.

Annexe 8 - Table 4.9

Table 4.9. MOD Tool Analysis of Digital Video: DUTCH_MALE_21.

Script Segment	Visual/Audio Prompt	MOD Tool Features Identified
Hello and welcome to our new company, "Solar Banks". We're a new company in the sustainable market...	Logo animation, nature visuals, background music	1-AF: Appellative function 3-PF: Poetic function MMF: Multimodal function CULDIOS: Visual prompt TQ: Triggers as questions RP: Repetition EV: Evaluate (HOTS) CR: Create (HOTS) ST: Structural accuracy SI: Social interaction
Our model is "For the Planet, for the people".	Slogan display, eco- themed background	3-PF: Poetic function 5-MMF: Multimodal function 6-CULDIOS: Visual prompt

Table 4.9, continued on next page.

Table 4.9, continued from previous page.

If we put our mission, vision, and goals into one statement...	Mission statement overlay, green visuals	AF: Appellative function EWO: Expressing wishes/opinions PF: Poetic function 6-CULDIOS: Visual prompt RD: Reduction PPH: Paraphrasing FC: Free creation 14-CR: Create (HOTS) 15-ST: Structural accuracy
So what is our product exactly?...	Product demo, recyclable material icons	1-AF: Appellative function MMF: Multimodal function CULDIOS: Visual prompt TQ: Triggers as questions RP: Repetition 11-FC: Free creation EV: Evaluate (HOTS) CR: Create (HOTS) ST: Structural accuracy
The general function of our product is that it allows you to recharge your electronic devices while on the go.	Charging animation, mobile device visuals	1-AF: Appellative function 5-MMF: Multimodal function 6-CULDIOS: Visual prompt 13-EV: Evaluate (HOTS) 14-CR: Create (HOTS)
The main two functions of our product are...	Split-screen showing charging and solar recharging	1-AF: Appellative function 5-MMF: Multimodal function 6-CULDIOS: Visual prompt 13-EV: Evaluate (HOTS) 14-CR: Create (HOTS)
Our target market is students between 18 and 30 years...	Target audience visuals, usage statistics	1-AF: Appellative function 5-MMF: Multimodal function 6-CULDIOS: Visual prompt 11-FC: Free creation 13-EV: Evaluate (HOTS)

Table 4.9, continued on next page.

Table 4.9, continued from previous page.

They use their phones daily for 3 to 6 hours...	Infographic, solar energy icons	AF: Appellative function EWO: Expressing wishes/opinions MMF: Multimodal function CULDIOS: Visual prompt PPH: Paraphrasing FC: Free creation CR: Create (HOTS) ST: Structural accuracy SI: Social interaction

See Annexe 9, Table 4.10 For Detailed Scoring And Feedback.

Annexe 9 - Table 4.10

Table 4.10. Results of the Digital Video MOD Tool Assessment. Activity 2.

Assessment Category	Italian Female 21	Dutch male 21
Total Score	272.2/350	283.95/350
Complexity of Utterances	Score: 39.85 – VERY GOOD	Score: 38.15 – VERY GOOD
Language Functions	Score: 43.85 – VERY GOOD	Score: 41.45 – VERY GOOD
Learner Fit	Score: 40 – VERY GOOD	Score: 50 – EXCELLENT
Communicative Resources / Negotiation of Meaning (NoM)	Score: 31.5 – FAIR	Score: 27.25 – FAIR
Language Skills	Score: 37.25 – VERY GOOD	Score: 40.25 – VERY GOOD
Cognitive Skills	Score: 37.5 – VERY GOOD	Score: 41 – VERY GOOD
Competences	Score: 42.25 – VERY GOOD	Score: 45.85 – EXCELLENT

Source: Paper authors. (*AMA = Asynchronous Mediated Activity).

See Annexe 10, Table 4.11 For Detailed Scoring And Feedback.

Annexe 10 - Table 4.11

Table 4.11. Instructions for VE Synchronous Exchange: Business Pitch.

Groups whose presentations you particularly liked about these issues. Why?	How would you assess your group's videos related to these issues?	If you had to do this task again, what would you do differently?
Viability of the product	Viability of the product	Viability of the product
Quality of the script	Quality of the script	Quality of the script
Quality of the transitions	Quality of the transitions	Quality of the transitions
Business description	Business description	Business description
Promotion	Promotion	Promotion
Financials	Financials	Financials
Communication (in general)	Communication (in general)	Communication (in general)

See Annexe 11, Table 4.12 For Detailed Scoring And Feedback.

Annexe 11 - Table 4.12

Table 4.12. Results of the MOD Tool's Assessment. Activity 3 "Business Pitch."

Assessment Category	Italian female 21	Dutch male 21
Total Score	301.55/350	287.25/350
Complexity of Utterances	Score: 38.9 – VERY GOOD	Score: 41.4 – VERY GOOD
Language Functions	Score: 43.5 – VERY GOOD	Score: 35.95 – VERY GOOD
Learner Fit	Score: 50 – EXCELLENT	Score: 50 – EXCELLENT
Communicative Resources / Negotiation of Meaning (NoM)	Score: 31 – FAIR	Score: 32.75 – FAIR
Language Skills	Score: 46 – EXCELLENT	Score: 46 – EXCELLENT
Cognitive Skills	Score: 45.5 – EXCELLENT	Score: 38 – VERY GOOD
Competences	Score: 46.65 – EXCELLENT	Score: 43.15 – VERY GOOD

Source: Paper authors. (*SMA = Synchronous Mediated Activity).

See Annexe 12, Table 4.13 For Detailed Scoring And Feedback.

Annexe 12 - Table 4.13

Table 4.13. Script Samples per Categories. Activity 3: Business Pitch.

MOD Tool Category	Italian female_21	Dutch male21
Language Functions	“OK, I hope everyone can hear me.” (Ph) “If you don’t, please tell me be-because I don’t know.” (Ph) “And I think especially for the target market of this digital story... people of our age.” (EV, EWO)	“You guys took a deep dive into the subject.” (EV/EWO) “What I think we could have done better in the preparation of the script.” (MCG, SI)
Learner Fit	“And I think especially for the target market of this digital story... people of our age.” (EV)	“I think that’s kind of what we tried to implement in our script—short but detailed to keep the attention of everyone watching.” (CULDIOS, ANHOT)
Negotiation of Meaning (NoM)	“OK, can we start?” (TQ)	“So for our video, we focus as I think Sandra before pointed out.” (TA)
Language Skills	“I think that it was Group E and group G... I think correctly Group E because they were really focused.” (RP)	“So we try to be very keen on this aspect... we try to think in a way that could capture the attention of the customers.” (EX)
Cognitive Skills	“But maybe the one who stood out the most... I think that it was Group E and group G.” (EV)	“I think it can be seen that your market research has definitely been done.” (ANHOT) “You guys took a deep dive into the subject.” (EV/EWO)
Competences	“They explain how it works and everything... Group G also I think that, correct me if I’m wrong.” (QC/SI)	“I think we tried to show our product very well... show everything shortly but with details.” (QC) “For example, we should have shown our faces... maybe our preparation was lacking.” (QC, EXT)

See Annexe 13, Table 4.14 For Detailed Scoring And Feedback.

Annexe 13 – Table 4.14

Table 4.14. Script Samples per Categories. Activity 3: Business Pitch.

MOD Tool Category	Italian_female_21	Dutch_male_21
Language Functions	"OK, I hope everyone can hear me." (Ph) "If you don't, please tell me because I don't know." (Ph) "And I think especially for the target market of this digital story... people of our age." (EV, EWO)	"You guys took a deep dive into the subject." (EV/EWO) "What I think we could have done better in the preparation of the script." (MCG, SI)
Learner Fit	"And I think especially for the target market of this digital story... people of our age." (EV)	"I think that's kind of what we tried to implement in our script—short but detailed to keep the attention of everyone watching." (CULDIOS, ANHOT)
Negotiation of Meaning (NoM)	"OK, can we start?" (TQ)	"So for our video, we focus as I think Sandra before pointed out." (TA)
Language Skills	"I think that it was Group E and group G... I think correctly Group E because they were really focused." (RP)	"So we try to be very keen on this aspect... we try to think in a way that could capture the attention of the customers." (EX)
Cognitive Skills	"But maybe the one who stood out the most... I think that it was Group E and group G." (EV)	"I think it can be seen that your market research has definitely been done." (ANHOT) "You guys took a deep dive into the subject." (EV/EWO)
Competences	"They explain how it works and everything... Group G also I think that, correct me if I'm wrong." (QC/SI)	"I think we tried to show our product very well... show everything shortly but with details." (QC) "For example, we should have shown our faces... maybe our preparation was lacking." (QC, EXT)

SECCIÓN II

ANÁLISIS DEL DISCURSO, TERMINOLOGÍA Y TRADUCCIÓN

Capítulo 5
Resisting marriage and parenthood: A corpus-pragmatic analysis of negative comments on Weibo

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5.1. Introduction

China is facing a crisis of sharply declining marriage and birth rates currently. In 2024, official figures reported only 9.54 million newborns, with the birth rate 6.77‰ and 6.106 million marriages, decreased by 20.5%, compared to 2023 (National Bureau of Statistics of China [NBS], 2025; State Council Information Office [SCIO], 2025). These shift matter for demography, but they also show that people are rethinking the meaning of marriage and parenthood. Although the government has made various policies that attempted to counter this terrible trend, such as measures on fertility support in October 2024 (State Affairs of the PRC, 2024), which have kept the topic in the spotlight, it received a limited response.

Yet only statistics cannot demonstrate how these changes are caused and developed. For that, this paper turns to the public, a more frequently interactive platform, social media. With around 590 million monthly active users in late 2024 (Sina Weibo Corporation, 2024), Weibo combines news flow with conversation. Its comment areas make it possible and more transparent to see how evaluations are made, how readers align, and how disagreements are expressed (People's Tribune, 2020), which are the main subjects of this study. Yet this paper only uses these threads as a window onto the social meanings of current marriage and childbirth debates. Still, neither considers these results broadly representative nor passes any judgement on policy outcomes.

Recent policy-oriented research by Cao and colleagues (2025) describes this shift into an endogenous low fertility stage, with four factors across economic (housing, education, childcare costs), social (gender inequality, urbanization), family (smaller size, weaker intergenerational support), and institutional cultural (welfare design, value change) dimensions, which provides verifiable objectives and direction for this study

In this paper, resistance refers to those expressions that question, ignore, or reject the assumed duty and obligation of marriage and parenthood. This paper focuses on first-level comments to avoid deeper conversational interactions and capture a clearer user stance. Chinese netizens frequently apply coded, playful, and emotional language strategies to express opinions or criticize in this context. Additionally, they rhetorically utilize veiled, double-entendre, and metaphorical expressions to evade censorship. (Lei & Tang, 2025).

From a methodological perspective, this paper encounters two issues simultaneously. Firstly, it is almost impossible to precisely identify and recognize the subtle emotions in the large Chinese corpus, and it can easily overlook sarcasm, irony, or shifts in voice. While detailed qualitative studies can promise a high level of nuance, they cannot be applied to such a corpus. Yet, this issue has not been fully resolved; therefore, manual analysis is the only remaining option. The study adopts Latent Dirichlet Allocation (LDA) to identify recurrent topics, with reliability guaranteed by Cohen's κ. The appraisal theory and impoliteness framework are used to understand how evaluations are expressed and formed. These resources are manually identified and labeled in the subsequent step for qualitative analysis.

The corpus contains 2436 first-level comments posted between July and October 2024; 2388 comments were retained after the cleaning process, and 466 of these were manually analyzed. It is notable that 93% of comments are identified as negative, a proportion that is significantly higher than that observed in other topics. And a total of four themes were identified: economic pressure, gender conflict, marriage institutions & policy and singlehood trend. These themes are mainly consistent with the findings reported by Cao. Analytically, Appraisal resources of Judgement and Appreciation dominate, with Affect comparatively restrained, and invoked realizations outnumber inscribed ones; impoliteness is preferentially indirect, with sarcasm/mock politeness and credibility-undermining moves recurring across topics. Taken together, the study offers an empirically grounded account of how negative stances and attitude toward marriage and parenthood are pragmatically assembled in a constrained, algorithmically amplified context.

5.2. Concepts in use

Before introducing the theoretical framework, it is necessary to provide a contextual background of the Chinese social media platform Weibo, as the subsequent concepts are discussed within this environment. Weibo is a text-oriented social media platform similar to X (Twitter), and it serves as China's most popular platform for news and public discourse. Its algorithmic structures, such as trending lists, top-comment rankings, and the repost mechanism, enable rapid dissemination of topics within a brief time period (People's Tribune, 2020).

Moreover, the platform's content moderation system restricts the use of explicitly violent or vulgar language and prohibits discussion of certain sensitive topics (Lei & Tang, 2025). Consequently, users frequently employ indirect expression strategies such as implication, metaphorical framing, and other pragmatic indirectness to convey meanings that circumvent explicit articulation.

The following section introduces research that integrates Impoliteness and Appraisal Theory and proposes a framework for taxonomy of impoliteness in Chinese online discourse.

5.2.1. Complementarity of impoliteness and appraisal theory

This paper seeks to investigate negative comments on Chinese social media, especially on Weibo, through an integrated perspective that combines Impoliteness and Appraisal theory. According to del Saz-Rubio (2024), the two share the same object of study and are functionally complementary within the domain of social media. Both aim to explain for the phenomenon of social evaluation, with impoliteness research, based on *face* (Brown & Levinson, 1987) and sociality rights (Spencer-Oatey, 2008), analyzing offensive behaviors in interpersonal interaction; Appraisal Theory, for its part, provides a systematic semantic analytic framework for such evaluations through its Attitude system, explicitly the three subsystems of Affect, Judgement, and Appreciation (Martin & White, 2005). By combining the two, it becomes possible to establish a correspondence such as, *which appraisal resources are deployed to accomplish which kinds of interactional impoliteness*, thereby constructing a complete explanatory pathway that runs from social norms and emotions to pragmatic form. In the practical context of Chinese social media, appraisal resources are used not only to express stance but also to participate directly in rapport management (Spencer-Oatey, 2005), and they share functional similarity with the communicative goals of impoliteness.

From this perspective, the Judgement subsystem corresponds to the social-normative dimension in impoliteness research. Impolite behavior can essentially be seen as the linguistic realization of society's normative judgement about what counts as appropriate conduct; the Judgement subsystem, especially its two subtypes of social esteem and social sanction (Martin & White, 2005), specifies such normative issues as evaluations of capacity, normality, tenacity, veracity, and propriety. Among these, veracity and propriety are the most directly aligned with everyday accusations and defenses concerning whether one is honest and whether one should do so. Annotation studies of Chinese political online discussions (Li et al., 2024) show that, in negative comments, Judgement is the most dominant Attitude dimension, accounting for about 63% of overall Attitude; within it, social sanction, involving veracity and propriety, has a higher proportion than social esteem, involving capacity, normality, and tenacity, and, among these, propriety alone accounts for as high as 83.9% within social sanction. This distribution indicates that the core of negative evaluation online in Chinese is not a simple and singular comparison of *good or not*. in terms of ability but rather revolves around normative adjudications such as *whether one ought to*, *whether one is worthy*, and *whether one keeps to one's proper role*. This suggests that, in the Chinese context, criticism often proceeds under the banner of ethics or good behavior to effect normative denigration of individuals or groups. Therefore, analysis needs to pay particular attention to the ethical bases and social-hierarchical bases potentially intertwined behind propriety judgements, so as to more precisely capture Chinese-characteristic critical expressions such as *crossing the line* and *failing to meet the role or standard*, which will be a major concern of this paper.

Beyond direct evaluation, impoliteness also frequently proceeds by more indirect routes (Bousfield, 2008), a phenomenon interestingly reflected in the Appreciation subsystem. In online interaction, many attacks do not initially target persons directly but first denigrate associated intentions or events through negative reaction, and then, as the discourse unfolds, convert this negation of the matter into a Judgement that negates the person. Conversely, in affiliative interaction, surface expressions of Affect are often read as confirmations of deeper propriety, although this is not instantiated in the present paper. In addition, impoliteness concerns not only normative judgement but is also tightly coupled with the emotional dimension. Cross-cultural research (Culpeper et al., 2014) shows that when interaction impacts on face or sociality rights, it readily activates two kinds of systematic emotions: other-directed condemning emotions (e.g., anger, disgust) and self-conscious emotions (e.g., embarrassment, shame). The Affect subsystem provides a partial corresponding framework for analyzing these emotions, thereby helping to explain why public opinion enhances and group antagonism forms.

There is also a high degree of fit and explanatory power between explicit or implicit modes of expression and the environment of Weibo as a social media platform. Appraisal theory distinguishes inscribed and invoked, whereas impoliteness research distinguishes explicit and implicit attacks; the two are highly similar in their use on Weibo. Owing to platform regulations, face management, and traditions of irony, a large amount of attack and denigration in negative comments is not stated bluntly with coarse words but, rather, relies on irony, sarcasm, objectification, homophony, and the like to prompt readers to complete the meaning within a shared context. Li et al.'s (2024) study on Chinese online forums have already indicated a high proportion of invoked Attitude, which mutually corroborates common expressive preferences on Weibo. In addition, the widespread use on Chinese social media of emojis and online meme images is reshaping and strengthening the ways in which impoliteness and Appraisal resources are combined. These symbols possess multi-layered signifying functions: they can serve directly as explicit carriers of Affect, conveying emotional reactions such as joy, anger, sorrow, and happiness; at the same time, in particular contexts, they can be used as Judgement cues, thereby bearing implicit evaluations of others, for example, emojis such as the *sneer*, *doge*, or *questioning face* often mark ironic expression and effect an implicit negation of the interlocutor (Shi, 2025).

5.2.2. An impoliteness taxonomy building upon Culpeper's framework

Unlike Appraisal Theory, which already has a truly clear, well-defined, and authoritative analytical framework, research on impoliteness in the Chinese online context still lacks a widely accepted, most appropriate taxonomy standard. Therefore, based on the existing material, adopting Culpeper's impoliteness framework as the theoretical point of reference remains reasonable. Del Saz-Rubio (2024) represents a first attempt to revise and extend Culpeper's model for interaction on social media platforms such as X, while still building on the core architecture of his taxonomy. In line with this body of work, the present study draws on Culpeper's five impoliteness strategies (Culpeper, 2011): Bald on-record impoliteness, Positive impoliteness, Negative impoliteness, Sarcasm/Mock politeness, and Withhold politeness, as well as a set of conventionalized impoliteness formulae.

This paper, targeting impolite comments on Chinese social media, attempts to propose a classification scheme. In the context of the Weibo platform, it retains the two extreme types of *bald on-record* and *sarcasm/mock*. The former encompasses direct attacks lacking any mitigation, such as crude insults and imperative expulsions; the latter includes ironic expressions that are polite on the surface but convey denigration pragmatically. Meanwhile, as mentioned above, the culture of emojis and meme images greatly facilitates the construction of those expressions that appear positive on the surface yet have negative real intentions, so this type of impoliteness often presents a high proportion on the platform. As for positive impoliteness, it offends the target's needs to be recognized, liked, and accepted; combined with features of online language, it can be manifested in several ways, such as contempt, stigmatizing labelling, exclusion, and boundary-drawing. Correspondingly, negative impoliteness constitutes a face threat by imposing pressure, intrusion, or restricting the other party's autonomy; in online environments it can be manifested as coercion, threats, and status-downgrading. It should be noted that these four types are not absolute; there is considerable possibility of overlap, and a single comment may simultaneously exhibit one or more impoliteness strategy types. As for the handling of withhold politeness, since the scope is limited to comments on the Weibo platform, an asynchronous textual interaction on a public platform, this type of impoliteness does exist, but its observability and operability are much lower than those of other types. It is therefore removed from the taxonomy and recorded only as an annotation-layer item.

5.3. Methodology

This study employs a qualitatively driven mixed-methods approach to discovering the emotional logics and discursive strategies in public expressions around marriage and childbirth through linguistic analysis. The study begins by constructing the corpus of user comments related to marriage and reproduction, collected from Weibo. The data first undergoes initial quantitative analysis using natural language processing (NLP) techniques, including sentiment analysis, keyword extraction, and topic modeling. Based on these quantitative findings, the study then conducts a pragmatically oriented analysis within the mentioned theorical frameworks, examining Chinese netizens emotional stances, linguistic strategies, and ideological orientations in discourses on marriage and childbirth.

5.3.1. Corpus and preparation

The corpus was collected from July to October 2024, drawing from marriage and childbirth related Weibo comments under policy announcements and news posts. This paper adopted a Python-based web crawler that collected a total of 2436 comments from ten posts published on the official Weibo account Weibo Hotspot (Weibo Redian), which regularly publishes content on trending societal issues. The posts selected for analysis are those most commented upon and related to marriage and childbirth. For each post, up to three hundred first-level comments were selected. If fewer than three hundred comments were available, then all comments were included. The selection followed a descending order based on the number of *likes*.

After collection, the comments were cleaned by removing blanks, robot comments, repost markers, etc., and then manually checked for accuracy. This resulted in a final corpus of 2388 valid comments. For the characteristic Chinese language, the corpus was then segmented using the Jieba tokenizer in Python for the database.

5.3.2. LDA model

The first step begins with topic modeling using the LDA model (Blei et al., 2003), implemented with the Gensim library in Python. This aims to verify the theoretically assumed key concerns among users about marriage and childbirth, and to support the verification of the research of Cao's team by identifying which specific topics elicit stronger emotionally. Following the LDA analysis, two researchers randomly sampled 10% of the comment clauses and manually annotated them based on the thematic categories yielded by topic modeling. Cohen's Kappa coefficient was calculated using the Python SKLEARN package to ensure its reliability. The most favorable number of topics is determined by identifying the model with the highest coherence score; in this case the number of topics is four, and the model achieved a maximum coherence score of 0.6891.

5.3.3. NLP tools

This paper plans to process the corpus using various NLP tools. First, a trained BERT model will be applied to detect initial sentiment range annotation on sentences (Devlin et al., 2019). Next, PaddleNLP's Chinese sentiment analysis module will be used concurrently, as it has models optimized for Chinese online texts to conduct validation (PaddleNLP Team, 2023). Additionally, lexical tools like LIWC-22 will also be employed to extract psycholinguistic features from the text, including sentiment categories and statistical metrics of related expressions (Boyd et al., 2022).

These tools serve distinct purposes, the BERT model provides foundational sentiment classification, PaddleNLP ensures stability within the Chinese linguistic context, while lexical tools aid in identifying noteworthy sentiment variations and linguistic inconsistencies. It should be noted that these tools are expected to have significant limitations in this context, particularly regarding sarcasm, implicit evaluations, memes, and culturally specific expressions. Building upon this, a representative set of first-level comments will be selected for manual analysis, which will be conducted within the theoretical framework mentioned above.

5.4. Findings

5.4.1. Sentiment analysis

The study initially employed tools such as BERT, as mentioned above, to assess the comment corpus, with the aim of obtaining an overall sentiment distribution for subsequent analysis; however, the outputs of the models consistently showed significant deviations from manual interpretations. This result was influenced by several factors, for instance, in the fact that a large portion of the comments in this corpus are realized through indirect means, often employing rhetorical questions, presuppositions, contrasts, and listings as indirect resources to convey negative stances, lacking explicit markers that can be directly identified by automated methods. Simultaneously, the widespread presence of sarcasm/mock politeness, where surface-level politeness or positive semantics conflicts with pragmatic derogation, led the tools to tend toward classifying them as neutral or positive. Furthermore, euphemistic expressions, homophones, and internet variants formed to avoid platform restrictions and censorship exhibit significant context dependence, with the same lexical item flipping in polarity depending on the topic and accompanying emojis, memes and images, making it difficult for universal parameters and lexicons to maintain stability. Given these limitations, this paper does not adopt the above results as evidence but instead shifts to manual analysis, categorizing into three classes: positive, non-positive, and unknown. The results indicate that the comments overall exhibit a clear negative tendency, with approximately 93% classified as non-positive. Considering the single-platform (Weibo) and like-based sampling method, this proportion is indicative rather than generalizable, aiming to characterize the overall evaluative tone of the corpus and provide a reference for the qualitative work in subsequent analysis.

5.4.2. Thematic Results with LDA Topic Modeling

This study applied LDA modeling to the cleaned corpus. After comparing coherence metrics across multiple K-values, K=4 was selected as the finest solution. The four emergent themes are economic pressure, gender conflict, marriage institutions & policy, and singlehood trend.

The economic pressure theme centers on essential costs including housing, childrearing, and education. Discourse typically originates with negative valuation within the appreciation framework, then evolves through comparative statistics or objective enumeration into judgment questioning policymakers' capabilities. The gender conflict theme addresses tensions in domestic and professional role division and resource allocation. These discussions feature both normative assessments through negative propriety judgments and identity-based dismissal through sarcasm and labeling. The marriage institutions & policy theme focuses on systemic viability and legitimacy, characterized by significantly more invoked than inscribed. Beyond sarcasm and bald-on record impoliteness, these discussions manifest negative impoliteness through coercive pressure. The singlehood trend presents rational calculations balancing quality of life against reproductive costs, demonstrating restrained affect expression with negative judgement primarily targeting governments' capacity.

This result aligns well with several studies mentioned above. The predominance of implicit communication in Chinese social media is reaffirmed (Li et al., 2024), particularly through rhetorical questions, comparative framing, and euphemistic substitution in marriage and policy discussions. And the prevalence of Judgement and Appreciation over Affect aligns with cross-corpus findings in Chinese digital communication, which highly aligns with Cavasso & Taboada's (2021) finding. Notably, these themes remarkably overlapped with Cao et al.'s (2025) quadripartite analysis of China's declining birth and marriage rates. Although the paper draws solely from Weibo comments rather than data and policy analysis, the findings are broadly similar. Thus, the resistance expressed by Weibo users provides qualitative insights that complement these macro-level demographic analyses, demonstrating how individual voices and structural forces intertwine to produce similar outcomes.

5.4.3. Short Summary of Impoliteness and Appraisal Theory

At the Appraisal level, many comments in this corpus seem, on the surface, to express negative Appreciation of a policy, measure, or situation. However, they in fact realize Judgement. Commenters typically begin by assigning a negative value to a given measure or situation and by constructing the context through comparative framing, factual listing, and concessive contrast. As the discourse unfolds, these evaluations come to be read as judgements of certain entities, especially of their capacity and propriety, and in some cases also their veracity. As shown in the previous section, the themes of economic pressure and marriage institutions & policy are especially representative, along the path from demeaning the matter to demeaning the person, commenters interpret the negation of costs and institutional feasibility as a questioning of the policymaker's capacity in formulation and implementation; gender conflict, beyond normative adjudication, issues of identity positioning and social belonging.

At the level of impoliteness realization, bald on-record impoliteness accounts for approximately 32% of all impolite instances, although it is not the most frequent type in the present corpus, its proportion is noticeably higher here than in the other topics (Zhong, 2018); sarcasm/mock politeness occurs with high frequency and serves as the default irony device, which means surface politeness or positive wording is placed within a contrary evidential context, thereby producing a stable derogatory implicature while preserving deniability. When the target of criticism shifts from matters to persons, positive impoliteness emerges most frequently, most often as criticism and contempt toward policymakers. Negative impoliteness likewise appears when the topic turns from evaluating matters to imposing pressure and constraints on persons, as in the frequent use of commands, prohibitions, and practical requirements, with the targets likewise being governments or experts.

5.4.4. Illustrative comment examples

The following are several comment examples to better illustrate the integrated application of the above theories.

1) *Nowadays, getting married relies entirely on parents. Otherwise, even if the couple buys a house, they can't afford the mortgage payments, let alone have children. Their combined monthly income barely covers the formula.*

   The comment employs realistic comparisons and enumerations, such as the scenario of buying a house but being unable to "afford the mortgage and incomes barely covering the formula", in order to convey a negative Appreciation of the broader economic structure surrounding marriage and parenting, primarily through invoked rather than inscribed meanings. In context, this negative evaluation is implicitly directed at those responsible for this state of affairs, such as the government or related institutions, thereby ascribing insufficient capacity and, to some extent, questionable propriety. From the perspective of impoliteness, no explicit commands, insults, or threats are issued; instead, the impolite force must be inferred, as it is realized through indirect criticism that undermines the face and credibility of policy actors. It is therefore appropriately classified as positive impoliteness, which functions to downgrade the perceived capacity of policymakers.

2) *With gold prices skyrocketing like this, it's tough for young people preparing for engagement and marriage. What used to cost 20 000 yuan for the three-gold and five-gold now requires 50 000 to 60 000 yuan. This price hike is outrageous!*

A scale contrast, from 20k to 60k, establishes a negative valuation, and outrageous is an inscribed attitudinal word that raises force. In a setting where market custom and regulation are attributable, readers naturally project this into Judgement of those relevant, the propriety and capacity. As impoliteness, the strong evaluation plus evidence-like contrast amounts to positive impoliteness.

3) *This subsidy is really something—maybe it covers a few diapers; who is going to take care of the mortgage, the nanny, and the school district?*

Really something sets up surface praise, then the big-ticket list flips the reading. The comment first gives Appreciation on reaction and valuation of the subsidy's effect and then projects to a Judgement of capacity for the poor grasp of actual costs. Realization of impoliteness is indirect and matches sarcasm/mock politeness, specifically mock praise. No commands are issued, so it is not negative impoliteness. The main face-damage is to positive face through ironic belittling.

4) *When will these 'experts' stop painting pies (making empty promises)? You don't even dare to implement maternity leave, yet you're saying all this.*

The scare quotes around 'experts' downgrade status; stop is an explicit command; the contrast "don't even dare to implement ... yet you say this" presupposes wrongdoing. Attitudinally, this targets the experts of Judgement of veracity, for painting pies and propriety, and also, the capacity. It mixes inscribed and invoked expression. Because it pressures and restricts the target, the main type is negative impoliteness, with positive impoliteness as a co-occurring side-axis. It narrows the other's discursive and actional space.

5) *No one will oppose subsidies; it is to oppose turning complex problems into cash—the statistics may look good, but life does not necessarily get better.*

The concessive pattern *"statistics ... but ... life"* rejects the government approach of *"turning complex problems into cash"*, giving a negative valuation of that policy path. In public debate, this projects to a Judgement of propriety and capacity for those responsible. The expression is invoked and restrained, but the phrase *"turning ... into cash"* carries a built-in normative censure. As impoliteness, it functions as positive impoliteness, for undermining credibility, through implicit criticism.

6) *I'm seriously fed up. Who the heck came up with this divorce cooling-off period? Why doesn't marriage require one? What's the point of this thing anyway? If it's an impulsive divorce, just remarry, right?*

   The opening Affect is inscribed with seriously fed up, but the stance quickly shifts to policy critique by a series of rhetorical questions that build a negative valuation of the logic of the law and project it onto unnamed lawmakers as Judgement, primarily on capacity for the poor design, and propriety. "Who the heck came up with…" and the ironic "just remarry, right?" add ridicule and a sarcastic solution, keeping deniability while demeaning those responsible. The expression is mainly invoked, with a mix of sarcasm/mock politeness and positive impoliteness. No commands are issued, so it does not instantiate negative impoliteness.

7) *Marriage is a breeze nowadays; you don't need a household register anymore. But divorce is getting stricter? Isn't this basically telling people not to get married?*

   This starts with a comparison, which constructs an Appreciation of valuation on policy inconsistency, which actually projects to the Judgement of propriety and capacity that targets to the lawmakers. The key moves are invoked through hyperbole and rhetorical questions, and no explicit slurs or directives appear. As impoliteness, this reads as positive impoliteness like other examples, also with a mock-conclusion *"basically telling people not to get married?"* sealing the derisive uptake.

8) *Free to marry, approval to divorce; five minutes to register, half a year to separate.*

   The aphoristic parallelism and contrast work as compressed irony, which is a concise Appreciation of valuation of the institutional pathway that projects to Judgement with its propriety and capacity. Everything is invoked, and there is no apparent attitude lexis, yet the imbalance is unmistakable. Impoliteness is realized through sarcasm/mock politeness, coupled with positive impoliteness.

9) *The 'cooling-off period' is like a renewal card for abusers; who guarantees the victim's safe period?*

   The simile inscribes a strong Judgement of propriety to the lawmaker, and by implication, also targets their capacity for failure to protect. The follow-up question foregrounds insecurity on behalf of victims while keeping the critique pointed at the policy's normative design. It blends inscribed and invoked. As impoliteness, this is positive impoliteness of high intensity, bordering on bald criticism in tone.

10) *One slap requires three pieces of proof, while one phrase— 'a couple quarrel'— wipes it clean.*

The paired clauses stage a stark mismatch between evidentiary burden and an institutional cliché that erases wrongdoing. The line thus evaluates enforcement practice as both tiring and dismissive, and readers carry this forward as a judgement of the authorities' propriety (fairness) and veracity (truthfulness). Realization is invoked, no insult words appear, but the contrast and the quote create a clearly severe stance. In impoliteness terms, the utterance attacks institutional credibility through exposure and ridicule, not through coercion. Without imperatives or threats, negative impoliteness is not the central pattern here.

11) *Eyes fixed on the birth rate—how about also looking at the unemployment rate.*

The speaker contrasts a single-minded focus on births with ignored unemployment, offering a negative valuation of metric selection and policy focus. This is then read as a negative capacity judgement because the decision makers appear unable to balance key indicators; it also implies a negative propriety judgement for privileging targets over people's livelihoods. The move is delivered indirectly using understated irony. It also undermines institutional credibility through ridicule, not through commands.

12) *The groom pays for the house and car, yet demands such a high dowry? Women clamoring for money and possessions while shouting about financial freedom and independence?*

The paired questions frame women as an inconsistent figure, seeking both high transfers and independence. The user issues a negative propriety judgement for perceived unfairness and a negative veracity judgement for hypocrisy. The stance is built with rhetorical questions which is invoked, and the target is a social group or women, so the attack works as positive impoliteness through othering and derogatory stereotyping.

13) *If a man can't even afford the dowry, why get married? Are you going to make her suffer a lifetime of hardship and misery?*

This gives men who cannot afford the dowry a negative capacity judgement and also a negative propriety judgement for marrying under such conditions is framed as morally wrong because it imposes harm. The questions are invoked rather than openly abusive, but they carry status downgrading toward the group in focus.

14) *At the interview they first make you do an X-ray, if you're pregnant you're screened out, really quite smart.*

    The closing really quite smart is mock praise; it flips the literal meaning and signals sarcasm. The speaker offers a negative propriety judgement because the practice is unfair and discriminatory, and a negative capacity judgement because it indicates poor HR or government standards. It is mostly invoked by irony, mapping neatly onto sarcasm/mock politeness; the face damage is to credibility and respect.

15) *The wage line is flat, the price line is slanted, and the birth line is required to be vertical.*

    This compresses a negative valuation of the macro environment and goal setting. Readers naturally project this into a negative capacity judgement that policy makers are portrayed as unable to align wages and prices with birth targets and a negative propriety judgement for imposing unrealistic requirements. The irony is invoked through contrast and graphical metaphors, producing ridicule rather than directives.

5.5. Conclusion

This paper aims to examine, through the analysis of pragmatic mechanisms in comments that collected from the Chinese social media platform Weibo; to discuss the reasons behind netizens' resistance and hostility toward marriage and childbirth; and to investigate how these attitudes are pragmatically constructed. The study first employed an LDA model to extract four main themes and compared them with findings from other scholars, reaching highly similar conclusions. In addition, sentiment analysis was conducted by combining machine assistance with manual analysis of the collected corpus, and then the results indicated that the proportion of negative comments reached as high as 93%, thereby establishing the overall evaluative and sentimental tone of the corpus. Building on these findings, the research adopted the framework of appraisal theory together with the pragmatical sights of impoliteness to analyze how netizens construct language and employ pragmatic strategies when engaging with these topics.

Theoretically, it demonstrates the complementarity of Appraisal Theory and impoliteness research for modeling Chinese online contention. From the perspective of appraisal theory, judgement and appreciation of the attitude system occupy a dominant position within the corpus, whereas affect remains relatively restrained. The most frequent targets of evaluation concern the efficacy, legitimacy, and fairness of policies and institutional practices, followed by negative judgements directed toward policymakers, experts, and government. At the same time, the value of policies promoting marriage and childbirth are also repeatedly questioned. Although explicit affect is less prominent, feelings of fatigue, anxiety, and frustration penetrate the discussion. With regard to impoliteness strategies, participants display a strong preference for indirect expression. Criticism is rarely expressed directly, instead, it is carried through implication, irony, and metaphor, which allow negative evaluations to be expressed while avoiding open confrontation and minimizing the risk of censorship.

These findings indicate that Chinese netizens' rejection of marriage and parenthood is realized through multiple strategies, combining evaluative language with implied criticism. The choice of such strategies reflects an attempt to challenge institutional discourse to the greatest possible extent, highlighting the creativity and resistance of netizens within navigating restricted and censored spaces. Although the present study is limited to the Weibo platform and the corpus is not extensive enough to be generalized across all platforms and contexts, it nevertheless sheds partial light on the discursive mechanisms through which sensitive issues, extending beyond demographic concerns, are debated and reconfigured in the online sphere. Future research could build on this by including multiplatform corpus and refining computational techniques for detecting irony and metaphor, thus enabling more layered and systematic analysis.

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Capítulo 6

ORTHONTOLOGY: diseño de una ontología en el ámbito ortopédico

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6.1. Introducción

La ortopedia es una especialidad médica y quirúrgica dedicada al diagnóstico, tratamiento, rehabilitación y prevención de las enfermedades, lesiones y deformidades del sistema musculoesquelético, que incluye huesos, articulaciones, músculos, ligamentos y tendones (Salter, 1999). Estas condiciones pueden ser causadas por diversos factores, tales como predisposición genética, degeneración relacionada con la edad, traumas, infecciones, trastornos autoinmunes y metabólicos y hábitos de vida (Da Costa y Vieira, 2010).

El diagnóstico de las enfermedades musculoesqueléticas se ve frecuentemente obstaculizado por la complejidad sintomática, la superposición clínica entre patologías y la subjetividad en la interpretación de datos clínicos. Esto resulta en altas tasas de error diagnóstico, especialmente en las enfermedades óseas ocultas como necrosis avascular, osteomielitis crónica, etc. (Diquattro et al., 2023).

Con el objetivo de resolver estos desafíos, hemos desarrollado ORTHONTOLOGY, una ontología en el ámbito ortopédico. Generalmente, estructura el conocimiento ortopédico en tres categorías principales interrelacionadas. En primer lugar, las entidades clínicas incluyen las enfermedades y sus síntomas, las estructuras anatómicas afectadas y las características particulares de los pacientes. En segundo lugar, las entidades de diagnóstico y tratamiento capturan las acciones médicas, englobando tanto las pruebas de evaluación y procedimientos diagnósticos como las diversas intervenciones terapéuticas disponibles. Por último, las entidades del conocimiento externo sirven de base para la validación y toma de decisiones, integrando evidencias de la literatura científica y estándares de práctica clínica establecidos.

Este artículo procede a detallar exhaustivamente el diseño y desarrollo de ORTHONTOLOGY. La siguiente sección describe la metodología de ingeniería del conocimiento empleada, comenzando por la especificación de los requisitos ontológicos y la identificación de fuentes terminológicas de referencia. Seguidamente, se expone el proceso de modelado conceptual, detallando las clases, jerarquías y propiedades. Finalmente, se presenta el proceso de implementación técnica de ORTHONTOLOGY.

6.2. Antecedentes y estado actual

6.2.1. Enfermedades del sistema musculoesquelético y su diagnóstico

La clasificación de enfermedades musculoesqueléticas se puede realizar según diferentes criterios, como la etiología, la estructura afectada o la naturaleza de la enfermedad. Algunos sistemas de clasificación y ontologías biomédicas combinan criterios con jerarquía, lo cual dificultaría su interoperabilidad debido a la rigidez de las estructuras predefinidas.

Por ejemplo, Salter (1999) en su libro de texto describió detalladamente los trastornos y lesiones musculoesqueléticas, los cuales se clasifican en variantes normales comunes, anomalías congénitas, trastornos generalizados y diseminados del hueso, trastornos inflamatorios de huesos y articulaciones, trastornos degenerativos de articulaciones y tejidos relacionados, trastornos neuromusculares, trastornos de las epífisis, neoplasias de tejidos musculoesqueléticos, fracturas y traumatismos articulares.

La Ontología de Enfermedades (DOID, en inglés *Disease Ontology*) (Schriml et al., 2019) emplea la clasificación por etiología, localización afectada y neoplasias organizando las enfermedades del sistema musculoesquelético en seis subclases: enfermedad autoinmune del sistema musculoesquelético, enfermedad del tejido conectivo, enfermedad muscular, neoplasma benigno del sistema musculoesquelético, cáncer del sistema musculoesquelético y enfermedad neuromuscular. En la terminología SNOMED CT,[1] se incluyen 44 subclases en la clase de Trastornos del sistema musculoesquelético (*Disorder of musculoskeletal system*), tales como trastornos inflamatorios del sistema musculoesquelético, trastornos de la bolsa sinovial, enfermedades musculoesqueléticas crónicas, etc.

El envejecimiento global es uno de los factores de riesgo más relevantes para la progresión de enfermedades musculoesqueléticas. Durante mucho tiempo, los ortopedistas han aplicado un enfoque basado en evidencia para el diagnóstico y tratamiento, integrando las mejores evidencias científicas (esto es, correlacionar los síntomas y signos clínicos

[1] SNOMED CT (Systematized Nomenclature of Medicine — Clinical Terms). https://www.snomed.org/

con los estudios pertinentes, verificando que los hallazgos radiológicos sean consistentes con la sintomatología observada), las experiencias clínicas y las preferencias individuales de cada paciente (Siminoff, 2013).

Sin embargo, la gran cantidad de publicaciones científicas en el ámbito ortopédico dificulta que los médicos se mantengan actualizados con los últimos avances. Además, la heterogeneidad entre las experiencias clínicas de los ortopedistas y la asignación desequilibrada de los recursos sanitarios conducen a la tasa elevada de diagnósticos erróneos en las enfermedades musculoesqueléticas.

6.2.2. Sistema de soporte para la toma de decisiones clínicas en el diagnóstico de enfermedades musculoesqueléticas

Un sistema de soporte para la toma de decisiones clínicas (CDSS, del inglés *clinical decision support system*) tiene como objetivo optimizar las decisiones clínicas mediante conocimientos médicos, informaciones del paciente y otros datos de salud (Sutton et al., 2020). Los CDSS, cuyo desarrollo se remonta a los años 70, se clasifican frecuentemente en los sistemas basados en conocimientos (*knowledge-based CDSS*) y los no basados en conocimientos (*non-knowledge based CDSS*).

Por una parte, los CDSS basados en conocimientos utilizan un conjunto de reglas predefinidas que se derivan de guías clínicas, protocolos médicos o literaturas científicas. El motor de inferencia, integrado en el sistema, aplica las reglas médicas a los datos del paciente para generar recomendaciones. De esta forma, garantiza relativamente mayor consistencia, pero hay casos en que las reglas predefinidas no se adapten a excepciones.

Por otra parte, los CDSS no basados en conocimientos emplean técnicas de inteligencia artificial y aprendizaje automático para identificar patrones en grandes volúmenes de datos clínicos sin reglas explícitas (Berner y McGowan, 2010). Son más flexibles y escalables en comparación con los CDSS basados en conocimientos, pero su efectividad depende de datos clínicos de calidad.

Los sistemas CDSS han logrado progresos significativos en el proceso diagnóstico de las enfermedades musculoesqueléticas. Por ejemplo, López de Ipiña et al. (2010) desarrollaron un CDSS para patologías de hombro, que combina métodos médicos, una base de datos y paradigmas de clasificación mejorados con estimación de covarianza. Mamud-Meroni et al. (2025) revisaron las terapias alternativas combinadas con los CDSS en el cuidado de las enfermedades musculoesqueléticas, las cuales complementarían las brechas persistentes en los tratamientos tradicionales. Toh et al. (2024) realizaron una revisión de literatura sobre los CDSS de trastornos espinales y resumieron 4 funciones principales en 31 estudios: la prevención de examinaciones radiológicas innecesarias, el soporte en el diagnóstico, la ayuda en el pronóstico y la recomendación de opciones de tratamiento.

6.2.3. Representación del Conocimiento Ortopédico

La representación del conocimiento, siendo un ámbito importante en la inteligencia artificial, se centra en investigar métodos de representación para que los programas informáticos utilicen estos conocimientos y resuelvan automáticamente problemas (Van Harmelen et al., 2008). El inicio del desarrollo de este ámbito en la ortopedia se remonta al año 1916, cuando la Asociación Americana de Ortopedia (AOA, del inglés *American Orthopaedic Association*) inició el proyecto de encontrar métodos para clasificar artículos relacionados con la ortopedia en el *Index Medicus* (Nelson y Schulman, 2010). EsEn esa época, la clasificación se basaba simplemente en métodos como el anatómico y el etiológico.

Van Harmelen *et al.* (2008) presentó varios métodos clave para la representación del conocimiento, los cuales incluyen lógicas de descripción (DL, del inglés *description logics)*, redes semánticas, lógica de primer orden, redes neuronales y representación distribuidas. A continuación, nos centramos en describir los métodos en el contexto de DL y redes semánticas.

6.2.4. Terminologías, tesauros y sistemas de clasificación

Terminologías, tesauros, sistemas de clasificación y ontologías son métodos formales para la representación del conocimiento en los dominios biomédicos, facilitando la integración de datos, la interoperabilidad y la comprensión semántica entre diversas aplicaciones (Cui y Agrawal, 2024).

Se muestra en la Figura 6.1 un espectro de estos sistemas de representación del conocimiento, ordenados desde los más simples hasta los más complejos en términos de expresividad formal (Oberkampf, 2015). Estos sistemas evolucionan de estructuras básicas como tesauros hacia ontologías formales, incrementando su capacidad expresiva y jerarquías sofisticadas.

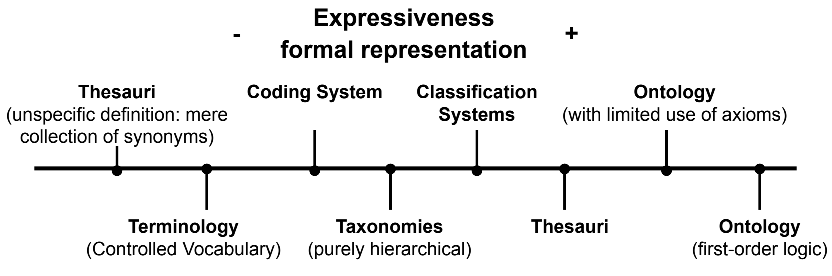

Figura 6.1. Sistemas de representación del conocimiento ordenados por creciente expresividad y formalidad.
Fuente: Oberkampf (2015).

A continuación, describimos las principales terminologías, tesauros y sistemas de clasificación en el campo biomédico.

SNOMED CT: es una terminología clínica exhaustiva que incluye más de 360 000 entidades en su última versión. El contenido en SNOMED CT se representa con tres tipos de componentes: conceptos, descripciones y relaciones. Cada concepto indica un significado clínico y se permite referir mediante un identificador único legible por la máquina. Mientras tanto, los conceptos tienen asociados un conjunto de descripciones textuales, que representan su forma legible para los humanos. Además, las relaciones establecen conexiones lógicas entre conceptos; "*is-a*" y "*finding-site*" son dos relaciones principales en SNOMED CT; "*is-a*" establece jerarquías y permite la clasificación de conceptos mediante herencia de propiedades; "*finding-site*" indica la ubicación anatómica asociada con un hallazgo clínico, procedimiento o condición.

El Tesauro del Instituto Nacional del Cáncer (NCIT, del inglés *National Cancer Institute*):[2] se considera un modelo semántico que integra información clínica y molecular relacionada con el cáncer, utilizando un tesauro controlado. El NCIT facilita el intercambio de datos y la interoperabilidad entre distintos sistemas del NCI. Se utiliza ampliamente para la codificación, referencia de conocimientos e informes públicos por otros socios, como la Administración de Alimentos y Medicamentos de los Estados Unidos. El NCIT abarca 184 164 clases y 97 propiedades.[3] Su principal innovación consiste en la integración de información molecular con conceptos oncológicos, p.ej. genes, desregulación de oncogenes, expresión de proteínas de fusión y translocaciones cromosómicas. De esta forma, NCIT permite definir con mayor precisión conceptos de diagnóstico y tratamiento (Zheng et al., 2020).

ICD-11: Durante décadas de desarrollo, la Clasificación Internacional de Enfermedades versión 11 (ICD-11, del inglés *International Classification of Diseases*) ha evolucionado desde una breve lista de causas de muerte hasta la clasificación predominante de enfermedades, síndromes y afecciones humanas en todo el mundo (Harrison et al., 2021). La arquitectura de la ICD-11 se propuso en 2007 e incluía tres partes: una red semántica de conceptos biomédicos (fundamento), una tabulación tradicional de códigos jerárquicos (linearización) y una ontología formal que combina la definición de los términos en la dicha red semántica (Chute y Çelik, 2022). La ICD-11 proporciona acceso a 17 000 categorías diagnósticas y más de 100 000 términos del índice diagnóstico médico. Se realiza la interpretación de 1,6 millones de términos mediante el algoritmo de búsqueda basado en índices.[4]

6.2.5. Ontologías biomédicas

Gruber (1995) definió ontología como una especificación explícita de una conceptualización. Se considera que las ontologías pueden expresar mejor los

[2] NCIT: https://bioportal.bioontology.org/ontologies/NCIT.
[3] Los datos se actualizan en febrero de 2024 con el NCIT versión 24.01e.
[4] ICD-11 Hoja informativa: https://icd.who.int/en/docs/icd11factsheet_en.pdf

conocimientos de un cierto dominio que terminologías, tesauros y sistemas de clasificación mediante la definición de un conjunto de entidades y sus relaciones.

En el ámbito biomédico, existe una variedad de ontologías bien organizadas y semánticamente ricas. En el NCBO BioPortal (*National Center for Biomedical Ontology Bioportal*),[5] que es un repositorio en línea de ontologías biomédicas, hay albergadas 1222 ontologías con más de 17 750 000 entidades y 36 000 propiedades.

NCBO Bioportal clasifica estas ontologías biomédicas en dos familias: el Sistema Unificado de Lenguaje Médico (UMLS, del inglés *the Unified Medical Language System*)[6] y las Ontologías Biológicas y Biomédicas Abiertas (OBO, del inglés *the Open Biological and Biomedical Ontologies*).[7] El UMLS contiene un conjunto de diferentes sistemas de clasificación y codificación multilingües, donde los conceptos están alineados a través del Metatesauro del UMLS. Por lo contrario, la Librería de OBO contiene ontologías ortogonales que se desarrollan a partir de una serie de ontologías de nivel superior. Es decir, no existe superposición de dominio entre las ontologías incluidas.

El desarrollo de ORTHONTOLOGY reutiliza un conjunto de ontologías de la Librería de OBO. A continuación, se describen brevemente las ontologías reutilizadas.

La Ontología Formal Básica (BFO, del inglés *Basic Formal Ontology*) es una ontología de nivel superior que se utiliza para estructurar una amplia variedad de ontologías, como las de la Librería OBO y CCO (*Common Core Ontologies*).[8]

La BFO distingue entre continuantes y ocurrentes. Los continuantes son entidades que persisten en el tiempo manteniendo su identidad, p.ej. entidades anatómicas o cualidades. Por lo contrario, los ocurrentes son entidades que suceden en el tiempo, p.ej. procesos. Los continuantes más allá se distinguen en continuantes dependientes y continuantes independientes. Por ejemplo, una entidad material es un continuante independiente, mientras que un rol, una función o una cualidad es un continuante dependiente. La Figura 6.2 muestra la clasificación de entidades incluidas en la Librería OBO.

Granularity	Continuant				Occurrent
	Independent		Dependent		
Organ and organism	Organism (NCBI taxonomy or similar)	Anatomical entity (FMA, CARO)	Organ function (Physiology ontology, to be determined)	Phenotypic quality (PATO)	Organism-level process (GO)
Cell and cellular component	Cell (CL, FMA)	Cellular component (FMA, GO)	Cellular function (GO)		Cellular process (GO)
Molecule	Molecule (ChEBI, SO, RnaO, PRO)		Molecular function (GO)		Molecular process (GO)

Figura 6.2. Clasificación de entidades incluidas en la Librería OBO.
Fuente: Smith et al. (2007).

5 NCBO Bioportal: https://bioportal.bioontology.org/
6 UMLS: https://www.nlm.nih.gov/research/umls/index.html
7 OBO Foundry: https://obofoundry.org/
8 CCO: https://github.com/CommonCoreOntology/CommonCoreOntologies

La Ontología para Investigaciones Biomédicas (OBI, del *Ontology for Biomedical Investigation*)[9] es una ontología que proporciona conceptos con definiciones precisas para describir todos los aspectos de cómo se llevan a cabo las investigaciones en los dominios biológicos y médico (Bandrowski et al., 2016). Su última versión 2025-05-01 incluye 4989 clases y 97 propiedades.

La Ontología para la Ciencia Médica General (OGMS, del inglés Ontology for General Medical Science)[10] abarca 187 clases, que proporcionan las entidades presentes en un encuentro clínico como paciente, enfermedad y diagnóstico. Adopta la BFO como el nivel superior y está diseñada para uso interdisciplinario, centrándose en una teoría formal de la enfermedad que puede ser ampliada por ontologías más específicas.

El Modelo Fundamental de Anatomía (FMA, del inglés *Foundational Model of Anatomy*)[11] es una ontología de las estructuras anatómicas humanas. Su última versión 5.0.0 contiene 104 721 clases y 168 propiedades. El FMA tiene como objetivo apoyar el razonamiento automatizado sobre la anatomía humana, cerrando así la brecha entre los recursos computacionales y la expansión continua del conocimiento en las ciencias biomédicas (Gröne et al., 2024).

La Ontología Génica (GO, del inglés *Gene Ontology*)[12] tiene como objetivo proporcionar una representación integral del conocimiento sobre las funciones de productos génicos (Gaudet et al., 2021). En concreto, contiene 54 747 clases que cubren vocabularios controlados con respecto a la función molecular, componente celular y rol biológic de estos productos génicos.

La Ontología de Enfermedades Humanas (DOID, del inglés *Human Disease Ontology*)[13] abarca en su última versión 19 147 entidades. La DOID integra características de enfermedades y factores etiológicos para describir la complejidad de las enfermedades. Se ha citado ampliamente e integrado en bases de datos de alto impacto académico (Schriml et al., 2022).

La Ontología de Fenotipo Humano (HPO, del inglés *Human Phenotype Ontology*)[14] proporciona recursos bioinformáticos integrales para el análisis de enfermedades y fenotipos humanos. Su versión vigente contiene 23 095 clases. Los tres componentes de la HPO son: el vocabulario de fenotipos, las anotaciones enfermedad-fenotipo y los algoritmos que operan sobre estos (Köhler et al., 2017).

9 OBI: https://obi-ontology.org
10 OGMS: https://www.bioportal.bioontology.org/ontologies/OGMS
11 FMA: https://bioportal.bioontology.org/ontologies/FMA
12 GO: https://bioportal.bioontology.org/ontologies/GO
13 DOID: https://bioportal.bioontology.org/ontologies/DOID
14 HPO: https://bioportal.bioontology.org/ontologies/HP

La Ontología de Síntomas (SYMP, del inglés *Symptom Ontology*)[15] contiene 1019 clases que describen síntomas, diferenciados principalmente por la región anatómica afectada (p.ej. síntoma en sistema musculoesquelético, síntoma abdominal, síntoma digestivo etc.) y el funcionamiento del sistema corporal (síntoma neurológico y fisiológico, síntoma de nutrición, metabolismo y desarrollo).

La Ontología de Relación (RO, del inglés *Relation Ontology*)[16] consiste en una colección de relaciones estandarizadas para definir y armonizar conexiones entre entidades en ontologías biomédicas de la Librería de OBO. La versión publicada en el año 2025 contiene 57 clases y 681 propiedades, las cuales pueden facilitar la combinación lógica de ontologías de forma consistente.

6.2.5.1. Lógicas de descripción y razonamiento

La Lógica de Descripción (DL, del inglés *Description Logics*) se define como una clase de formalismos para la representación del conocimiento, que se origina a partir de las redes semánticas (nodos y enlaces), y los sistemas basados en marcos (Jiang et al., 2009). Según Baader et al. (2010), una característica distintiva de la DL es su capacidad para representar diversos tipos de relaciones que pueden existir entre conceptos, más allá de las relaciones "*is-a*".

La Figura 6.3 muestra un ejemplo de representación en la red semántica, simplemente los nodos indican conceptos y los enlaces se utilizan para caracterizar las relaciones entre ellos. A parte de esta jerarquía de generalización, las clases en DL se pueden definir mediante su relación con otras clases a través de restricciones de valor, restricciones numéricas o equivalencias con la intersección de otras clases.

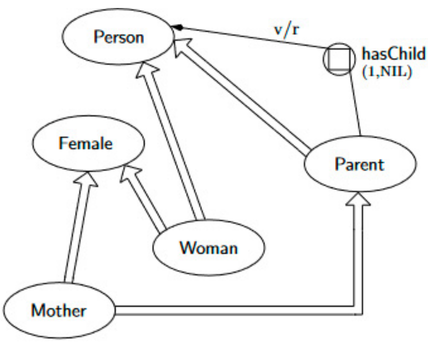

Figura 6.3. Un ejemplo de representación en la red semántica.
Fuente: Baader et al. (2010).

15 SYMP: https://bioportal.bioontology.org/ontologies/SYMP
16 RO: https://bioportal.bioontology.org/ontologies/OBOREL

El mecanismo de estructura de representación y razonamiento de DL se extiende a la incorporación de axiomas complejos, la cual permite formular modelos ontológicos comprehensivos y expresivos. De acuerdo con la expresividad y la complejidad de razonamiento, se distinguen distintos lenguajes de DL, p.ej. *DL lite* y *DL full*. Además, las capacidades de clasificación e inferencia de DL se pueden adaptar a diversas tareas de razonamiento, las cuales incluyen pruebas de subsunción, comprobación de consistencia y respuesta a consultas.

6.2.5.2. Tecnologías de la Web Semántica

La Web Semántica tiene el propósito de proporcionar el significado semántico en toda la web para que los sistemas puedan hacer razonamientos lógicos. Berners-Lee et al. (2001) mostraron su estructura utilizando la pila de tecnología de la Web Semántica en la Figura 6.4.

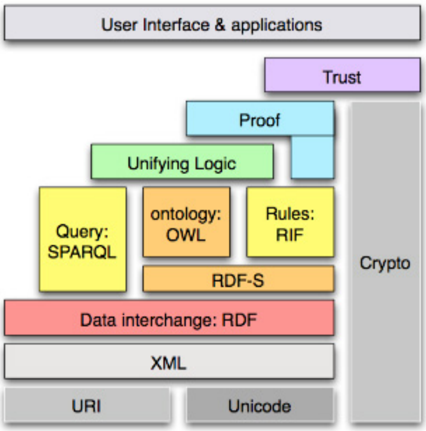

Figura 6.4. Pila de tecnología de la web semántica.
Fuente: Berners-Lee et al. (2001).

Básicamente, las funciones de la Web Semántica se logran mediante el uso del Marco de Descripción de Recursos (RDF, del inglés *Resource Description Framework*). Las entidades y relaciones entre ellas son representadas por Identificador Uniforme de Recursos (URI, del inglés *Uniform Resource Identifier*) y Unicode. Las capas centrales, RDF-S y OWL, introducen la semántica formal, permitiendo la descripción de ontologías que confieren significado explícito a los datos. El lenguaje SPARQL habilita la consulta estructurada, mientras que mecanismos de lógica y confianza permiten inferir nuevos conocimientos y validar su procedencia (Wang et al., 2012).

En el sector sanitario, se están desarrollando sistemas dinámicos de razonamiento de enfermedades basado en la estructura de la Web Semántica. Por ejemplo, Sanaeifar et al. (2022) desarrollaron un generador de diagnóstico diferencial basado en el razonamiento semántico, mediante la convergencia de bases de conocimientos del UMLS. Singh et al. (2025) utilizaron el modelado semántico para cuantificar anomalías patológicas jerárquicas de atrofia cerebral, auxiliando en el diagnóstico diferencial. Chytas et al. (2023) presentaron PrescIT, un grafo de conocimiento que integra ontologías relevantes como DrugBank, SemMeDB, OpenPVSignal y DINTO. Su objetivo consiste en la identificación automatizada de reacciones adversas a medicamentos basada en evidencia.

6.2.5.3. Anotación semántica

La anotación semántica se refiere a la anotación de datos no estructurados con conceptos de ontologías. En concreto, las entidades ontológicas se mapean con las palabras correspondientes en el texto clínico, basándose en el vocabulario controlado de una ontología (Oberkampf, 2015).

Este proceso también se corresponde con la tarea del Reconocimiento de Entidades Nombradas (NER, del inglés *Named Entity Recognition*) del PLN. En el ámbito biomédico, se concentra en la extracción y desambiguación de entidades mencionadas en contenido biomédico textual. Por ejemplo, la 1.5 muestra anotaciones semánticas del concepto doid: ankylosing_spondylitis, una indica que esta enfermedad es una subclase de doid: autoimmune_disease_of_musculoskeletal_system y tiene síntoma symp: spinal_stiffness.

En esta investigación, utilizamos el anotador NCBO[17] para anotar textos con términos de ontologías de UMLS y NCBO BioPortal.

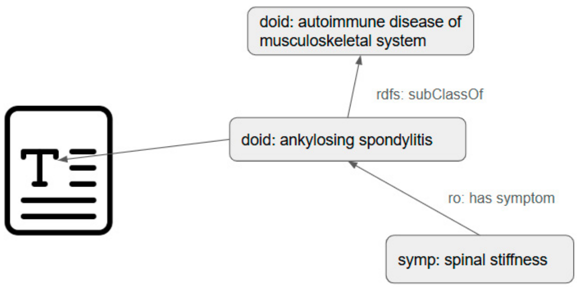

Figura 6.5. Anotación semántica de un texto no estructurado con la clase DOID ankylosing spondylitis.

6.3. Metodología

Hemos seguido la metodología de METHONTOLOGY (Fernández-López et al., 1997) para el desarrollo de ORTHONTOLOGY. Incluye una serie de actividades como especificación, adquisición del conocimiento, conceptualización, integración,

[17] Anotador NCBO: https://bioportal.bioontology.org/annotator

implementación, evaluación y documentación. En esta fase de investigación, nos enfocamos en construir el núcleo de ORTHONTOLOGY. A continuación, la selección de ontologías para reutilizar y la integración de sus clases y propiedades.

6.3.1. *Principios fundamentales para el desarrollo de ORTHONTOLOGY*

Se han creado diferentes herramientas para el desarrollo de ontologías, de las cuales el editor Protégé OWL[18] es probablemente la más popular para su procesamiento manual. Sin embargo, considerando la estructura extensa de ORTHONTOLOGY, lo combinamos con otras herramientas basadas en web, p.ej. Ontofox,[19] Ontobee[20] y Ontodog,[21] que permiten la extracción de subconjuntos de ontologías para la reutilización de entidades y el alineamiento semántico.

En general, adoptamos tanto la vinculación a terminologías como la post-coordinación. Nos enfocamos en la estructura de las jerarquías de clases, evitando cualquier forma de duplicación.

6.3.1.1. Vinculación a terminologías

La reutilización consistente de ontologías y terminologías como SNOMED CT, ICD, FMA y DOID en ORTHONTOLOGY se realiza mediante una vinculación entre ellos. Por ejemplo, ORTHONTOLOGY describe que las examinaciones radiológicas para el sistema musculoesquelético tienen una modalidad específica, tanto como requiere una posición del paciente durante el proceso. Como se muestra en la Figura 6.6, ORTHONTOLOGY define una clase *patient position* y la vincula con las subclases de la clase radlex: patient position. La propiedad rdf: type se utiliza para hacer referencia a una de estas clases.

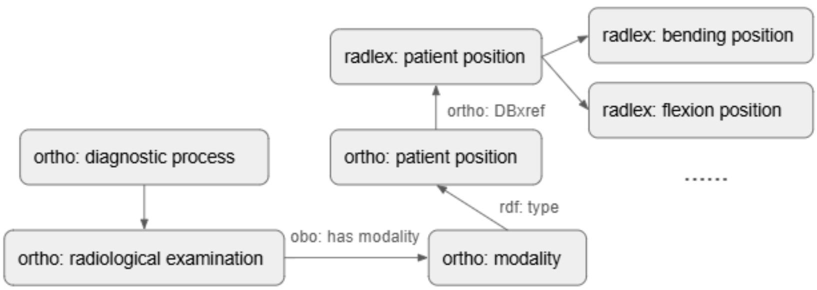

Figura 6.6. Representación de posiciones del paciente durante examinaciones radiológicas mediante referencia a RadLex.

18 Protégé: https://protege.stanford.edu/
19 Ontofox: https://ontofox.hegroup.org/
20 Ontobee: https://ontobee.org/
21 Ontodog: https://ontodog.hegroup.org/tutorial/index.php

6.3.1.2. Post-coordinación

El proceso de post-coordinación tiene dos objetivos principales, representar con precisión conocimientos complicados y modificar conceptos duplicados o ambiguos.

Por una parte, si una afirmación de conocimiento es compleja, es posible que no exista una única clase que la represente en las terminologías disponibles. En estos casos, se hace necesario recurrir a la post-coordinación de clases para lograr una representación precisa. Este enfoque permite, por ejemplo, especificar cualidades como la intensidad o la severidad de una lesión en el sistema musculoesquelético. Por ejemplo, la HP contiene una clase hp:Osteomyelitis, la cual tiene cuatro subclases: hp: Foot_osteomyelitis, hp: Mandibular_osteomyelitis, hp: Osteomyelitis_leading_to_amputation_due to_slow_healing fractures y hp: Salmonella_osteomyelitis. Observamos que la lógica de esta clasificación no sigue un único criterio uniforme, sino mezcla dimensiones de localizaciones anatómicas afectadas (osteomielitis del pie, osteomielitis mandibular), la gravedad de la complicación (amputación) y la etiología (fractura de lenta curación, osteomielitis por Salmonella).

Por otra parte, la post-coordinación permite evitar la duplicación o ambigüedad de entidades a través de la combinación dinámica de conceptos atómicas en lugar de predefinir las entidades complejas de manera estática. Por ejemplo, la DOID contiene una variedad de enfermedades que se clasifican en las de aparición en adultos y las infantiles.

6.3.2. Ontologías para reutilizar

ORTHONTOLOGY se basa en ontologías de nivel superior e intermedio seleccionadas de la Librería de OBO. Estas ontologías se evalúan según criterios como: a) ser de acceso libre y bien definidos; b) tener una amplia cobertura de entidades sobre información clínica, p.ej. diagnóstico, procesos, examinaciones etc.; c) contar con una comunidad activa que las mantenga; d) ser estables y se basan en estándares; d) permitir la reutilización modular para evitar elementos innecesarios.

De acuerdo con estos criterios, las principales ontologías importadas a ORTHONTOLOGY son Ontología Formal Básica (BFO), Ontología para la Ciencia Médica General (OGMS), Modelo Fundamental de Anatomía (FMA), Ontología de Enfermedades Humanas (DOID), Ontología de Fenotipo Humano (HPO), Ontología de Síntomas (SYMP) y Ontología de Relación (RO).

6.3.3. Clases y propiedades

Las estructuras jerárquicas de ORTHONTOLOGY se organizan en el nivel alto, intermedio y especializado (Figura 6.7). A continuación, se describen las clases y propiedades definidas por ORTHONTOLOGY.

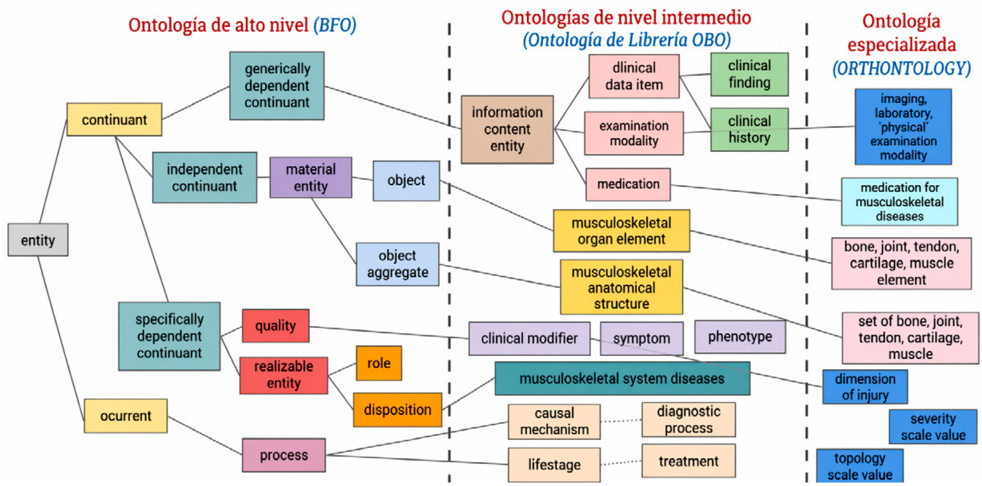

Figura 6.7. Estructuras jerárquicas de ORTHONTOLOGY.

6.3.3.1. Clases

El proceso de diagnóstico consiste en identificar la etiología de un trastorno o enfermedad mediante la evaluación integral de historias clínicas del paciente, la realización de examinaciones médicas y el análisis de estudios de laboratorio e imágenes radiológicas, para finalmente formular un diagnóstico definitivo que describe dichos hallazgos. Por lo tanto, nos enfocamos en incluir clases sobre regiones anatómicas, enfermedades y trastornos musculoesqueléticos, síntomas, fenotipos clínicos, examinaciones médicas, mecanismo causal y tratamiento.

En primer lugar, siguiendo los principios de BFO, organizamos los conceptos de elemento de órgano musculoesquelético y estructura anatómica bajo la clase superior bfo: material_entity (Figura 6.8). Dentro de esta clase, distinguimos que los elementos anatómicos discretos (p.ej. ortho: flat_bones) se modelan como bfo: object. Las estructuras compuestas por una colección de elementos (p.ej. ortho: apendicular_ skeleton) se clasifican como bfo: object_aggregate.

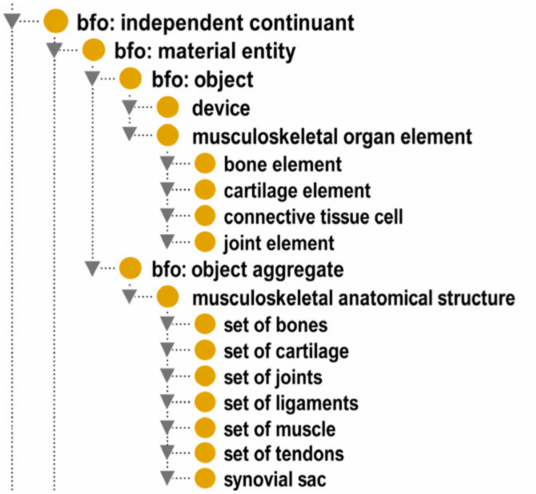

Figura 6.8. Estructura jerárquica de regiones anatómicas del sistema musculoesquelético.

En segundo lugar, modelamos la clase ortho: musculoskeletal_system_disease como una tendencia intrínseca del organismo hacia un curso patológico específico. Así que la clasificamos bajo bfo: disposition. Tiene subclases de arthropathy, autoimmune_disease_of_musculoskeletal_system, connetive_tissue_disease, muscular_disease, musculoskeletal_system_benign_neoplasm y musculoskeletal_system_cancer (Figura 6.9).

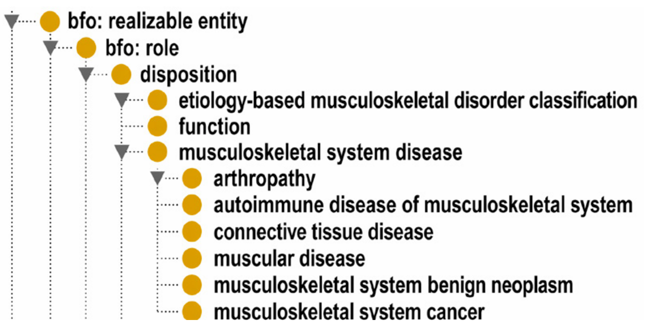

Figura 6.9. Estructura jerárquica de enfermedades y trastornos musculoesqueléticos.

En tercer lugar, como indica la Figura 6.10, la clase bfo: process incluye eventos o acciones que se desarrollan en el tiempo; ortho: causal_mechanism describe la relación causa-efecto de un fenómeno clínico; ortho: healthcare_process contiene procesos durante la atención médica, p.ej. un diagnóstico, una cirugía, una terapia; ortho: life_stage describe una fase en el desarrollo de la vida de un organismo, p.ej. infancia, adolescencia, edad adulta.

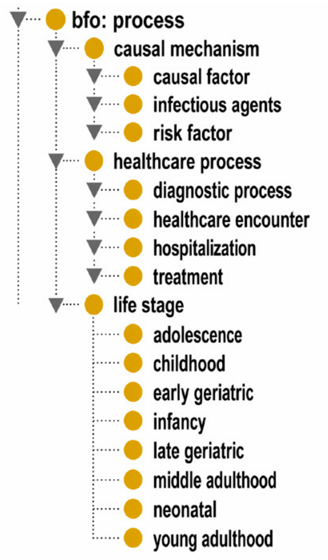

Figura 6.10. Estructura jerárquica de mecanismo causal, proceso sanitario y etapa de la vida.

6.3.3.2. Propiedades generales

Las propiedades generales se categorizan en tres tipos fundamentales: propiedades de objeto, propiedades de datos y propiedades de anotación. En esta sección, describimos propiedades específicas de cada tipo incluidas en ORTHONTOLOGY.

En primer lugar, las propiedades de datos relacionan un individuo con un valor de dato literal. Por ejemplo, ortho: date_of_birth relaciona un paciente con su fecha de nacimiento; ortho: start_date_time indica la fecha del inicio de un proceso; ortho: end_date_time, al contrario, la fecha del final del proceso; ortho: creation_date_time conecta la fecha en que una entidad informativa fue creada. Estas propiedades tienen el rango xsd:dateTime.

En segundo lugar, las propiedades de objeto relacionan dos individuos. Revisamos la Ontología de Relación y seleccionamos una serie de propiedades relevantes para ORTHONTOLOGY. Por ejemplo, ro: has_part define la relación entre una región anatómica y sus componentes; ortho: disease_has_location especifica la región anatómica primaria donde se manifiesta o localiza una enfermedad; ortho: disease_has_basis_in indica la etiología, i.e. la causa o el proceso fisiopatológico que da lugar a una enfermedad; ortho: correlated_with establece una asociación epidemiológica entre enfermedades y factores de riesgo. Otras propiedades incluidas en ORTHONTOLOGY son has_symptom, has_participant, derives_from, has_clinical_phenotype, aggravated_by, mitigated_by, treated_by, etc.

En tercer lugar, las propiedades de anotación proporcionan metadatos sobre clases, propiedades, etc. Por ejemplo, rdfs: label proporciona el nombre legible para un concepto o propiedad; skos: altLabel añade un sinónimo para este concepto; skos: definition ofrece su definición textual; obo: hasDbXref indica la fuente de donde se obtuvo el término o su definición y rdfs: comment da informaciones adicionales.

6.4. Conclusión

El presente capítulo ha detallado el diseño de ORTHONTOLOGY, una ontología especializada en el ámbito ortopédico, desarrollada para abordar los desafíos de integración del conocimiento y apoyo al diagnóstico diferencial en este campo.

ORTHONTOLOGY proporciona un modelo conceptual formal que integra de manera coherente las entidades clínicas fundamentales, los elementos de diagnóstico y tratamiento, y el conocimiento externo. A través de la definición exhaustiva de clases, propiedades, axiomas y relaciones semánticas, ORTHONTOLOGY trasciende el papel de un mero vocabulario controlado para convertirse en una infraestructura de conocimiento computable.

Las futuras líneas de investigación se centrarán en la evaluación e implementación de ORTHONTOLOGY. Esto incluye una fase de validación rigurosa con ortopedistas para refinar el modelo, seguida de su integración en plataformas clínicas piloto. El objetivo final es demostrar su eficacia operativa en la asistencia real, midiendo métricas de mejora en la precisión diagnóstica y la eficiencia clínica.

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Capítulo 7
Audio description of motion events: An English – Chinese descriptive study

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7.1. Introduction

According to data from the first *World Vision Report* released by the World Health Organization, the number of people in the world with visual impairment or blindness is upwards of 2.2 billion (World Health Organization, 2019), which accounts for approximately 28.67% of the total population. According to data from the China Association of Persons with Visual Disabilities for 2019, there are 17.31 million people with visual disabilities in China, and the elderly account for more than 70% of the population with low vision. We live in an age of information and communication technologies, where access to information means, to a large extent, access to audiovisual information.

In the era of information and communication technology, access to information is an equal right for all individuals. To ensure media accessibility for people with sensory disabilities, various models have emerged in the field of audiovisual translation over the past decade, with audio description (AD) being the primary focus of this study. Audio description aims to assist individuals with visual impairments in receiving audiovisual information (Díaz-Cintas, Orero & Remael, 2007). Although it does not involve translation from source to target languages, it is classified within the field of audiovisual translation. European countries have established robust policies to ensure media accessibility for persons with disabilities. In contrast, audiovisual translation research in China began relatively late, emerging only in 1992 and gradually developing through subtitling, recorded CDs, and online platforms (Wu & Xie, 2015; Tor-Carroggio & Casas-Tost, 2020).

While the development of media accessibility and AD has been examined from a policy and practical implementation perspective, it is equally important to consider how such content is linguistically structured and cognitively processed. One crucial dimension in studying how AD communicates visual information is the way motion events are represented and translated. This brings us to the broader research area of motion events.

This study aims to examine the differences in motion event expressions between Chinese and English ADs to promote cross-cultural communication. Specifically, we will analyze how motion events are expressed in English and Chinese AD texts by comparing the number and types of motion events in the English and Chinese audio-described versions of five films.

7.2. Theoretical framework

7.2.1. Audio description

Audio description (AD) is increasingly recognized as an integral part of audiovisual translation research and is the focus of this dissertation. AD provides media access to supplement captioning for blind and partially sighted people which complements subtitling for people who are deaf, deafened or hard of hearing (BPS) (Fryer, 2016, pp. 1-2).

Audio description differs from the subtitling, dubbing or voice-over modes of audiovisual translation in that it is not accompanied by a pre-existing text that needs to be translated from one language to another. Braun (2008, p. 16) defines it as "intersemiotic, intermodal or cross-modal translation or mediation". The term 'intersemiotic' was coined by Jakobson (1959) to describe the type of translation in which part of the context comes from information outside the translation channel, including spoken, written, musical and sound effects (SFX). However, it can also be thought of in relation to different sensory modalities: that is, information received through one sense (visual) must be transformed into information that can be received through another sense (auditory) (Fryer, 2016, p. 22). Therefore, Joel Snyder's use of "the visual made verbal" to summarize AD seems reasonable. Kruger's comment is also interesting with this regard: "Audio description or narration is substantially different from other AVT modes like dubbing and subtitling, primarily because the focus in other modes is on dialogue" (Kruger, 2012, p. 232).

Both Gorlée (1994) and Remael (2010) suggest that one of the main problems of translation is how the meaning embedded in words through one language or symbol system is conveyed through another language or symbol. In audiovisual translation, there are generally multiple channels or systems interacting with each other. Gambier's (2006) view is that AD should be considered 'multisemiotic', since AD translates visual (or verbal, e.g. subtitles, newspaper headlines, and non-verbal, e.g. action events in films) into spoken language. Szarkowska and Orero (2014) also agree with this idea.

Although AD is usually intersemiotic, we can now find examples of AD being the result of interlinguistic transfer (cf. Fryer 2016). In recent developments, AD scripts have begun to be translated directly from one language to another. For example, an AD script for an English source program may be translated directly into Polish, without a Polish describer having to reinvent the wheel (Jankowska, 2015). This also means that with the development of audiovisual translation and AD, the place of AD in AVT is no longer always cross-symbolic, but sometimes just cross-linguistic (Fryer, 2016, p. 23).

Although AD has been flourishing in the European culture since 1990, Remael (2014, p. 135) still describes it as an "AVT newcomer", and research scholars vary in their definitions of AD. As commented by Snyder (2005), it seems too one-sided for us to keep emphasizing that the audience for AD is the blind and visually impaired, when in fact AD can enhance the arts for all those who experience exhibits in museums, theatergoers, those who watch television or go to the cinema, and even improve a child's "literacy skills". It can be very useful for anyone who wants to really appreciate any visual event with a fuller perspective (2005, p. 937).

7.2.2. Motion events

According to Talmy (1985), a motion event is "a situation containing movement or maintenance of a stationary location. The basic motion event consists of one object (the 'Figure') moving or located with respect to another object (the reference-object or 'Ground')" (1985, pp. 60-61). There are semantic components[1] in motion events which play an important role in my study, they are (Talmy, 1985, p. 61):

- Figure: the physical entity that moves.
- Motion: the action involved in changes in position or location.
- Path: the trajectory along which a figure moves.
- Ground: the entity with respect to which the figure changes location.
- Manner: the way in which the movement unfolds.
- Cause: the impetus of the motion.

According to Talmy (1991), path is the schematic core of a motion event. Thus Talmy (1991) divided world languages into two types based on how paths are encoded in motion events:

[1] Among these, figure, motion, path, ground are basic semantic components, and manner and cause are optional semantic components.

- Verb-framed languages (VFLs) (e.g. French, Spanish): languages that characteristically map the core schema (path) into the verb.
- Satellite-framed languages (SFLs) (e.g. English, German): languages that characteristically map the core schema (path) into a satellite.

On the basis of Talmy, Slobin (2004) did not only contributed to the language types, providing a third typology: Equipollently-framed languages (EFLs) (e.g, Chinese, Thai): path and manner are expressed by equivalent grammatical forms. He also made new research on language relativism and language use from the perspective of discourse in terms of narrative style and linguistic habitual expressions, and on the basis of which he proposed the thinking-for-speaking hypothesis. According to this hypothesis, "[…] each language provides a limited set of options for the grammatical encoding of characteristics of objects and events. Thinking for speaking involves picking those characteristics that (a) fit some conceptualization of the event, and (b) are readily encodable in the language" (Slobin, 1987, p. 435). In other words, different languages exhibit variations in describing the same motion event. For instance, SFLs tend to use richer and more diverse manner verbs; VFLs tend to describe the physical environment in the narrative, while SFLs pay more attention to describe the dynamics (Slobin, 1996b).

Then, Slobin (2000) extends his theory of thinking-for-speaking to other areas, for example, the thinking-for-translating hypothesis. Slobin (2000) argued that "the translator always faces the problems of thinking for reading and thinking for writing. It is necessary to go from the mental image produced by reading the source language to an appropriate rendering of that mental image in the target language. Translation reveals the extent to which the target language can accommodate itself to the source language, versus assimilating the original to its own patterns of thinking for writing" (2000, p. 123). Thus, Slobin (2003) proposes the "thinking-for-translating hypothesis" to explain the effect of rhetorical differences on the translation of motion events, which we can also understand as some strategies employed by translators when dealing with motion expressions.

The thinking-for-speaking and thinking-for-translating hypotheses have been primarily tested through the study of narrative texts. Molés-Cases (2024) pioneered the integration of multimodal texts into the "thinking-for-translating" hypothesis framework, defining the phenomenon of "thinking-for-audio-describing" as:

> "[…] it is half-way between Thinking-for-speaking (i.e., the end product of AD is affected by language type) and Thinking-for-translating (i.e., audio descriptions are not spontaneous texts and are influenced by constraints derived from the transfer process, e.g., timing)" (Molés-Cases, 2024, p. 292).

Unlike the diversity and richness of other text types in the field of research on the thinking-for-translating hypothesis, there has been less research on multimodal texts such as AD, possibly because of some specific limitations, such as the fact that they: i) need to convey information through both linguistic and acoustic elements; ii) are created based on images; and iii) involve special constraints such as time (Molés-Cases & Feist, 2025).

These studies (Molés-Cases, 2024; Molés-Cases & Feist, 2025) are the basis and source of inspiration for this piece of research.

7.3. Methodology

This study employs a corpus-based approach, integrating qualitative and quantitative methods, to systematically examine the representation of motion events in Chinese and English audio descriptions. In terms of methodology, this study employs qualitative analysis to reveal semantic structure and syntactic feature differences between Chinese and English in expressing motion events. Simultaneously, a quantitative analysis and statistical methods (such as chi-square tests) are utilized to validate these differences (significance of differences). Specifically, by analyzing the quantity, proportion, and diversity of manner- and path-verbs, as well as the distribution of boundary-crossing motion events, the study examines differences in information density and expressive tendencies between the two languages.

7.3.1. Research objects: Motion events in English and Chinese audio-described films

The study focuses on motion events in audio-described films due to the growing global population of blind and visually impaired (BVI) individuals and the increasing need for accessible media. As a major form of cultural entertainment, films should provide equitable access to all audiences; however, because BVI viewers cannot directly perceive visual information, audio description (AD) plays a crucial compensatory role. Among the various types of visual information conveyed through AD, motion events are particularly important, as they include character actions, spatial transitions, and camera movements that are central to narrative development and emotional impact. Consequently, the effectiveness of AD in representing motion events significantly influences the viewing experience of BVI audiences, a point also reflected in existing AD guidelines (Bittner, 2014). Adopting Talmy's (1985) definition of motion events as situations involving movement or maintenance of position, this study focuses on translational self-agentive motion events, in which figures control their own movement and change location(e.g., "The boy runs into the classroom"), as well as local wander within self-contained motion events, where movement occurs within a specific space (e.g., "The boy walks in the park").

7.3.2. Corpus-based research

We selected five films with both Chinese and English audio descriptions. The data was sourced from the audio descriptions of the five films involving motion events. The five films are: *The Pursuit of Happyness*, *Frozen*, *Scent of a Woman*, *The Shawshank Redemption*, and *Rain Man*.

The English audio descriptions of these five films are sourced from Amazon Prime, while the Chinese versions are from Qingting FM. The entire English corpus consists of the English audio descriptions from the five films, while the Chinese corpus consists of the Chinese audio descriptions from the five films. However, since our research focus is on specific motion events, we did not record all the audio descriptions. Instead, while watching the films, we identified motion events that aligned with our research objectives to form our analysis. These fragments were transcribed using an Excel spreadsheet, along with their corresponding time code readers (TCRs). For English units of analysis, we only needed to transcribe the specific motion events, recorded their corresponding TCRs, and noted the time available after the motion event (measured manually in seconds). For Chinese units of analysis, to make them easier to understand for the readers of this thesis, we also needed to translate the transcribed specific motion events into English. To ensure transcription accuracy, we first conduct a manual transcription, then use Otter for a second transcription, and finally record the final transcription results in the spreadsheet.

7.4. Results

In this section, we will conduct a detailed analysis of how motion events are expressed through linguistic mechanisms in an English monolingual corpus (Corpus_EN) and in a Chinese monolingual corpus (Corpus_CH). Our research objective is to compare whether there are differences between Chinese and English in how motion events are described in audio descriptions. We will examine these differences by comparing the lexicalization patterns, amount of motion information, semantic richness, and the influence of boundary-crossing on motion events in both languages. To facilitate reading and data interpretation, we have marked motion events using different colors based on the type of main verbs (indicating manner, path, or general movement) in the motion events.[2]

7.4.1. Lexicalization patterns of motion events

We will elaborate on the lexicalization patterns of motion events observed in the Corpus_EN (comprising English audio descriptions of motion events in five American films) and the Corpus_CH (comprising Chinese audio descriptions of motion events five American films) to compare differences in lexicalization patterns between English ADs and Chinese ADs in expressing motion events.

2 Patterns where the main verbs or verb phrases contain path information are marked in blue, patterns where the main verbs or verb phrases express manner information are marked in green, and patterns where the main verbs or verb phrases simultaneously express both path and manner information are marked in yellow. Other more specific cases are marked in pink.

By watching and listening to the films and manually transcribing ADs, we identify 615 motion events within the scope of our study in the English ADs and 525 motion events in the Chinese ADs. We classify these motion events based on the main verbs they contained and the components beyond the verbs as well. This table shows the lexicalization patterns of the two languages:

Table 7.1. Lexicalization patterns according to the type of main verb.

Lexicalization patterns (main verb)	Corpus_EN	Corpus_CH
Path verb or multiword expression	45.04%	30.86%
Manner verb or multiword expression	47.48%	4.57%
Manner + path verb or multiword expression	1.95%	64.57%
Others (motion verbs, verb omitted, etc.)	5.53%	/

From the above table and data, we can conclude that there are differences in the lexicalization patterns used to express motion events in Chinese and English in the audio descriptions we studied.

First, due to the characteristics of Chinese serial verb construction, Chinese tends to fuse manner and path expressions. In the Chinese corpus, manner verb + path verb (or corresponding multi-word expressions) is the most common lexicalization pattern, accounting for as much as 64.57%. This indicates that in Chinese expressions of motion events, manner information and path information tend to be expressed together in a compound structure rather than separately.

In contrast, English lacks serial verb constructions and typically allows only one main verb slot to encode either manner or path information. As a result, English motion events are most often expressed using either a manner verb (47.48%) or a path verb (45.04%) as the main verb, with the two strategies occurring at nearly equal frequencies. Verbs encoding both manner and path, such as climb, are rare, accounting for only 1.95% of cases. While the dominant pattern—manner verbs with path expressed in satellites—aligns with Talmy's (1985) classification of English as a satellite-framed language, the similarly high frequency of path-verb constructions suggests that English ADs exhibit two competing lexicalization patterns rather than a single dominant one.

7.4.2. Amount of motion information in ADs

In this section, we focus on the differences in the amount of motion information (specifically, path and manner) in the English and Chinese audio descriptions of motion events.

a) *Manner information in ADs*

We first examine the amount of manner information in the Chinese and English audio descriptions of motion events. The table below shows the number of motion events in the English and Chinese ADs of five films, as well as the number of motion events that include manner expressions.

Table 7.2. Motion events in the corpus researched.

Language	Motion events	Manner-of-motion events
English	615	323 [615] (52.52%)
Chinese	525	392 [525] (74.67%)

In Table 7.2, we can see that a total of 615 English motion events and 525 Chinese motion events were identified in the corpus studied. The number of motion events identified in English was slightly higher than that in Chinese. Further analysis of the manner information contained in the motion events revealed that in the Chinese corpus, events containing manner information accounted for 74.67% of all motion events, a percentage significantly higher than the 52.52% in the English corpus. $\chi^2(df = 1) = 59.86$, $p < 0.001$[3], indicating that there is a significant difference in the amount of motion information (here primarily referring to manner information) between Chinese and English audio descriptions.

b) Use of verbs in ADs

After observing the amount of information about motion events and their expression of manner in the Chinese and English corpora, we turned our attention to the expression of manner and path information in motion events. First, we looked at the use of verbs in the audio descriptions included in the Corpus_EN and the Corpus_CH:

Table 7.3. Distribution of verb types and tokens in ADs in English and Chinese.

Language	Path verbs and multiword expressions	Manner verbs and multiword expressions	Manner and path verbs and multiword expressions	Motion verbs and multiword expressions
English	34(277)	76(292)	3(12)	2(34)
Chinese	57(481)	25(341)	2(21)	-

3 We introduce the chi-square test here, a commonly used non-parametric statistical method, considering that our data are in the form of frequencies/counts rather than continuous data such as means and standard deviations, and we want to test whether there is a statistically significant association between two or more categorical variables (i.e., categorical variables) (Cantos Gómez, 2013). Therefore, we use the chi-square test.

This table reveals clear cross-linguistic differences between Chinese and English ADs. In terms of frequency, Chinese ADs favor path verbs (481 tokens) over manner verbs (341), whereas English ADs show the opposite tendency, with manner verbs (292) outnumbering path verbs (277); this distributional difference is statistically significant ($\chi^2(3)=61.33$, $p<0.001$). Differences are also evident at the type level: English ADs contain a greater variety of manner verbs (76 types) than path verbs (34), while Chinese ADs exhibit more path verb types (57) than manner verb types (25), with the contrast again reaching significance ($\chi^2(3) = 29.24$, $p < 0.001$). Although Chinese manner verbs occur more frequently, their lexical diversity is limited, suggesting repeated use of a relatively small set of verbs across contexts, whereas English employs a wider range of manner verbs to encode distinct motion scenarios. Conversely, Chinese demonstrates greater lexical richness in the encoding of path information, as reflected in both the higher frequency and broader range of path verbs. Overall, these findings indicate systematic differences between English and Chinese in both the distribution and lexicalization of motion event components in AD.

c) Other linguistic resources to express manner

In addition to using verbs to encode manner information, we also observe other linguistic resources that express manner information,

Table 7.4. Encoding of manner across the description in ADs in English and Chinese.

Language	Manner verb	Manner outside verb	Manner encoded both places
English	280	21	24
Chinese	295	30	64

From the previous data, we could see that this is indeed the case. English and Chinese audio describers not only frequently use manner verbs to encode motion events but also add additional manner information outside the verb position to enhance the manner information in motion event descriptions. In fact, Chinese adds additional manner information outside the verb position at a frequency nearly three times higher than English, $\chi^2(df = 2) = 14.54$, $p < 0.001$. We consider this may be due to differences in the semantic richness of manner verbs between the two languages. Since Chinese manner verbs are not as diverse as English manner verbs, when audio describers from both languages describe the same scene, Chinese audio describers need to add additional manner information to ensure consistency of information.

7.4.3. Verb lexicon of manner in the languages examined

As we have observed in the corpora examined, there are differences in the diversity of manner verbs between Chinese and English. In this section, we will focus on the manner verb lexicon of the two languages. The figure below shows the types and tokens of manner verbs in the two corpora:

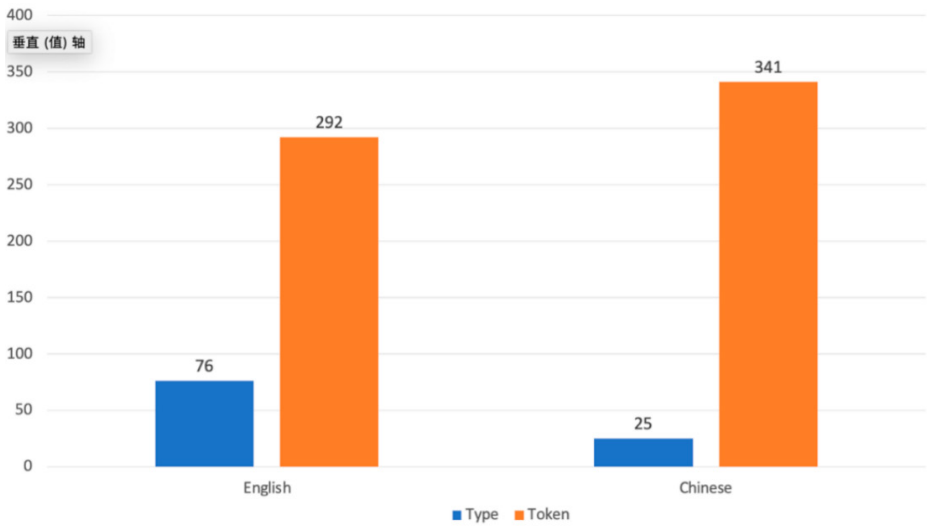

Figure 7.1. Variety and quantity (types and tokens) of manner verbs.

According to Figure 7.1, although the number of manner verbs in the English and Chinese ADs is not significantly different, there are 341 manner verbs in the Chinese corpus and 292 in the English corpus. However, the types in the two languages differ significantly. In the English corpus, 76 types of manner verbs are identified, whereas only 25 distinct types are found in the Chinese corpus. This means that the number of manner verb types in English is nearly three times that of Chinese. The data shows that there are significant differences in semantic richness between Chinese and English ADs when expressing manner in motion events.

7.4.4. The influence of boundary-crossing on the expression of motion events

Aske (1989) and Slobin and Hoiting (1994) point out that boundary-crossing events affect the expression of motion events in different types of languages. According to this theory, ideally, boundary-crossing situations should not affect the expression of manner information in English ADs. However, there is currently no relevant research on whether boundary-crossing situations affect the expression of motion events in Chinese, a language with a serial verb construction. Therefore, to investigate the influence of boundary-crossing situations on the expression of motion events and to more accurately

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describe typological patterns, we deem it necessary to consider whether the motion expressed in motion events involves boundary-crossing situations (Aske, 1989; Slobin & Hoiting, 1994).

In the Corpus_EN, we observe a total of 225 motion events that include boundary-crossing. Among them, 100 motion events contain manner information, whilst 125 do not. we will observe the types of main verbs in these motion events with boundary-crossing,

Table 7.5. Motion events involving boundary-crossing in the Corpus_EN, classified according to the type of their main verb.

Boundary-crossing	Events	%
Manner verb or multiword expression	86	38.2
Path verb or multiword expression	127	56.4
Manner and path verb or multiword expression	7	3.1
Others (motion verbs, etc.)	5	2.2
Total	225	100

And in the Corpus_CH, we observe a total of 177 motion events that include boundary-crossing. Among them, 119 motion events contain manner information, while 58 do not. Similarly, we observe the types of main verbs in these motion events that include boundary-crossing,

Table 7.6. Motion events involving boundary-crossing in the Corpus_CH, classified according to the type of their main verb.

Boundary-crossing	Events	%
Manner and path verb or multiword expression	112	63.28
Path verb or multiword expression	65	36.72
Total	177	100

Table 7.7. The expression of manner information in motion events with boundary-crossing.

Language	Boundary-crossing events	Boundary-crossing events (with manner)
English	225	100[225](44.44%)
Chinese	177	119[177](67.23%)

A comparative analysis of boundary-crossing motion events reveals systematic differences in verb selection between English and Chinese. In the English corpus, path-verb–dominated structures are most frequent (56.4%), followed by the typical satellite-framed pattern dominated by manner verbs (38.2%), suggesting that although English is typologically inclined to encode motion via manner, boundary-crossing semantics favor the prominence of path verbs. This pattern partially departs from Talmy's (1985) typology but aligns with findings by Aske (1989) and Slobin and Hoiting (1994) that boundary-crossing events attract explicit path encoding. In contrast, Chinese exhibits a consistently path-oriented pattern, with serial verb constructions combining manner and path verbs accounting for 63.28% of cases, and path-only structures comprising the remaining 36.72%, indicating that path verbs are indispensable in such events while manner verbs are optional and context-dependent. Overall, English shows limited typological mixing under semantic constraints, whereas Chinese maintains a stable path-based strategy, reflecting how each language balances typological tendencies with semantic demands in the lexicalization of motion events.

7.5. Conclusions

We systematically analyzed motion events in Chinese and English ADs from four dimensions: lexicalization patterns, amount of motion information, semantic richness, and boundary-crossing. The results show that there are indeed significant differences between English and Chinese in the way their users (specifically here, audio-describers) express motion events.

First, in terms of lexicalization patterns, Chinese ADs and English ADs exhibit distinct differences in how they encode motion events. In English ADs, we observe two primary lexicalization patterns. The more common pattern involves using a manner verb as the main verb, while encoding path information within satellite structures. The other, less common pattern uses path verbs as core verbs, with manner information encoded as optional elements within the satellite structure. Then, in Chinese ADs, we also identify the primary lexicalization pattern: serial verb constructions. In this verb structure, path verbs and manner verbs coexist, forming a compound verb structure that occupies the primary verb slot in the motion event. This lexicalization pattern is very common in the expression of motion events in Chinese, accounting for over half of all cases.

Second, there are also significant differences in the amount of motion information expressed in Chinese and English motion events. Specifically, the proportion of manner information in Chinese ADs is significantly higher than that in English ADs. Although this finding is somewhat unexpected, it can be explained to some extent from a typological perspective. Although we have not yet clearly categorized the typological features of Chinese, considering that English, as a typical SFL, is generally regarded as a high manner-salient language, the performance of Chinese in this study demonstrates a stronger tendency toward manner expression.

Then, we observe that Chinese and English also have significant differences in semantic richness in ADs. Semantic richness is specifically reflected in manner verbs. We analyze manner verbs in Chinese and English motion events and find that although both languages tend to use manner verbs in motion events, English has a richer and more diverse manner verb lexicon than Chinese.

Finally, although boundary-crossing situations do not affect the expression of manner information in English and Chinese in motion events, we also observe differences in the lexicalization patterns of the two languages when expressing boundary-crossing events. In the English corpus, motion events with boundary-crossing can be encoded by manner verbs or path verbs, but in the Chinese corpus, boundary-crossing events must rely on path verbs.

The present study provides an initial corpus-based account of how motion events are linguistically encoded in English and Chinese audio descriptions (ADs), promoting cross-cultural communication.

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Capítulo 8
Traductores: entre la alta tecnología y la baja ergonomía

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8.1. Introducción

A partir de la segunda mitad del siglo xx, la ergonomía se consolidó como una disciplina científica. Los primeros estudios de este campo se centraron en comprender mejor cómo las personas interactúan con las máquinas, las herramientas y los entornos de trabajo, con el objetivo de optimizar la eficiencia de los trabajadores y reducir el riesgo de lesiones en estos (Salvendy y Karwowski, 2021, p. xv). Con la llegada de la informática y la tecnología digital en las décadas de 1970 y 1980, la ergonomía se expandió para abordar los desafíos relacionados con la interacción persona-ordenador. En la actualidad, la ergonomía se ha convertido en un campo global y mucho más amplio, con aplicaciones en una gran variedad de sectores, que van desde las líneas de producción industriales hasta las ciencias de la salud, pasando por la aviación o el diseño de productos (Karwowski, 2012, pp. 3-4). En definitiva, la ergonomía se ha vuelto un pilar fundamental en la creación de entornos de trabajo seguros, saludables y productivos, así como para el crecimiento y el desarrollo empresariales (Marras, 2012; Kufre et al., 2023).

Las estaciones de trabajo altamente tecnologizadas se han convertido en la norma para la mayoría de los trabajos de oficina, entre los que se encuentran la traducción y las profesiones afines (O'Hagan, 2020). Actualmente, los profesionales de la traducción utilizan las pantallas de visualización de datos (PVD)[1] de forma intensiva y necesitan contar con conocimientos informáticos avanzados, además de tener que estar familiarizados con las tecnologías de la traducción[2] (Ehrensberger-Dow, 2019, p. 40). No obstante, a pesar del uso extendido de los ordenadores y otros dispositivos digitales, así como el fácil acceso a estos por parte de la población general, no siempre es habitual contar con una estación de trabajo cuyas condiciones sean óptimas para los usuarios desde un punto de vista ergonómico (Ehrensberger-Dow, 2019). El objetivo del presente capítulo es reflexionar en torno a las condiciones ergonómicas en la formación de traductores en España mediante el análisis de las guías docentes (GD) de las asignaturas que componen los grados de Traducción e Interpretación (TeI) en España y la observación directa de un grupo de alumnado de uno de dichos grados.

A continuación, se abordan los conceptos clave relativos a la ergonomía en el puesto de trabajo, poniendo el foco en cómo estos principios se aplican al ámbito de la traducción y las profesiones afines. En el apartado 8.3, se describe el diseño del estudio y el enfoque metodológico adoptado, con el análisis de contenido y la observación directa como métodos de recopilación de datos, y se analizan y discuten los resultados de forma exhaustiva.

8.2. Ergonomía en la estación de trabajo

Según la International Ergonomics & Human Factors Association (IEA), la ergonomía es la disciplina científica que se ocupa de comprender las interacciones entre humanos y otros elementos de un sistema, y la profesión que aplica teorías, principios, datos y métodos para diseñar con el objetivo de optimizar el bienestar humano y el rendimiento general del sistema (IEA, 2000).

Existen varias corrientes para clasificar los tipos de ergonomía que existen, en función del objeto u objetivo al que se aluda para su clasificación. Así pues, encontramos clasificaciones de la ergonomía según el objetivo de la intervención (ergonomía preventiva y ergonomía correctiva), según el enfoque de aplicación (microergonomía y macroergonomía) y según el ámbito de aplicación (Oliver Hernández, 1996). Si atendemos a este último objeto, la ergonomía se puede clasificar en ergonomía cognitiva, organizacional y física.

[1] Según el Real Decreto 488/1997, de 14 de abril, sobre disposiciones mínimas de seguridad y salud relativas al trabajo con equipos que incluyen pantallas de visualización, las pantallas de visualización de datos son aquellas pantallas alfanuméricas o gráficas, independientemente del método de representación visual utilizado.

[2] A efectos del presente capítulo, entendemos las tecnologías de la traducción en la línea de la propuesta de O'Brien y Rodríguez Vázquez (2019, p. 264), según las cuales estas incluyen una amplia gama de herramientas informáticas que ayudan a los profesionales de la traducción a llevar a cabo su trabajo. Entre estas, encontramos los editores de textos; los correctores ortográficos, gramaticales y de estilo; internet; las herramientas de compilación y análisis de corpus; las herramientas de gestión terminológica; las herramientas de traducción asistida por ordenador; los sistemas de gestión de proyectos; y la traducción automática.

La ergonomía cognitiva analiza los procesos mentales, como la percepción, la memoria, el razonamiento y la respuesta motora, ya que afectan a las interacciones entre los seres humanos y otros elementos del sistema (por ejemplo, la carga mental, la toma de decisiones, la interacción persona-ordenador, el estrés laboral o la formación). Por su parte, la ergonomía organizacional se ocupa de la optimización de los sistemas sociotécnicos, en los que se incluyen las estructuras, las políticas y los procesos organizacionales (por ejemplo, la comunicación, la gestión de recursos, el diseño y la distribución del trabajo, el diseño de las jornadas laborales, el trabajo en equipo y cooperativo, los nuevos paradigmas laborales, los entornos virtuales, el teletrabajo y la gestión de la calidad). Por último, la ergonomía física se ocupa de las características anatómicas, antropométricas, fisiológicas y biomecánicas del ser humano en relación con la actividad física que este desempeña (por ejemplo, la manipulación de materiales, los movimientos repetitivos, los trastornos musculoesqueléticos relacionados con el puesto de trabajo, la distribución del puesto de trabajo, la seguridad laboral y la salud física) (IEA, 2000).

Son estos dos últimos tipos de ergonomía (organizacional y física) los que cobran especial relevancia para nuestro estudio, ya que son los que afectan de manera directa al puesto de trabajo físico de los profesionales de la traducción. Esto se debe a que la actividad traductora implica largos periodos frente a dispositivos electrónicos y PVD, posturas estáticas y la realización de movimientos repetitivos que, si no se abordan adecuadamente, pueden derivar en lesiones musculoesqueléticas.

Varios estudios han demostrado que las estaciones de trabajo diseñadas de forma ergonómica tienen como resultado una mayor productividad y calidad, así como una mayor seguridad en el puesto de trabajo (Dainoff et al., 2012, p. 1557; INSST, 2020, p. 10) gracias, entre otras cuestiones, al alivio de las molestias físicas ocasionadas por el uso de una estación de trabajo poco ergonómica (Fischer y Woodcock, 2011) Para lograrlo, es necesario poner en marcha mecanismos que tengan como objetivo el diseño de tareas, estaciones de trabajo, herramientas, equipos y organizaciones que reduzcan los factores de riesgo que pueden provocar molestias y lesiones en los usuarios. Además, en el caso de los traductores y los profesionales afines, esta prevención no solo mejora su bienestar físico, sino que también favorece una mayor capacidad de concentración y rendimiento cognitivo, factores esenciales para la calidad de su trabajo (Ehrensberger-Dow, 2019).

8.2.1. Ergonomía organizacional y física en el sector de los servicios lingüísticos

El «teletrabajo» se refiere a un tipo de trabajo en el que los profesionales trabajan desde sus casas en lugar de hacerlo en las instalaciones del empleador (Sigmund y Sladek, 2021, p. 2). El teletrabajo aprovecha de buen grado la flexibilidad que ofrece el equipamiento tecnológico que se utiliza de forma habitual en el puesto de trabajo (ordenadores de sobremesa, portátiles, tabletas, teléfonos móviles, etc.) y la inexistencia de límites impuestos por un lugar físico de trabajo común.

Para los profesionales de la traducción, el teletrabajo es una realidad desde hace muchísimos años (Ehrensberger-Dow, 2019). A pesar de que la traducción profesional no suele considerarse, por lo general, una actividad física, un estudio llevado a cabo por Maureen Ehrensberger-Dow y Gary Massey (2014, p. 72) en el que se monitorizaron los movimientos de varios profesionales del sector, reveló que, de media, estos escribieron aproximadamente 1000 caracteres y espacios y realizaron más de 80 clics del ratón en 15 minutos. Por otra parte, según las conclusiones de otro estudio llevado a cabo por Ehrensberger-Dow y Hunziker Heeb (2016, p. 12) en el que estudiaron las condiciones ergonómicas de la estación de trabajo de traductores y traductoras que trabajan en diferentes modalidades laborales, con distintos grados de control sobre su flujo de trabajo, en varios entornos y usando herramientas de traducción asistida por ordenador (TAO), sería conveniente poner el foco en los recursos, las herramientas, los entornos, los equipos y los sistemas organizativos ergonómicos con el objetivo de proporcionar información valiosa y fiable que ayudase a estos y estas profesionales, así como a las empresas, a diseñar estaciones de trabajo, herramientas y flujos de trabajo más orientados a los usuarios. Así pues, dado que estos profesionales pasan gran parte de su jornada laboral interactuando con ordenadores y PVD, la ergonomía organizacional y la física resultan de vital importancia en su día a día, tanto si trabajan desde sus casas como si lo hacen desde instalaciones de terceros.

Las estaciones de trabajo de los profesionales de la traducción suelen estar compuestas por equipos de sobremesa u ordenadores portátiles que, en muchos casos, se utilizan a modo de equipo de sobremesa (Ehrensberger-Dow, 2019). Hay numerosos estudios que revelan que las personas que manejan ordenadores y PVD están más cómodas y sufren menos molestias si sus estaciones de trabajo están ajustadas de forma adecuada a su cuerpo, es decir, si son ergonómicas (Dainoff et al., 2012, p. 1562; Ehrensberger-Dow et al., 2016). En este sentido, las PVD han sido objeto de cierta preocupación, ya que su uso en muchos sectores (entre los que se incluye la traducción y las profesiones afines) se ha vuelto prácticamente universal. Las PVD mejoran la productividad y simplifican el trabajo, pero también tienen el potencial de causar problemas cuando se combina un diseño deficiente de la estación de trabajo con largas jornadas de manipulación de estas (Dainoff et al., 2012, p. 1557). Y es que, en nuestro día a día como profesionales, pasamos muchas más horas de las recomendadas en posturas frente al ordenador que no resultan nada beneficiosas para nuestra salud, tanto a corto, a medio como a largo plazo (Ijmker et al., 2007; Ehrensberger-Dow et al., 2016).

Se podría afirmar que, en términos generales, las condiciones laborales en que desempeñan su actividad los profesionales de la traducción no siempre son óptimas para el trabajo intensivo con textos (por ejemplo, tener a otras personas hablando y moviéndose alrededor, tener otros ruidos ambientales, contar con una iluminación o temperatura incómodas, tener un diseño inadecuado del escritorio, una silla que no se adapte a la persona, realizar movimientos repetitivos con el ratón o el teclado, o permanecer muchas horas en postura sedente) (Ehrensberger-Dow et al., 2016, p. 2; Ehrensberger-Dow, 2019, p. 38). Además, teclear y utilizar otros dispositivos de entrada son actividades que implican mucho más que las manos o los antebrazos: la repetición constante del movimiento también puede causar una sobrecarga muscular en las extremidades superiores y la espalda y provocar molestias y lesiones, como tendinitis en las manos y las muñecas, síndrome del túnel carpiano o síndrome del túnel cubital (Lavault-Olléon, 2011; Dainoff et al., 2012, p. 1554-1556; Ehrensberger-Dow, 2019, p. 38). Este problema se agrava cuando las jornadas laborales son largas y se carece de una correcta formación sobre ergonomía para configurar la estación de trabajo de forma adecuada.

8.3. La estación de trabajo del estudiantado de TeI en España

Desde que, en marzo de 2020, la Organización Mundial de la Salud (OMS) declaró la pandemia provocada por la COVID-19 (OMS, 2020), se implementaron acciones a nivel mundial para evitar la transmisión del virus, alertar a la población sobre los riesgos de la enfermedad que este provocaba y atender los casos detectados. Como consecuencia de ello, el teletrabajo pasó a ser una realidad que, en muchos sectores, llegó para quedarse. Tal y como hemos comentado anteriormente, la traducción es una profesión en la que el teletrabajo (o el trabajo de oficina interactuando con un ordenador) lleva años siendo una realidad. Los profesionales de este sector trabajan habitualmente desde casa, en oficinas más o menos adaptadas a sus necesidades.

No obstante, desde el punto de vista de la investigadora que firma el capítulo, con experiencia profesional previa como traductora desde 2012 y como docente en grados de TeI desde 2016, se detectó que, durante los meses de confinamiento en que el estudiantado tuvo que trabajar desde sus casas, las condiciones ergonómicas (especialmente las físicas) del día a día de estas personas no eran las adecuadas. Por ello, se consideró adecuado, por una parte, analizar si el estudiantado de TeI en España recibe algún tipo de formación reglada en materia de ergonomía y, en caso afirmativo, de qué tipo; y, por otra parte, observar directamente a un grupo de alumnado de uno de dichos grados.

8.3.1. Diseño del estudio

El presente estudio adopta una metodología de investigación mixta que combina métodos cualitativos y cuantitativos para ofrecer una visión amplia y matizada de las condiciones ergonómicas que caracterizan el entorno de trabajo del estudiantado del grado en TeI en España. El objetivo central es analizar en qué medida los futuros profesionales de la traducción están sensibilizados y preparados, desde su formación universitaria, para desarrollar su actividad en condiciones físicas que respeten los principios básicos de la ergonomía. Para ello, se han articulado dos fases diferenciadas, cada una con su propio enfoque metodológico: por un lado, un análisis de contenido de GD (fase A); y, por otro, una observación directa del alumnado en el aula universitaria (fase B).

8.3.1.1. Fase A: análisis de contenido a partir de un corpus de GD

En la primera fase del estudio (fase A), se llevó a cabo un análisis de contenido de carácter cualitativo, complementado por una cuantificación de resultados. Esta fase se centró en examinar la presencia (o ausencia) de referencias a cuestiones relacionadas con la ergonomía en las GD de las asignaturas que componen los planes de estudios de los grados de TeI en universidades españolas. La muestra se obtuvo a partir de un corpus previamente recopilado para un estudio anterior, centrado en el análisis de elementos relacionados con las tecnologías de la traducción en los planes de estudios vigentes durante el curso académico 2019-2020 en España (véase Sánchez-Castany, 2022). En total, se identificaron 32 planes de estudios de TeI distribuidos entre 29 universidades, tanto públicas como privadas, que ofrecían el grado en ese momento. Estas titulaciones comprendían un total de 2931 asignaturas, cuya documentación, en forma de GD, se buscó en los portales web institucionales correspondientes.

Para la conformación definitiva de la muestra, se aplicaron tres criterios de selección: en primer lugar, se incluyeron únicamente las GD que pertenecían efectivamente a alguno de los planes de estudios identificados; en segundo lugar, se exigió que dichas guías estuvieran disponibles públicamente en línea, condición necesaria tanto por razones éticas como de transparencia metodológica; en tercer lugar, se excluyeron del análisis las asignaturas puramente teóricas, las asignaturas de enseñanza de lenguas extranjeras y las asignaturas de interpretación, dado que no suelen implicar el uso prolongado de tecnologías de la traducción ni de estaciones de trabajo habituales informatizadas en la misma medida que otras tipologías. De este modo, la muestra final quedó constituida por 994 asignaturas, mientras que se descartaron 1937.

Una de las principales dificultades metodológicas con las que se enfrentó el análisis fue la gran heterogeneidad formal de las GD. A pesar de que estas constituyen documentos oficiales de planificación y evaluación de la docencia universitaria, su estructura y contenido no están regulados de forma homogénea en la legislación española. De hecho, no existe un formato normativo único que especifique qué apartados deben incluir, lo que provoca una notable variabilidad entre universidades —e incluso dentro de una misma institución— en cuanto al grado de detalle, la terminología empleada o la organización del contenido. No obstante, fue posible identificar una serie de apartados comunes a la mayoría de las guías analizadas, que sirvieron como referencia para la codificación del corpus: información general de la asignatura, competencias, contenidos, metodología, resultados de aprendizaje y sistema de evaluación.

El análisis de contenido se centró en detectar en estos apartados cualquier mención explícita o implícita a elementos relacionados con la ergonomía, la salud laboral, el confort físico en el trabajo con tecnologías, o el diseño de entornos digitales de aprendizaje y producción textual. Para ello, se elaboró una plantilla de codificación abierta que permitió registrar las referencias pertinentes sin forzar su clasificación prematura. El procedimiento de análisis se basó en una lectura exhaustiva y sistemática de cada guía a través del *software* de análisis cualitativo Atlas.ti.[3]

Aunque el objetivo de esta fase era primordialmente cualitativo —explorar si se enuncia la dimensión ergonómica en la formación universitaria en traducción—, también se procedió a una cuantificación básica de los resultados. Así, se contabilizó el número total de asignaturas que contenían alguna referencia relacionada con la ergonomía, y se clasificaron los tipos de referencia según la sección de la GD en la que aparecían y su grado de especificidad.

8.3.1.2. Fase B: observación directa en el aula

La segunda fase del estudio (fase B) se basó en la observación directa del alumnado del grado de TeI de la Universitat Jaume I (UJI) durante los cursos académicos 2020-2021 y 2021-2022. Esta observación se llevó a cabo desde una perspectiva docente-investigadora y en calidad de profesora responsable de asignaturas en las que el alumnado trabajaba regularmente con tecnologías de la traducción, como herramientas de traducción asistida por ordenador (TAO), procesadores de textos o herramientas de traducción automática (TA). La observación no se estructuró como un experimento ni como una recogida de datos cuantitativos mediante rúbricas o *checklists*, sino como una recogida sistemática de evidencias cualitativas en el aula, a partir de situaciones reales de trabajo académico.

La posición de la investigadora permitió identificar patrones recurrentes en el comportamiento del alumnado, así como en la configuración de su entorno de trabajo. Entre los aspectos observados, se incluyen: la disposición del equipamiento (ordenadores portátiles, periféricos, mobiliario), la postura adoptada durante el trabajo prolongado frente a la pantalla, el uso (o la falta de este) de elementos ergonómicos como elevadores, cojines o ratones externos, y la manifestación de quejas relacionadas con la fatiga, el dolor físico o el malestar durante las sesiones de aula.

Cabe destacar que la observación se desarrolló en un entorno de docencia práctica, tanto presencial como en línea, lo que permitió contrastar la ergonomía del entorno físico en el aula universitaria con la del espacio de trabajo doméstico del estudiantado, especialmente durante los periodos de docencia síncrona remota. Esta comparación entre entornos físicos distintos fue especialmente reveladora, ya que puso de manifiesto no solo la precariedad de muchas estaciones de trabajo domésticas, sino también la escasa conciencia que el alumnado tenía respecto a la importancia de una configuración ergonómica adecuada para prevenir riesgos físicos y cognitivos asociados al uso prolongado de ordenadores y PVD.

Si bien esta segunda fase no puede generalizarse en términos estadísticos, su valor reside en la riqueza contextual de la información obtenida y en su complementariedad con los datos documentales recogidos en la fase anterior. La triangulación entre el análisis

[3] Atlas.ti. <https://atlasti.com/es> Consulta: 22 de septiembre de 2025.

documental de contenido y la observación directa en el aula permite elaborar una panorámica más sólida de la situación actual, en la que la dimensión ergonómica del trabajo traductor se encuentra ampliamente desatendida, tanto en la formación como en la práctica cotidiana del estudiantado.

En conjunto, esta metodología mixta ha permitido identificar lagunas formativas concretas, evaluar la sensibilidad del estudiantado hacia su propio entorno de trabajo y reflexionar sobre la necesidad de integrar la ergonomía en los planes de estudios universitarios como medida preventiva, además de como componente estructural de la competencia traductora en un contexto profesional totalmente tecnologizado.

8.3.2. Desarrollo del estudio

El desarrollo del estudio se llevó a cabo a través de las dos fases descritas en el apartado anterior, que se implementaron de manera secuencial y complementaria. La primera de ellas consistió en un análisis de contenido de GD y la segunda en una observación directa del comportamiento y las condiciones físicas del alumnado del grado de TeI de la UJI. Ambas fases se diseñaron con el objetivo común de evaluar el grado de presencia de la dimensión ergonómica en la formación de futuros traductores y traductoras, tanto desde un enfoque institucional como desde una perspectiva experiencial situada.

En la fase A, una vez compilado el corpus de 994 GD pertenecientes a los 32 planes de estudios del grado en TeI ofertados en el curso 2019-2020, se procedió a la creación de un proyecto de análisis cualitativo en Atlas.ti para sistematizar el proceso de lectura y análisis de contenido de cada uno de los documentos. La distribución geográfica de los planes de estudios incluía tanto universidades públicas como privadas de distintas comunidades autónomas, lo que proporcionó una muestra representativa del panorama nacional. La mayoría de las guías se encontraban disponibles en los portales institucionales o en los repositorios de los departamentos, y se ofrecían en formato PDF o HTML, cosa que permitía explorarlas mediante lectura y búsqueda por palabras clave.

Para facilitar la detección de contenidos potencialmente relacionados con la ergonomía, se elaboró una lista preliminar de términos y expresiones clave que podrían señalar algún tipo de referencia relevante. Esta lista incluía, entre otros, «ergonomía», «bienestar», «salud laboral», «puesto de trabajo», «estación de trabajo», «pantalla», «monitor», «teclado», «silla», «mesa», «iluminación», «postura», «postural», «pausa», «dolencias», «confort» o «ambiente físico». También se tuvieron en cuenta menciones indirectas a la organización del entorno de trabajo digital, especialmente en asignaturas vinculadas al uso de tecnologías de la traducción.

La fase B, centrada en la observación directa, tuvo lugar en los laboratorios que el departamento de Traducción y Comunicación de la UJI, así como en las estaciones de trabajo propias del estudiantado, en el contexto de una asignatura de tecnologías de la traducción impartida entre 2020 y 2022. La investigadora desarrolló un seguimiento continuado del comportamiento y las condiciones de trabajo del alumnado a lo largo de las sesiones prácticas, lo que permitió recoger una serie de evidencias empíricas relacionadas con las rutinas de trabajo, la disposición del mobiliario y los recursos utilizados por el alumnado.

En paralelo a esta observación informal, se ofreció al alumnado de todo el grado de TeI de la UJI un curso breve centrado en nociones de ergonomía aplicadas a la traducción, cuya inscripción exigía responder a un cuestionario inicial de autodiagnóstico, seguido por otros siete formularios complementarios sobre distintos elementos del entorno de trabajo: monitor, ratón, teclado, silla, mesa, iluminación y temperatura. A través de esta herramienta de recogida de datos, se obtuvieron resultados cuantitativos valiosos que complementaron la observación cualitativa en el aula, y que se analizarán en detalle en otra publicación.

8.3.3. Análisis de los resultados

Los resultados obtenidos en el marco de este estudio permiten esbozar un panorama claro —y, en algunos aspectos, preocupante— sobre la escasa presencia de contenidos ergonómicos en la formación universitaria en TeI en España, así como sobre las condiciones reales de trabajo del alumnado en sus espacios de estudio, tanto presenciales como domésticos. A través de un enfoque dual que combina el análisis de contenido de GD (fase A) y la observación directa en el aula (fase B), se constata que la dimensión ergonómica del trabajo traductor está ampliamente desatendida, tanto desde el diseño curricular como desde las prácticas cotidianas de los estudiantes.

8.3.3.1. Fase A: análisis de contenido de las GD

El corpus analizado, compuesto por 994 GD correspondientes a asignaturas de los planes de estudios de 32 titulaciones de TeI ofrecidas en 29 universidades españolas, arrojó un total de 31 citas relevantes relacionadas con la ergonomía. Aunque el número absoluto de menciones pueda parecer significativo en un primer vistazo, el análisis cualitativo de su contenido y distribución revela una situación muy distinta: estas menciones son escasas, repetitivas y mayoritariamente concentradas en unos pocos centros universitarios, lo que limita considerablemente su representatividad a nivel nacional.

Del total de citas, 15 aparecen en el apartado de «Competencias» y proceden todas de diferentes asignaturas de traducción impartidas en la Universidad Complutense de Madrid (UCM). Todas ellas reproducen, con ligeras variaciones, un mismo enunciado: «Conocer las características del puesto de trabajo y de las herramientas informáticas del traductor y el intérprete». Este tipo de formulación, aunque en principio relevante, presenta una notable ambigüedad. No especifica qué se entiende por «características del puesto de trabajo», ni tampoco si dicha competencia incluye contenidos relacionados con la postura, el mobiliario, la iluminación o cualquier otro elemento físico del entorno laboral. Además, esta competencia no suele acompañarse de actividades formativas ni evaluativas concretas que permitan desarrollar o comprobar su adquisición. Su presencia, por tanto, parece responder más a una fórmula estándar que a una preocupación curricular genuina por la ergonomía.

En el apartado de «Contenidos» se identificaron 12 menciones, repartidas entre varias universidades: Universidad de Alicante (UA), UCM, UJI, Universidad de Murcia (UMU), Universidad Europea del Atlántico (UNE), Universidad Pontificia de Comillas (UPC) y Universidad de Vigo (UVigo). Algunas asignaturas, como las de informática aplicada o herramientas tecnológicas, incluyen apartados que aluden a la «estación de trabajo del traductor» (n=6), a la «ergonomía» (n=4) o al «*hardware* básico» (n=2). En estos casos, las referencias tienden a enmarcarse en listados de contenidos sin desarrollo adicional, por lo que no es posible conocer cómo se materializan, desde el punto de vista didáctico, dichos contenidos en el aula. Las menciones más desarrolladas se encuentran en asignaturas como «Traducción general directa C-A», de la UA, donde se incluye un tema específico titulado «La estación de trabajo del traductor: panorama actual», o en las asignaturas de «Documentación aplicada», de la UJI y la UNE, donde se hace referencia a la «*workstation*» como objeto de análisis. En términos generales, sin embargo, la presencia de contenidos ergonómicos en este apartado sigue siendo anecdótica y secundaria respecto a otros temas tecnológicos.

En el apartado «Objetivos», únicamente se encontró una cita, correspondiente a la asignatura «Tecnologías aplicadas a la traducción y la interpretación I», de la UCM, que establece como uno de sus objetivos «familiarizarse con la configuración física y lógica de la estación de trabajo de un traductor o intérprete y aprender a personalizarla para ser más productivo y eficiente». Aunque este enunciado reconoce explícitamente la relación entre la configuración física del entorno y la productividad, su escasa presencia en el corpus de estudio limita su impacto formativo real.

En cuanto al apartado de «Resultados de aprendizaje», se identificó también una sola cita, en la asignatura de «Gestión y normalización de proyectos de traducción», de la UPC, que menciona que el alumnado «Dispone de nociones de ergonomía». Este tipo de formulación plantea dudas similares a las que ya se han mencionado: ¿qué se considera una «noción de ergonomía»? ¿Cómo se adquiere? ¿Cómo se evalúa?

Finalmente, bajo el epígrafe «Otros», se recogieron dos citas de la Universidad de Valladolid (UVA), ambas procedentes de la asignatura «Informática aplicada a la traducción». Estas menciones, si bien indirectas, son particularmente relevantes porque vinculan el conocimiento del *hardware* con la adaptación del entorno a las necesidades del traductor, y hacen referencia explícita al mantenimiento del equipo en condiciones óptimas. Esta relación entre equipo informático y confort en el trabajo podría servir como punto de partida para una integración más sistemática de contenidos ergonómicos en asignaturas de tecnologías de la traducción.

Por último, cabe destacar que una de las observaciones más reveladoras de esta fase fue la omisión sistemática del bienestar físico en las GD, ya que la práctica totalidad de las guías se centraban en competencias traductoras, lingüísticas, documentales o tecnológicas, pero sin incorporar ninguna dimensión relacionada con la salud ocupacional, la prevención de riesgos o la configuración de un entorno de trabajo sostenible.

En resumen, los resultados de la fase A ponen de relieve que la ergonomía ocupa un lugar residual, fragmentario y poco sistematizado en los planes de estudios de los grados de TeI en España. En este sentido, cabe destacar que las menciones encontradas carecen en su mayoría de desarrollo pedagógico o implementación práctica, y no se traducen en objetivos de aprendizaje claramente definidos ni en actividades formativas específicas. Además, su concentración en ciertas universidades —en particular en la UCM— y su reiteración textual indican que no responden a una preocupación transversal en el diseño curricular del grado.

8.3.3.2. Fase B: observación directa del alumnado

Los resultados obtenidos mediante la observación en el aula confirman y amplifican los resultados de la fase anterior. A lo largo de varios cursos académicos (2020-2021 y 2021-2022), se ha constatado de forma sistemática que la mayoría del alumnado del grado de TeI trabaja con configuraciones físicas poco ergonómicas, tanto en el aula universitaria como en sus espacios de estudio domésticos.

En primer lugar, se observó que prácticamente la totalidad del alumnado hace uso exclusivo de ordenadores portátiles que se colocaban directamente sobre el pupitre del aula, sin la integración de monitores, elevadores, teclados ni ratones externos. Esta elección, habitual por razones de movilidad y economía, conlleva posturas forzadas durante largas jornadas: inclinación excesiva del cuello, muñecas en tensión y espalda encorvada. Aunque en el aula el mobiliario disponible (mesas amplias con elevador para el monitor, teclado y ratón externos) permite ciertas adaptaciones, pocos estudiantes hacen uso consciente de las posibilidades de ajuste. El uso de reposapiés, cojines o alfombrillas ergonómicas es totalmente inexistente.

En el ámbito doméstico, la situación es aún más precaria. Durante las sesiones en línea, se observó que parte del alumnado asistía a clase en condiciones poco recomendables: sentados en sillas de cocina, en el sofá o incluso tumbados en la cama, sin ningún tipo de soporte externo para el equipo. Esta realidad, más allá de lo anecdótico, evidencia la falta de formación y de sensibilización sobre los riesgos físicos asociados al trabajo prolongado frente a pantallas. La iluminación, sin embargo, muestra resultados más favorables. La mayoría del alumnado trabaja con luz natural directa, aunque con ángulos de incidencia variables. También es habitual que utilicen siempre el mismo espacio de trabajo, lo cual favorece la creación de rutinas, aunque no siempre ergonómicas. En cuanto al mobiliario, la mayoría dispone de una silla giratoria con ruedas y de una mesa fija, pero sin elementos auxiliares que mejoren la postura o la distribución del espacio.

El dato más preocupante, sin embargo, es la alta incidencia de molestias físicas: dolores de espalda, cuello, muñecas y ojos, derivados del uso prolongado de PVD y de una configuración inadecuada del entorno de trabajo. Aunque aproximadamente la mitad del alumnado refiere tomar medidas preventivas —como hacer pausas, estiramientos o descansos visuales—, estas prácticas no son sistemáticas ni están apoyadas por una orientación institucional clara. En este sentido, dichas dolencias o molestias físicas se suelen verbalizar de forma informal en clase o durante tutorías, sin que ello se traduzca en una acción preventiva sistematizada.

Por último, cabe destacar que una parte significativa del alumnado suele expresar su preocupación por la falta de información práctica sobre ergonomía y manifiesta interés por conocer posturas adecuadas, pautas preventivas y soluciones de bajo coste para mejorar su entorno de trabajo. Este tipo de demanda —recurrente en las conversaciones que se mantienen en el aula al respecto— pone de manifiesto que, aunque la ergonomía no esté formalmente integrada en los planes de estudios, sí que existe una necesidad percibida por parte del estudiantado que podría aprovecharse como palanca para el cambio y la adaptación curricular.

8.4. Consideraciones finales

Los resultados obtenidos a lo largo de este estudio permiten trazar un diagnóstico claro: el entorno de trabajo del estudiantado del grado de TeI, al menos en el caso de la UJI, no responde a los principios básicos de la ergonomía. A pesar de que la práctica profesional de la traducción requiere largas sesiones frente a dispositivos electrónicos y PVD, el análisis empírico desarrollado revela que ni los espacios físicos ni los hábitos del alumnado están alineados con las recomendaciones ergonómicas recogidas en la literatura especializada. Esta disociación entre el perfil tecnológico del trabajo traductor y las condiciones materiales en que se lleva a cabo resulta especialmente preocupante si se tiene en cuenta la precariedad con la que muchos estudiantes —y futuros profesionales— se enfrentan a su jornada laboral ya desde la etapa formativa.

Una de las constataciones más evidentes del estudio es la falta significativa de contenidos relacionados con la ergonomía en los planes de estudios de los grados en TeI en España. De hecho, el análisis de 994 GD ha puesto de manifiesto que solo en torno al 3 % (n=31) de ellas incluye alguna mención a esta dimensión del trabajo traductor, y que dichas menciones son, en su mayoría, superficiales, genéricas o anecdóticas. Además, muchas de estas citas están concentradas en unas pocas universidades, lo que refuerza la idea de que no existe una preocupación transversal ni sistematizada en el diseño curricular de los grados de TeI.

A esta invisibilización institucional se suma una falta de sensibilización del propio estudiantado, que reproduce rutinas de trabajo poco saludables sin ser consciente de los riesgos que implican. El uso generalizado de ordenadores portátiles sin elementos periféricos, las posturas inadecuadas frente a las PVD, la ausencia de elementos como reposapiés o cojines lumbares o la utilización de espacios no acondicionados para el trabajo (como sofás o camas) durante la docencia en línea son solo algunos de los comportamientos observados que ilustran la falta de formación en esta materia. Aunque una parte del alumnado toma medidas preventivas, estas acciones son más bien reactivas y puntuales, sin un marco de referencia estable que les otorgue continuidad ni fundamento técnico.

Todo ello apunta a una laguna formativa estructural que debería ser abordada con urgencia. En un contexto profesional cada vez más digitalizado, en el que las tareas de traducción, localización y revisión se realizan principalmente frente a PVD durante jornadas prolongadas, formar al alumnado en ergonomía no debería considerarse un complemento accesorio, sino una parte esencial de su preparación para el ejercicio profesional, en línea con lo que apuntan investigaciones como las de Ehrensberger-Dow y Hunziker Heeb (2016) o Ehrensberger-Dow y O'Brien (2015). La ergonomía, en este sentido, no solo contribuye al bienestar físico, sino que incide directamente en la productividad, en la calidad del trabajo, en la capacidad de concentración y, en última instancia, en la sostenibilidad de la carrera profesional a medio y largo plazo.

En el plano institucional, es imprescindible que las universidades y los responsables del diseño y el desarrollo curricular de los grados reconozcan esta necesidad y trabajen para incorporar contenidos ergonómicos de forma explícita en asignaturas clave del grado de TeI. Esto puede hacerse desde distintos enfoques: integrando módulos sobre ergonomía en asignaturas ya existentes (como «Tecnologías de la Traducción», «Documentación» o asignaturas de traducción especializada), diseñando actividades prácticas específicas para cualquier asignatura del grado (por ejemplo, autoevaluaciones del entorno de trabajo, propuestas de mejora, dinámicas de detección de riesgos posturales) o incluso creando materiales didácticos interdisciplinares en colaboración con expertos en prevención de riesgos laborales o salud ocupacional.

La conciencia ergonómica debe entenderse como una competencia transversal que atraviesa las dimensiones cognitiva, física y organizativa del trabajo traductor. Tal y como propone la IEA, el diseño ergonómico no se limita al mobiliario o al hardware, sino que implica una comprensión profunda de las condiciones en las que se produce la interacción entre las personas y los sistemas (2000). Desde esta perspectiva, formar en ergonomía es también formar en sostenibilidad profesional, en salud mental, en gestión del tiempo y en toma de decisiones autónoma y crítica respecto a los propios entornos de trabajo.

Además, más allá de la formación formal, se hace necesario desarrollar estrategias de sensibilización activa tanto para el alumnado como para el profesorado. El análisis realizado muestra que, en muchos casos, el desconocimiento ergonómico no es exclusivo del estudiantado, sino que también está presente entre los docentes, quienes a menudo no han recibido formación específica en este ámbito y reproducen dinámicas laborales poco saludables. Invertir en formación para el profesorado, en este sentido, puede tener un efecto multiplicador sobre la calidad de la enseñanza y sobre la concienciación del estudiantado.

Desde un punto de vista más amplio, este estudio abre también una serie de líneas de trabajo futuras que merecen ser exploradas con mayor profundidad. En primer lugar, sería pertinente ampliar el alcance del análisis documental a nuevos corpus de planes de estudios actualizados. En segundo lugar, convendría realizar entrevistas y cuestionarios dirigidos al profesorado, para conocer de primera mano su percepción sobre la ergonomía en la formación y detectar posibles resistencias o lagunas de conocimiento. En tercer lugar, se plantea como línea de actuación estratégica la propuesta y la validación de materiales didácticos sobre ergonomía específicos para los grados de TeI. Estos materiales podrían adoptar distintos formatos —presentaciones teóricas, vídeos demostrativos, guías de autoevaluación, rúbricas de revisión del entorno de trabajo, etc.— y adaptarse a las características de cada asignatura. Sería particularmente interesante implementar estos materiales en un contexto experimental y evaluar su impacto real en las prácticas del alumnado, tanto en términos de modificación del entorno habitual de trabajo como de reducción de molestias físicas o mejora del rendimiento.

Finalmente, otra vía de investigación prioritaria consiste en medir de forma sistemática la efectividad de las intervenciones ergonómicas en contextos educativos. Para ello, sería necesario diseñar estudios longitudinales que incorporen variables como la productividad (cantidad y calidad del trabajo realizado), la salud física (registro de dolencias o molestias) y el bienestar general (niveles de concentración, satisfacción, estrés percibido). Estos estudios permitirían validar las propuestas didácticas, así como ofrecer datos sólidos que justifiquen su incorporación en el diseño curricular de los grados de TeI desde una perspectiva basada en evidencias.

En definitiva, la incorporación de la ergonomía en la formación de traductores no es una cuestión menor ni un capricho disciplinar, sino una respuesta necesaria a las condiciones materiales reales del trabajo profesional en el siglo XXI. Si la universidad desea preparar a profesionales competentes, responsables y sostenibles, debe incluir entre sus objetivos tanto el dominio técnico de las herramientas de traducción como la capacidad de organizar entornos de trabajo saludables, eficientes y respetuosos con los cuerpos que los habitan. La ergonomía, en este sentido, deja de ser un apéndice y se convierte en una pieza clave de la competencia traductora contemporánea.

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