Marco Bagni

ICT Tools in ESP Syllabus Design

Designing a Syllabus for a Course in Technical English for Industry 4.0

Abstract

In recent years, Information and Communication Technologies (ICT) have become a regular part of everyday English Language Teaching (ELT) practices in higher education and are merging with face-to-face activities. A hybrid modality, defined as Blended Learning (BL) (Sharma and Barrett 2007), has become established practice in Italian universities. The advantages of BL have long been recognized, particularly in ESP instruction (Luzón, 2009; Arnó-Macía, 2012), whose overall objective is to adapt the language learning experience to the learners' specific needs. ESP practitioners who have experimented with BL to deliver their university courses may have recognized in it an efficient way of meeting the students' needs and offering them an original experience. Having learned the lesson of the Covid-19 pandemic, and since they will very likely continue to teach their courses in hybrid or blended modalities in the future, it is arguably essential that ESP practitioners explore the full potential of ICT tools and are brought to reflect on the issues pertaining to their use. This paper aims to contribute to a reflection on the use of ICT in English language teaching (ELT) in higher education. It draws on the author's personal experience of designing a Blended Learning (BL) syllabus for an undergraduate English for Specific Purposes (ESP) course in Technical English at the Department of Sciences and Methods for Engineering (DISMI) of the University of Modena and Reggio Emilia in the academic year 2021/2022. It describes the syllabus design process, illustrating how ICT tools and particularly online resources were used to analyze target students' needs and customize the syllabus for the Technical English course.

Keywords: *English for Specific Purposes (ESP), syllabus design, technical English, Information Communication Technologies (ICT), Blended Learning (BL)*

Italian universities faced the unexpected challenge of the Coronavirus pandemic by putting into practice emergency remote teaching (ERT) (Hodges et al. 2020) as a back-up, temporary option to in-presence classes. Digital technologies thus provided a quick, although perhaps not always a well-thought-out solution to the unforeseen crisis. The shift to online teaching was indeed abrupt and implemented perhaps too hastily in an educational system not fully ready

for the change. However, although teachers may have perceived ERT at the beginning as an emergency protocol, over the two years of the pandemic, they have started to explore the possibilities of the online format, if not yet, to take full advantage of the affordances of Information and Communication Technologies (ICT) in education.

This paper aims to contribute to a reflection on using ICT in English language teaching (ELT) in higher education. It draws on the author's personal experience of designing a Blended Learning (BL) syllabus for an undergraduate English for Specific Purposes (ESP) course in Technical English at the Department of Sciences and Methods for Engineering (DISMI) of the University of Modena and Reggio Emilia (UNIMORE) in the academic year 2021/2022. It describes the syllabus design process, illustrating how ICT tools and particularly online resources were used to analyze target students' needs and customize the syllabus for the Technical English course.

1. ICT and the surge of Blended Learning

In the context of ELT, the use of technology has been experimented with ever since the advent of Computer Assisted Language Learning (CALL) in the 1980s (Constantinou and Papadima-Sophocleous 2020). Over the last three decades, however, the changes could not have been more dramatic. First, the advent of the Internet in the 1990s and then the momentous developments of Web 2.0 in the aughts paved the way for integrating ICT in ELT practices (Dudeney and Hockly 2012). In recent years, the development of ICT cloud technologies and Learning Management Systems (LMSs) has allowed ELT practitioners to experiment with innovative ways of delivering language education at a distance, both as an alternative and a complement to in-presence classes (Sadeghi 2019). As a result, ICT have now become a regular part of everyday ELT practices in higher education and are merging with face-to-face activities. Besides distance learning, which identifies an ICT-mediated learning environment where students and teachers are physically distant, a hybrid modality, defined as Blended Learning (BL) (Sharma and Barrett 2007), has become established practice in Italian universities.

Initially emerged from CALL, BL replaced the latter with a more comprehensive and inclusive model. As defined by Whittaker, "in ELT 'blended learning' is the term most commonly used to refer to any combination of face-to-face teaching with computer technology (online and offline activities/materials)" (Whittaker 2013, 13). However, according to Hinkelman (2018), effective BL must be conceived as a complex method that combines the principles of communicative and Task-Based Language Teaching (TBLT) and integrates them into a new ICT-mediated learning

environment to maximize the abilities and the intellectual potential of learners (Hinkelman 2018).

Based on this conceptualization of BL, it follows that the mere adoption of an LMS such as Google Classroom or Moodle to create a repository of materials for student self-study use or simply allowing students to attend classes in streaming, for instance, do not represent sufficient conditions for the effective implementation of the blended modality. The fundamental principle of the BL approach is thus to create a synergistic relationship between the traditional physical, face-to-face (f2f) learning environment on the one hand and a virtual space using a Virtual Learning Environment (VLE) on the other. That is to say that ELT educators who deliver their courses in blended modality need to learn how to combine a variety of tools and, most importantly, must "know how to develop a cycle" in which the f2f and the online components are combined "by providing online work that can be accessed before a f2f session, for instance, and which can then be integrated into that session" (Hartle 2020, 175). In fact, it has been noted that BL "is concerned with the search for 'best practice', i.e. the attempt to identify the optimum mix of course delivery in order to provide the most effective language learning experience" (Sharma 2010, 457-458). Effective implementation of the BL formula thus conceived has not only the advantage of overcoming possible time and distance constraints but also enables teachers to customize the learning experience, facilitating the creation of subject-specific materials and the provision of ad-hoc tasks.

Such advantages of BL have long been recognized, particularly in the field of ESP instruction (Arnó-Macía, 2012; Luzón, 2009), whose overall objective is to adapt the language learning experience to the specific professional/vocational needs of learners (see Section 4), and where learners are often working students who seek to advance their career prospects. ESP practitioners who have experimented with BL in the last two years to deliver their university courses may have recognized in it an efficient way of meeting the students' needs and offering them an original experience. Having learned the lesson of the pandemic, and since they will very likely continue to teach their courses in hybrid or blended modalities in the future, it is arguably essential that ESP practitioners explore the full potential of ICT tools and are brought to reflect on the issues pertaining to their use.

2. The affordances of ICT in ESP instruction

Already a decade ago, Bloch highlighted the key role played by technology in the teaching of ESP "[f]irst, as a tool for helping with traditional types of language learning and, second, as a space for creating new forms of communicating" (2013, 385). The advent of ICT has enormously

impacted teaching/learning approaches and strategies. Today, ICT can no longer be considered an added extra but rather an intrinsic part of ESP teaching practices.

2.1 Online resources for target-specific learning materials

A wide array of e-learning tools, instructional design software, interactive multimedia packages, audio- and video-editing software, and other resources dedicated to the creation of specialized materials are nowadays available on the world wide web. ESP practitioners can exploit these tools to create and share target-specific learning materials and engage students in activities relevant to their future jobs (Arnó-Macía, 2012).

Furthermore, ESP teachers who have explored the possibilities opened up by the Internet, and the new mobile technologies can arguably make their lessons more motivating, as these tools enable them to use the vast amount of material that is available outside the classroom and bring to the ESP class the authentic language that is used in the target work context (Bloch 2013). The internet represents a huge repository of authentic written and audiovisual material, including news and magazine articles, TV and radio broadcasts, news podcasts, movies, and documentaries. However, since much of this material has not been vetted by gatekeepers, a great deal of responsibility falls on the teacher to examine and select it. Nevertheless, suitable materials, such as scientific journals, educational videos and conferences, can also be easily found on the web. In addition, entire university courses are available in open-access archives, where ESP teachers can find ready-to-use classroom materials such as copies of syllabi, audio and video recordings of lectures, readings, and class notes (Bloch 2013).

2.2 Web-based language corpora

Web-based language corpora represent another tool that has greatly impacted ESP instruction in relation to the need to expose students to authentic samples of the target language (see, e.g., Dashtestani and Stojkovic 2016; Nesi 2013; Gavioli 2005). The use of English for specific purposes is closely associated with genres within the target discourse communities. Online free-access corpora can support data-driven learning (DDL), that is, learning directly from language rather than from mediated resources such as textbooks, grammars, and dictionaries (Johns 2002). Corpus data can be explored in class to learn directly from authentic language samples and to analyze and solve language problems the student may have encountered (Nesi 2013). ESP teachers can easily compare professional or scientific texts with the texts and/or the speech produced by learners to juxtapose their respective features and point out ungrammatical and/or inappropriate forms. On top of that, although domain-specific dictionaries that the students

may consult for quick reference and identification of specialized lexicon are available for free access (Bloch 2013), corpora represent a far more useful tool than online dictionaries. Providing examples of terms and phrases in context stimulates critical reflection, helping the students find the answer for themselves rather than accepting a dictionary definition.

Furthermore, specialized corpora and concordancing sites can be very useful to ESP practitioners, particularly at the stage of preliminary research into the target situation (see section 4.1.1), to identify the target-specific language and design materials for the ESP course syllabus. ESP practitioners are often outsiders to the target vocational/professional communities and not always conversant with the professions and disciplines of their students. By conducting exploratory corpus research, they can learn more about how domain-specific, specialized language is used in the students' target vocational/professional situation (Nesi 2013). There are nowadays several ready-made corpora in the public domain to which ESP practitioners can turn. Most of these also contain sub-components that isolate genres or specialized discourse that can be particularly relevant to ESP instruction. Besides general language corpora, such as the British National Corpus (BNC) or the COCA Corpus of Contemporary American English (COCA), the web has also made smaller discipline-specific corpora of both written and spoken language available. For instance, one of the largest open-access corpora for investigations of the language of technology and science is the Professional English Research Consortium (PERC) corpus, a 17-million-word collection of copyright-cleared academic journal texts in engineering, technology, science, and other fields. Another is the Engineering Lecture Corpus (ELC), a growing collection of transcripts of English-medium engineering lectures on comparable topics delivered by both native and non-native speakers from around the world.

Besides supporting ESP practitioners in becoming familiar with the features of specialized discourse, corpora can also assist them in designing their course syllabi and materials. To this end, ESP practitioners can also build their corpus, selecting relevant texts and/or speech transcriptions to meet the specific needs of their learners. Furthermore, concordancing tools can be used to explore corpora to provide lexical and syntactic examples from authentic texts in specialized discourse, generate word frequency lists, and provide detailed descriptions of the contexts in which a word is found (Nesi 2013). Sketch Engine,[1] for instance, a user-friendly web-based corpus query software, can offer ESP practitioners the possibility of identifying specialized vocabulary and producing wordlists for classroom materials and test design. It

[1] https://www.sketchengine.eu/. Last visited 30/03/2023.

contains 96 ready-to-use corpora in English and presents a variety of text analysis tools. Sketch Engine also serves as corpus building software, by uploading files or by downloading content from the web, and allows the researcher to compare a personal corpus to a reference one, extracting the most typical single words and multi-word terms of the former.

2.3 Online testing tools

Research into the domain-specific features of discourse and lexicon can also facilitate the development of customized tests. Computer-based tests have become very popular nowadays, and there are free, user-friendly testing tools—such as Quiz and Survey Master (QSM), Google Forms, SurveyMonkey—that offer the opportunity to create target-specific tests and also allow to create more authentic simulations of the target situation (Douglas 2013). Furthermore, online testing tools can also be used for course evaluation, and to conduct surveys, for instance, to identify the ESP learners' own perceived needs, expectations, and preferences.

2.4 Cloud technologies and social media

Several tools that ESP teachers can use to assess the target situation and create course materials and tests can also be used as spaces where both teachers and students can disseminate their own materials across the Web (Bloch 2013). The ability to publish and share information is well-known to be one of the major changes brought about by the Internet Revolution. The internet, however, also represents a powerful medium for collaboration and interaction between students and teachers and among students. Cloud technologies allow information to be collaboratively created and shared, fostering peer collaboration and teamwork. The use of digital literacy practices potentially enables ESP students to participate in their learning communities and interact with people in their target professional/vocational field in both synchronous and asynchronous modalities. In this way, ESP learning can be more than merely learning to use the typical language forms in the target situation. Social media, for instance, can become a space where students immerse themselves in specific areas of interest to explore the use of the target language in real-life contexts, (virtually) meet experts and seek expert advice on course content-related issues, transforming their learning into meaningful understandings. In addition, online professional forums are out there on the web that offer technical support to students and professionals alike. For instance, the Eng-Tips Engineering Forums[2] is a professional forum community for engineering professionals of all

[2] https://www.eng-tips.com/. Last visited 30/03/2023.

branches of the discipline. It features a Student Engineer General Discussion section, where ESP students specializing in engineering can post requests about specific issues and find valuable tips to dispel their doubts and solve problems.

2.5 Virtual Learning Environments

A variety of the above-mentioned ICT tools can be combined using a VLE. For instance, a communication and collaboration platform such as Microsoft Teams can be used as a space for hosting teaching sessions and online meetings, course materials, activities, and formative assessment tests. The use of VLEs has nowadays been generalized in all university departments to deliver BL courses. With BL being a rising trend and fast becoming the new norm in Italian universities (see Section 1), teachers and students have started to take up the affordances of VLEs as a space to access and share materials, communicate, and collaborate remotely. The specific merits of adopting VLEs in ESP instruction relate mainly to the possibility of creating a needs-specific learning environment. As a hub that allows access to various ICT tools, a VLE greatly facilitates the provision of authentic language inputs related explicitly to the students' needs and the design of task-based activities related to the students' future professions or specific purposes.

In brief, even the most basic ICT tools have created a wealth of new opportunities for ESP instructors to offer their students a meaningful learning experience. This paper aims to show that their use makes it possible to smoothen out the process of designing a target-specific syllabus.

3. ESP and the centrality of needs analysis

The task of designing a syllabus for an ESP course must start from the obvious, tacit assumption that ESP instruction is goal-oriented and associated with the learners' specialist studies. Indeed, ESP instruction differs from the other approaches to the teaching and learning of English as a second/foreign language because it bases its objectives and the related content on the specific needs of target learners, who are expected to use English in the future in a particular work domain (Paltridge and Starfield 2013; Robinson 1991). It has been observed that ESP is fundamentally "a practitioner movement" that is "based upon the research necessary to meet the need discourses and contexts of target student populations" (Johns 2013, 18-19). Therefore, the key mandate of the ESP practitioner is represented by a thorough "learner needs analysis" (Long 2005), through which the effectiveness and success of a course can be ensured.

As defined by Hyland, "[n]eeds analysis refers to the techniques for collecting and assessing

information relevant to course design: it is the means of establishing the how and what of a course." (2006, 73). Hyland points out that needs analysis "embraces many aspects, incorporating learners' goals and backgrounds, their language proficiencies, their reasons for taking the course, their teaching and learning preferences, and the situations they will need to communicate in" (2006, 73). Needs analysis is, in fact, more than a mere "target-situation analysis" (Basturkmen 2010, 71), that is, an analysis of the students' "objective needs" (Dudley-Evans and St. John 1998, 125) identified in terms of the tasks that students are expected to use English for in the future work context, and the specific language skills needed to undertake those tasks. Furthermore, it is widely agreed that a thorough needs analysis must include the ESP students' personal "wants, means and subjective needs" (Dudley-Evans and St. John 1998, 125) and an assessment of the students' current English language skills. Through such personal information about the students taking the course, ESP teachers can also identify gaps in learners' knowledge. Conceived as such, needs analysis makes it possible for ESP instructors to recognize the peculiarity of the target situation and respond to the diversity of the students. Hence, through needs analysis, ESP teachers can thus acquire "the expertise to function as needs-knowledgeable instructors" and provide "needs-responsive instruction" (Belcher 2010, 3). All the information required for a complete needs analysis can be collected and analyzed in a variety of ways, from more informal observations to more systematic and structured procedures, often supplemented with more quantitative data involving tests, surveys and on-site ethnographic observations (Flowerdew 2013).

Throughout its evolution, the concept of needs analysis has shifted and broadened its scope from being merely understood in terms of analysis of the language requirements in the target situation also to include a "present situation analysis" (Flowerdew 2013) aimed at identifying: (1) gaps between the students' language proficiency and the language skills needed to function in the target situation; (2) the students' familiarity with the specialist content area, their aspirations and preferences; (3) the most effective methods of teaching and learning; (4) the opportunities and constraints in the teaching situation, and other possible factors that might be favorable or unfavorable to the attainment of the teaching/learning goals. In addition, it must be noted that, as argued by Hyland, the very concept of learners' needs "carries a misleading aura of technical precision and impartiality, suggesting that teachers can simply read off a course from the study of an objective situation" (2014, 394). In fact, in the process of needs analysis, ESP teachers will necessarily select, prioritize and exclude based on their own personal criteria and pedagogical beliefs. In this sense, the learners' objective needs, as the target situation dictates, represent nothing but a starting point for the ESP course designer.

With this in mind, it must also be observed that the centrality of needs analysis is nevertheless not exclusive to ESP. In fact, any language syllabus is necessarily selective and "therefore, all sensible course designers must begin by trying to assess students' specific needs. ESP is simply a narrowing of this needs spectrum" (Holme 1996, 3). Moreover, since ESP courses should reflect the activities carried out in real-life work contexts (Robinson 1991), it is mainly through the lenses of the target situation requirements that the needs spectrum of each ESP course is narrowed down.

4. An ESP course in Technical English for Industry 4.0

With English being the undisputed global language of wider communication in the most diverse professional sectors, the Italian education system has stepped up its offer of English language instruction. Italian universities have made a threshold level of English mandatory in almost all undergraduate programs. The threshold is typically set at level B1 of the Common European Framework of Reference for Languages (CEFR), although in some cases—such as BA programs in foreign languages—a C1 level is required. However, several degree programs in science, technology, engineering, and mathematics (STEM), in addition, or substitution to the (general) English language qualifying exam, include an ESP course that targets the specific content areas of the program. Some of these are labelled Technical English (*inglese tecnico*). As it is used in the Italian academic context, Technical English is a blanket term that refers to the use of English for the specific purposes related to several academic/professional fields. The focus and scope of each Technical English course will thus necessarily be dictated by the specific subject area and curriculum of the degree program in which it is included. The Technical English course that is considered in this paper was mandatory in the curriculum of Technologies for the Intelligent Industry (*Tecnologie per l'industria intelligente*), a three-year BA program with a vocational profile (*laurea professionalizzante*) that aims to prepare students to enter the field of modern industrial manufacturing as highly skilled technicians.

As early as ten years ago, Flowerdew (2013) acknowledged the influence of technologization on ESP as one key transformation brought about by globalization. Over the last decade, unprecedented advances in technology have had a profound impact in all work contexts, with ICT having become a distinguishing feature of all modes of communication in workplaces, as well as modes of production, within the framework of what has been called the Fourth Industrial Revolution (Carvalho and Cazarini 2020). This Fourth Industrial Revolution has brought about radical changes on the factory floor, where cutting-edge ICT are integrated into a new model of intelligent industrial manufacturing known as Industry 4.0. In such a context of rapidly

evolving technological capabilities, the challenge for the designer of an ESP course in Technical English for Industry 4.0 is represented by the necessity of keeping up with such a fast-changing scenario.

The following sections illustrate how ICT tools and particularly online resources assisted the author of this paper in analyzing the target situation and customizing a syllabus for a course in Technical English for Industry 4.0.

4.1 Designing the syllabus

The process of designing the Technical English syllabus here considered started with a needs analysis. Based on the considerations discussed in Section 3, the needs analysis was conducted in two stages. First, in the weeks that preceded the start of the semester in which the course was taught, a target situation analysis was undertaken as a preliminary step in the syllabus design process. Before the start of the course and during the first two weeks of classes, a present situation analysis was carried out. The two stages of needs analysis eventually brought the teacher to define the course objectives and content, select the course materials, and identify the teaching method and tools.

4.1.1 Target situation analysis

The key importance of research as a preliminary step in target situation analysis has been highlighted in ESP instruction literature (Johns 2013). As non-experts in the specific disciplinary/professional field of the BA program in which the ESP course is included, ESP practitioners who set out to design the syllabus for their course must first carry out target situation analysis by researching the target field and possibly collaborating with subject or vocational specialists (Dudley-Evans and St. John 1998).

4.1.1.1 Researching the target field

Under the educational objectives of the BA program in Technologies for the Intelligent Industry, the author of this paper identified the domain of Industry 4.0 as the subject area the preliminary research had to explore. Considering the speed at which changes are occurring in the scenario of the Fourth Industrial Revolution, turning to the world wide web, where there is a constant flux of information and content is constantly updated, appeared as the obvious choice to discern the lay of the land on the target situation. Google's search engine was initially used to define the concept of Industry 4.0, find general information on the subject, and learn its fundamental principles. However, to gain better knowledge of the technical, domain-specific vocabulary

necessary to teach the Technical English course, a search for academic publications was also carried out on Google Scholar, which yielded approximately 231,000 results for "Industry 4.0." Given the high number of items obtained by this simple search, the Google Scholar settings were subsequently adjusted to run an advanced search query that would return only review articles written in English, published in the years 2020 and 2021. This search yielded 580 results. All the titles were browsed, and the paper abstracts were read to verify the relevance of their content to understand the key concepts related to Industry 4.0. Based on this criterion, the selection was narrowed down to a dozen papers that included a description of the 4.0 industrial model. All the papers highlighted automation and the integration between the Internet and production processes, obtained through the application of artificial intelligence (AI) technologies to machines, as the key innovations that have characterized the Fourth Industrial Revolution. However, most works on the subject were too specific to understand the basics of Industry 4.0.

Furthermore, the academic perspectives on the concept of Industry 4.0 found through Google Scholar were not meant to be selected as potential course materials. A search query for Industry 4.0 was repeated on the OAPEN Library website,[3] a central repository for hosting and disseminating open-access books. One edited monograph (Ortiz 2020) included reviews and case studies about Industry 4.0. It was eventually selected as the primary source of information for the teacher to research on the subject.

Another search query was conducted using the Keystone Academic Courses search engine[4] to identify degree programs offered worldwide by educational institutions such as Community Colleges, Vocational and Technical Schools, which aim to prepare students for careers as highly skilled technicians in the 4.0 industrial sector. The search was limited to Associate Degree[5] programs because this type of academic degree is more akin to the vocational BA program in Technologies for the Intelligent Industry. Several variously named Associate Degree programs in the fields of technology and engineering (e.g., Automation Engineer Technology, Technology Innovation, Advanced Manufacturing Technicians, etc.) were found, of which the quasi totality was taught in Technical, and Community Colleges located in the USA. 11 of these targeted the field of advanced manufacturing engineering and technology. Although each had its specific curriculum, they all shared a common core of subjects with the curriculum of the BA program

[3] https://www.oapen.org/. Last visited 15/04/2023.
[4] https://www.academiccourses.com/. Last visited 30/08/2022.
[5] An Associate Degree is an undergraduate college degree that is obtained from a Community College or other four-year institutions after completing two years of study.

in Technologies for the Intelligent Industry: mathematics and general physics, electronics, machining operations and tools, computer systems and networks, and robotics. Other essential subjects that were present in almost all curricula included industrial process controls, programmable logical controllers (PLC) and automation, Internet of Things (IoT), and workplace safety. However, none of the websites of the Associate Degree programs that were found offered a complete syllabus, nor did they make available in open access any ready-to-use materials that could be adopted either to expand one's knowledge of the subject-specific vocabulary or throughout the course delivery as ready-to-use classroom materials. Nevertheless, they provided a series of key topics and subject-specific terminology to build the syllabus.

4.1.1.2 Building and analyzing a personal text corpus

Using the Sketch Engine corpus building tool, a personal text corpus aptly named "Industry 4.0" was created from texts available on the web. Creating a web-based corpus of texts aimed to identify a set of topics, draw a list of keywords, and ultimately better define the course content. Four seed phrases were used as input for the web-based text search: *Industry 4.0*, *Fourth Industrial Revolution*, *Intelligent industry*, and *Technicians*. The processed corpus contained 74 documents and 217,749 tokens, of which 183,900 were words. The Sketch Engine "Keywords" tool for terminology extraction was used to compare the personal corpora to a reference corpus, English Web 2020 (enTenTen20), automatically selected by Sketch Engine. By extracting the 1,000 single words and the 1,000 multi-word phrases that appeared more frequently in the focus corpus than in the reference corpus, it was possible to identify the typical or unique terms in the former and define the focus corpus topics. The results were saved in an excel file, and the multi-word terms that most accurately identified a set of technical English terms and suggested the key topics and content of the course syllabus were highlighted. They included, among others, the following: cyber-physical system, smart factory, internet of things, industrial internet, digital transformation, digital twin, predictive maintenance, intelligent manufacturing, smart manufacturing, real-time datum, smart product, big data, augmented reality, industrial internet of things, cloud computing, advanced robotic, artificial intelligence, smart industry, cyber-physical production, smart sensor, smart machine, embedded software, machine learning, and skills gap.

Other Sketch Engine tools were also used. The Wordlist tool served to identify the most frequent nouns and verbs, the two basic syntactic categories of the sentence structure. Two lists were generated, one including 5,905 nouns and another including 1,380 verbs. The Concordance tool

was used to identify the typical collocations of 20 of the most frequent nouns and verbs obtained from the Wordlist tool and view examples of typical combinations of words and/or phrases in context. Limiting the number to 20 items was purely arbitrary and dictated by the primary need to become familiar with the tool and try it out. Subsequently, the Word Sketch tool was also used to identify the modifiers of selected nouns and verbs previously obtained from the Wordlist tool. This operation made it possible to expand the technical vocabulary and, most importantly, to find sentences and texts that could be used as classroom materials to study target situation-specific terminology in authentic contexts. The Word Sketch analysis of the gerund *manufacturing*, for instance, produced six different lists: (1) (adjectival) modifiers of *manufacturing*; (2) nouns modified by *manufacturing*; (3) verbs with *manufacturing* as an object; (4) verbs with *manufacturing* as a subject; (5) *manufacturing* and/or other nouns that are frequently associated with it; (6) prepositional phrases which modify the noun phrase *manufacturing*, or in which the latter is a modifier to the head of the prepositional phrase. The results for each list presented a few examples in the context of the most typical collocations of *manufacturing*. Some of these were copied to a word file and subsequently used to design classroom materials (exercises of transformation, fill in the blanks, etc.) which would be used throughout the course. The N-Grams tool, which generates a list of fixed multiword expressions, such as discourse markers or other language chunks, produced a list downloaded for later use as classroom material to focus on a set of common fixed phrases and look at their use in context.

4.1.1.3 Delineating the objectives and content points, building materials and activities

It must be noted that the purpose of using the Sketch Engine tools was not carrying out an empirical corpus analysis study. Hence, detailed descriptions, comparisons, and, most importantly, the rigor of statistics were not sought in analyzing the data obtained. Instead, the mere objective of adopting text analysis tools was to orient the author of this paper in the language typical of the target situation, become familiar with subject-specific terminology, and compare and corroborate the results obtained from the above-mentioned web-based search query. Secondarily, Sketch Engine helped delineate the course content points and draw a list of specific keywords and phrases to build course materials and activities. Finally, all the lists of terms obtained through Sketch Engine were downloaded and saved because it was thought that they might come in handy in class whenever it was necessary to incorporate a grammar focus into reading, writing, listening or speaking tasks.

The preliminary research outlined above helped the teacher define the learning objectives and the course content points. However, since the learning objectives had to be articulated following

the B1 level of the Common European Framework of Reference (CEFR) and given the vocational profile of the BA program in Technologies for the Intelligent Industry, the study of genre-specific discursive conventions of subject-specific literature, which is typical of many academic ESP courses, was not considered. The focus was instead narrowed to the technical English terminology needed to perform practical tasks in a 4.0 manufacturing context.

Based on the information obtained from the preliminary research and the definition of the students' objective needs, some topics were singled out to form the course content, which was arranged into three units, each corresponding to two European Credit Transfer and Accumulation System (ECTS) credits.

1. Energy, forms of energy and energy sources; work, power, electricity; machine tools and machining operations.
2. Fourth Industrial Revolution/Industry 4.0; technicians' skills for Industry 4.0.
3. Internet of Things (IoT) and Industrial Internet of Things (IIoT); automated manufacturing; robotics; digital twins.

Two textbooks (Piccioli 2016; Ibbotson 2009) for classroom use were selected that only featured general themes related to the engineering field, as included in the first content unit (1). Specifically, two learning units from each textbook were selected as a source of information on the following topics: energy and energy sources; work, power and electricity; machine tools and machining operations. Each unit also included reading comprehensions and vocabulary exercises. One contribution (Carvalho and Cazarini 2020) to the edited monograph referred to above (Ortiz 2020), which offered a definition and a brief description of the key principles of Industry 4.0, was selected to introduce the topics in unit 2 and create a reading comprehension worksheet.

However, to find materials for classroom lectures and student self-study related to the topics listed above in units 2 and 3, another web-based search query was undertaken on the Center for Occupational Research and Development (CORD) website.[6] CORD is an American nonprofit organization, which among its initiatives, offers professional development for U.S. and international teachers and over 50 conferences on technician education. CORD was chosen for its prestige and because among the English-speaking countries, the USA arguably plays a leading role in driving innovation in the manufacturing sector. Of the various links featured on

[6] https://www.cord.org/. Last visited 30/08/2022.

the CORD website, one was directed to a project, "Preparing Technicians for the Future of Work." This Advanced Technological Education (ATE) project funded by the U.S. National Science Foundation aims to facilitate a paradigm shift in technicians' education at the secondary and post-secondary educational levels across the U.S.A. By supporting active collaboration between academic partners and industry, this project aims to meet the modern industry's expectations for technicians' education and prepare students of Associate Degree programs for the technological challenges brought about by the Fourth Industrial Revolution. The project's credibility was thus verified, and likewise the authenticity and suitability of the materials found on its website.[7] The project's website provided access to several classroom materials, including podcasts, short articles, and instructional cards on artificial intelligence, machine learning, robotics, the Internet of Things, and other workforce issues and technologies related to Industry 4.0. Four instructional cards on "Advanced Digital Literacy" were downloaded for classroom use, namely "Internet of Things," "Automation/Robotics/Human Machine Interfaces (HMI)," "Digital Twins," and "AI and Machine Learning." Some of the texts in the instructional cards were also copied, pasted to word files, and adapted to create reading comprehension and cloze test worksheets. These were stored in a folder in the Microsoft Teams group space of the course named "course materials," so the students could retrieve them and complete them as offline homework.

For their relevance to the course content, two podcast episodes were selected to be listened to and discussed in class: "Episode 17: Technician Skills for Industry 4.0"[8] and "Episode 35: The Emerging Workforce of Advanced Manufacturing."[9] Each episode featured an interview with an influential leader from the fields of education and industry, who informed the listeners about innovative trends in Industry 4.0. The podcast episodes also provided valuable additional resources, such as interview transcripts, links to webpages referenced in the interviews, and information about relevant organizations. The web-based search was extended to the popular video-hosting site YouTube[10] to find suitable, credible, and authentic audiovisual material. Several short documentaries and instructional videos addressed the following topics: the Fourth Industrial Revolution/Industry 4.0, IIoT, automation and the smart factory, and digital twins. The selection was narrowed down to include only the videos with closed captioning so that the

[7] https://www.preparingtechnicians.org. Last visited 30/08/2022.
[8] https://www.preparingtechnicians.org/episode-17-technician-skills-for-industry-4-0/. Last visited 30/08/2022.
[9] https://www.preparingtechnicians.org/episode-35-the-emerging-workforce-of-advanced-manufacturing/. Last visited 30/08/2022.
[10] https://www.youtube.com/. Last visited 30/08/2022.

students could use them to listen to and read simultaneously. However, the closed captioning of most YouTube videos is automatically generated, and as such, they are not always accurate. Therefore, it was decided that the videos could not be suitable for self-study use but had to be first introduced and commented on in class. The links to the videos were saved into a folder created in the Microsoft Teams group space associated with the course.

As mentioned earlier, the lists of words and multi-word terms, the keywords lists, and all the other results obtained from the Sketch Engine tools were also used to design exercises and activities to study and test both the vocabulary and the knowledge of grammar in authentic contexts. Subsequently, these worksheets were used in the BL class and assigned to the students as offline homework. In addition, short texts illustrating the typical collocations of technical English terms and typical phrases were copied in a word file to be used by the teacher as class material, and to design cloze tests and mock exam sheets, also to be assigned as offline homework. All these materials were stored in the Microsoft Teams group space 'course materials' folder.

4.1.2 Present situation analysis

One of the objectives of carrying out present situation analysis was to assess the students' start level of proficiency in general English and identify possible major knowledge gaps. To this end, the Google Forms tool was used to create a structured language test. The test included 100 multiple-choice questions targeting several grammar knowledge and language use areas. It did not include, however, any questions aimed at assessing the target-specific language's competence level. Based on the assumption that the Technical English course students had yet to reach a B1 level, knowledge of target-specific vocabulary was not considered a prerequisite. The test questions were arranged in increasing order of difficulty. A link to the test was generated and sent to all the students on the first day of class. Ten students attended in presence, and five off-site students attended remotely. Both the students in class and those attending via videoconference could easily access and complete the test using their devices. The advantage of using the online form was that it automatically generated statistical data, including a list of the questions marked incorrectly by more than 50% of the students. Such information allowed the teacher to identify the most critical grammar knowledge and language use areas.

Although the preliminary test was designed to target the competence in general English, present situation analysis also inquired into the students' familiarity with the specialist content area, their preferences, and their own perceived needs (see Section 3). To that purpose, on the

first day of class, an informal and unstructured discussion, conducted in Italian, was initiated, which involved both the students attending in presence and those attending in distance modality through the Microsoft Teams group's conference tool associated with the course. This tool made it possible to carry out a simultaneous online discussion, as also the students attending remotely could ask to participate and contribute their opinions. Rather than assessing the specific competence in the field of study and the knowledge of target-specific vocabulary in English, the discussion aimed to understand whether the students—who were in their first year of the BA program—were knowledgeable about Industry 4.0 and its innovations, whether they had had previous work experience in any manufacturing or service company, and what they thought the most relevant content areas the Technical English course they were attending should focus on. The discussion was also extended beyond class time to the virtual space of the Teams group by creating a specific chat. Through this tool, the teacher also prompted the students to conduct a quick survey among themselves and identify their own perceived needs reporting them back. All the students' observations were noted down, and eventually, the mix of synchronous and asynchronous discussions allowed the teacher to define the course content better and design appropriate materials. It emerged that although most students appeared to be well-versed in the subject area of technology and advanced manufacturing, they lamented a lack of knowledge of the subject-specific English terminology.

Furthermore, the students expressed the desire to focus on studying grammar structures. Also, one student with work experience as a quality control inspector in a plastic manufacturing industry suggested the topic of automated assembly, which was not initially included in the content points list. In light of the students' suggestions, the content points were revised to include automated assembly, and a note was taken to dedicate grammar focus time to all reading and discussion sessions and design course materials that included more grammar exercises.

Present situation analysis also confirmed the advantages of adopting a BL modality approach and using the Microsoft Teams platform. From the discussion and chat survey, it emerged that several off-site students and working students lamented personal time and distance constraints, expressing their desire to attend and participate in classroom activities at a distance. This was made possible by broadcasting the classes online through the Microsoft Teams videoconference tool and allowing all the students registered as members of the course Teams group to join the videoconference. The availability of high-speed Wi-Fi internet access and a smart projector in the classroom, plus the fact that all the students confirmed that they owned a personal smart device, encouraged the use of Teams as a VLE. Teams provided the teacher with user-friendly

tools for storing course materials, hosting the teaching sessions, and engaging students in class and those attending at a distance in synchronous and asynchronous discussions.

Furthermore, it was found that Teams could be used to incorporate into the teacher-fronted classes collaboration activities that could involve all the students by sharing with the entire class worksheets, which everyone could edit. For example, reading comprehension worksheets were uploaded on the collaboration platform and made accessible to all the students. Each student could thus contribute their answer to a given question and/or comment and edit the other students' answers. In addition, mock exams were also uploaded and shared with the class to foster collaborative work.

The students' level of competence in English, as well as their lack of familiarity with language corpora and the methods of corpus analysis, were thought to prevent a systematic use of concordancing tools in class throughout the course delivery. Nevertheless, as noted in the previous section, particularly the Sketch Engine tools were found to offer the teacher the possibility to present the target language in a more meaningful context than the traditional grammar drills and textbooks and meet the students' own perceived need to consolidate the knowledge of grammar and subject-specific vocabulary. At the stage of present situation analysis, the author of this paper thought he could adopt in class the authentic language samples extracted by using the Sketch Engine tools to guide the students to undertake basic discovery tasks, such as finding the common collocations of a technical term and/or distinguishing the appropriate position and use in a sentence of different lemma forms, each corresponding to a different morphosyntactic category and performing a specific function. As illustrated in the examples below, the teacher selected a series of sentences extracted by using the Concordance tool in which a lemma appears in different forms (and functions):

(1) 3D Printing and Advanced Robotics are essential when *designing* a manufacturing organization's Digital Transformation.

(2) Digitization is changing the way products are *designed*.

(3) The *design* principles of Industry 4.0 play a key role in the radically changing architectures of the various industrial solutions as we know them.

(4) With the 3D printing and the additive manufacturing, the operator can offer customized *designs* for his clients.

By using the Sketch Engine tools in this way, the teacher thought he could approach teaching English grammar and technical lexicon from the perspective of real-life language usage and foster DDL (see section 2.2).

4.2 Syllabus evaluation

Although no empirical study examined the students' satisfaction with the teaching methodology and the course content and materials, it can be confidently stated that the BL approach was well-received by the students who attended the course in Technical English. The students' familiarity with ICT and smart devices no doubt represented a major facilitating factor for implementing the blended modality. Using Microsoft Teams as a VLE proved very useful in planning and carrying out the simultaneous delivery of f2f and synchronous remote instruction. The videoconference and chat tools allowed the teacher to engage both the off-site and working students, who had expressed the desire to attend remotely, and the students attending in presence. Particularly, the students frequently used the chat tool to conduct group discussions and contact the teacher, who, in turn, could easily schedule remote office hours for individual meetings with the students.

The creation of a course material folder on the Teams platform was appreciated by the students, who found it very useful to have an online repository of all the reading comprehension, exercise, and mock exam sheets used in class and assigned as homework. However, although all the students willingly completed the homework assignments and mock tests, very few of them engaged in collaboration activities such as the co-editing of a reading comprehension worksheet, and those who did, did so only when requested by the teacher. The co-editing of a reading comprehension sheet with open-ended answers, for instance, was carried out in the BL class, whereas at home, the students preferred to work on their own and shared their homework with their peers and the teacher in class only after they had completed it.

Conversely, listening to and commenting on the podcast episodes in the BL class proved to be engaging. The students appreciated the possibility of reading and listening simultaneously, as most were concerned with pronunciation issues. The selection of videos proposed by the teacher was also very well received, and some students were motivated to search for more videos on the same topics as those covered in class. Based on the student's suggestion, the list of videos selected as course materials was eventually updated to include video tutorials that showed how computerized machining tools such as computer numerical control (CNC) are operated. Unsurprisingly, as BA students with a vocational profile, they seemed more interested in practical, work-related issues rather than linguistic ones.

Nevertheless, as mentioned above, at the stage of the present situation analysis, they had expressed the desire to focus on grammar. Therefore, although the teacher had used the Sketch Engine analysis tools to create worksheets to engage the students in the guided exploration of authentic samples of target-specific language, this DDL approach was implemented on very few occasions since several of the students' requests for clarification on matters of morpho-syntax and vocabulary related mainly to general English rather than the target-specific language. In this respect, the use in class of the corpus of authentic texts created by the teacher proved to be rather superfluous, as the students were concerned with developing general language skills for everyday communication. In brief, the usefulness of the Sketch Engine tools for terminology extraction and corpus analysis mainly related to the help they offered the teacher at the stages of needs analysis and course content and materials design.

5. Conclusion

Creating a syllabus from scratch can be challenging for ESP teachers without expertise in the target professional/vocational area. This is all the truer when the ESP course targets students who are expected to enter a highly specialized and innovative work environment where changes occur at great speed. This paper reported on the author's personal experience in using ICT tools to design a syllabus for a BL course in Technical English for Industry 4.0. It showed how using a selection of online tools and resources had a fundamental role in supporting the author in carrying out a target- and present situation analysis, smoothening out the syllabus design process.

However, it must be noted that not all the affordances of the ICT tools that were adopted were explored. Online collaboration tools, for instance, can also be adopted to establish links with other academic communities or entities involved in the target vocational field and/or to communicate with other students who specialize in the same vocational area, both native- and non-native speakers of English. Furthermore, the tools that were employed to design the syllabus were basic. There remains to be explored whether other more specialized ICT tools are available that can assist ESP practitioners in the task of designing their Technical English syllabus and help them deliver an effective language learning experience to their students. More research in this area is needed that helps ESP practitioners navigate the vastness of the world wide web and put order into the vast amount of ICT tools. In this regard, ESP teacher education on using ICT tools is fundamental.

The teacher's experience reported in this paper suggested that, although the BL modality appeared well-received by the students attending the course, the main advantages of BL related

merely to the possibility offered to the students to attend via videoconference and access and share course materials online. However, as mentioned in the previous section, the students seemed reluctant to co-edit and share worksheets and mock tests on the Teams platform, and preferred to complete their homework tasks individually, even when they were allowed to collaborate. In order to foster collaborative work, it may thus be necessary to plan activities that involve the accomplishment of tasks in teams and reward collaborative work rather than individual achievement. Furthermore, in order to effectively deliver synchronous f2f and remote instruction and develop a fruitful cycle of online collaborative activities and in-class work, a more structured approach may be needed by which every single lesson must focus on a mandatory homework assignment to be completed online by the students in groups.

To conclude, it must be remarked that this paper only reported on the author's personal experience, and therefore it can only give broad suggestions as to how to employ ICT tools to design a Technical English course in BL modality. More systematic, empirical studies are needed that provide hard evidence based on which the effectiveness of ICT tools for syllabus design in ESP—and more generally in ELT—can be assessed.

Marco Bagni *is Adjunct Professor of English language and translation at the University of Modena and Reggio Emilia, where he completed his PhD in 2022, and has 18 years' experience teaching in Italian high schools. His main research interests include Global English Language Teaching and English as a Lingua Franca, English Medium Instruction, Global Englishes and English language variation, the Sociolinguistics of English in Africa. Among his recent publications: Beyond monolithic English: Pop culture materials informing Global English Language Teaching (ITL-International Journal of Applied Linguistics 2022).*

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