Argentinian Journal of Applied Linguistics
Vol. 7, No. 2, November 2019, 8-33

A bibliometric approach to the analysis of the Technologically-Enhanced Language Learning (TELL) literature

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(Received 20/02/19; final version received 25/03/19)

ABSTRACT

This paper presents a state-of-the-art research into three areas of TELL (Technologically-Enhanced Language Learning), namely Mobile-Assisted Language Learning (MALL), Language Massive Online Open Courses (LMOOCs), and Social and Open Language Learning (SOLL).

In particular, the references from the Web of Science, Scopus and the UNED-Linceo+ meta-search engine discussed in Drakidou, Pareja-Lora & Read (2018), are analyzed here at a deeper level, in order to obtain some statistics on the languages taught, the countries with the most published papers, and the frequency of terms appearing in the keywords. Regarding the last one, the authors have aimed at identifying trends, tendencies and scarcities in all these three areas of TELL. Thus, this paper shows mainly the results of this bibliometric research, obtained in the second stage of the study.

Keywords: language learning; TELL; MALL; LMOOC; SOLL; bibliometrics.

RESUMEN

Este artículo presenta los resultados de una investigación del estado de la cuestión en tres áreas del aprendizaje de lenguas mejorado mediante la tecnología (TELL): el aprendizaje de lenguas asistido por dispositivos móviles (MALL), los cursos de lenguas masivos, abiertos y en línea (LMOOC) y el aprendizaje de lenguas social y abierto (SOLL).

En concreto, las referencias de la Web of Science, Scopus y el metabuscador UNED-Linceo+ examinadas en Drakidou, Pareja-Lora y Read (2018) se analizan aquí en mayor profundidad, con el objetivo de obtener datos estadísticos más avanzados, tales como los lenguajes aprendidos, los países con mayor producción de artículos en estas áreas, o la frecuencia de aparición de los términos usados como palabras clave en los mismos. En este último caso, los autores han buscado, sobre todo, identificar tendencias y valores atípicos o inesperados en dichas áreas de TELL. Por tanto, este artículo muestra, principalmente, los resultados de esta investigación bibliométrica, obtenidos en esta segunda etapa del estudio.

Palabras clave: aprendizaje de lenguas; TELL; MALL; LMOOC; SOLL, bibliometría.

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THIS PAPER PRESENTS some detailed results of research being undertaken to survey the state-of-the-art of advanced Technologically-enhanced Language Learning (TELL) approaches and initiatives. It also reviews the preliminary results included in Drakidou, Pareja-Lora & Read (2018) and discussed at the TISLID'18 international conference. So far, the research presented here has focused on the areas of Mobile-Assisted Language Learning (MALL), Language Massive Online Open Courses (LMOOCs), and Social and Open Language Learning (SOLL)[1].

In the end, this research aims at identifying, amongst other things, the theoretical factors and elements that seem to determine and guide the use of technology for the enhancement of language learning, such as their psychological and/or pedagogical approach. However, this paper shows only the results of a first step towards achieving this goal, that is firstly, a shallow analysis of their contents; and secondly, a deep statistical and/or bibliometric analysis of other elements of the papers. In particular, the elements of the papers that have been processed more deeply are their (a) titles, (b) abstracts, and (c) keywords (when present), as well as their authors' (d) affiliations and (e) countries. Attaining the more ambitious and global goal mentioned above will require having a much closer look at the contents of the papers and, therefore, it has been left for further work. Accordingly, the present paper seeks to present some interesting results and/or conclusions that have been drawn from these primary analyses so far.

The rest of the paper has been organized as follows: firstly, the following section describes the methodology applied to obtain the statistical and bibliographical results presented in the following sections. Secondly, three consecutive, dedicated sections show the results obtained when analyzing the references retrieved, respectively, in the areas of MALL, LMOOCs and SOLL. Fourthly, some final remarks and conclusions are stated; and finally, the paper includes some endnotes (with the acknowledgements associated to this research and the URL where the relevant papers analyzed can be found) and the particular references used when writing it.

Methodology

The methodology followed to carry out this research can be described as follows. Firstly, relevant indexed journal and proceedings papers, as well as book chapters, have been collected. Their selection criteria applied were:

1. these papers and chapters had to include in their title and/or their abstracts the terms (a) Mobile Assisted Language Learning, or Mobile "language learning"; (b) LMOOC, Language MOOC, or Language Massive Open Online Course; and/or (c) Social and Open Language Learning;
2. they had to be indexed either in the Web of Science (WOS) database (Clarivate Analytics, 2018), in Scopus (Elsevier, 2018) or in Linceo+ (UNED, 2018).

Secondly, these references were superficially analyzed[2] in order to find out some key but also basic information, such as the year and the countries in which they were written, the language and the level being taught or learnt in the research presented, and the language in which the paper was written. The goal of this phase of the study has been to carry out an empirical assessment of, for example, the number of languages and levels being taught/learnt by means of TELL approaches and initiatives, or the pioneering, most devoted countries to developing this modality of language learning.

Thirdly, the keywords of the papers were statistically processed in order to (1) calculate their respective occurrences across the different papers studied; (2) rank them according to the number of occurrences calculated; (3) get an idea of their relevance in the field being considered (that is, MALL, LMOOCs or SOLL) and (4) use them as an indicator of the main themes being tackled in these fields. This analysis was performed by means of a program written ad hoc in the R programming language, and whose pseudocode has been presented in Figure 1 (main program) and Figure 2 (a keyword normalization function written for the purpose). The input of this program are the three Excel files containing the information of the references being analyzed, each one corresponding to one of the areas of study already mentioned.

FORALL *file* **IN** {MALL_Excel_File, LMOOC_Excel_File, SOLL_Excel_File} **DO**

1. *myFile* = LoadWorkbook(*file*)
2. *mySheet* = ReadFirstSheet(*myFile*)
3. *myKeywordTable* = ReadColumns(*mySheet*, “Date”, “Keywords”)
4. *myKeywordTable* = PutOneKeywordPerRowWithItsYear(*myKeywordTable*)
5. *myKeywordTable* = Normalize(*myKeywordTable*)
6. *allYearsTabulatedKeywords* = ObtainAndTabulateFrequencies(*myKeywordTable*)
7. *myOutputFile* = CreateAndLoadExcelResultWorkbook(Name(*file*))
8. *mySheet* = CreateAndOpenSheet(*myOutputFile*, “Keywords (all years)”)
9. *mySheet* = WriteOnSheet(*mySheet*, *allYearsTabulatedKeywords*)
10. **FORALL** *year* **IN** *myKeywordTable.Years* **DO**
    a) *myYearlyKeywordTable* = *myKeywordTable*[*year* == *myKeywordTable$Years*,]
    b) *myYearlyKeywordTable* = ObtainAndTabulateFrequencies(*myYearlyKeywordTable*)
    c) *mySheet* = CreateAndOpenSheet(*myOutputFile*, as.character(*year*))
    d) *mySheet* = WriteOnSheet(*mySheet*, *myYearlyKeywordTable*)
11. CloseWorkbookAndSaveToHardDisk(*myOutputFile*)

Figure 1: Pseudocode of the program written to statistically process the paper keywords.

```
Normalize = function(keywordObject)
{
   1. Remove from keywordObject the main acronyms between parentheses (since they
      occur after their corresponding expanded keyword): {“MOOC”, “CALL”, “MALL”,
      “EFL”, “ESL”, “ESP”, “LSP”, “L2”, “OER”, “CLIL”}
   2. Remove from keywordObject the plural mark in main acronyms: {“MOOCs”,
      “OERs”}
   3. Remove or add dashes from keywordObject where required (remove noisy
      alternance): {       "-assisted", replacement =" Assisted",
                           "Mobile-", replacement ="Mobile "
                           "Computer-", replacement ="Computer ",
                           "Game based", replacement ="Game-based"}
   4. Expand in keywordObject acronyms without an expanded term accompanying them:
      {"LMOOC", replacement ="Language MOOC",
                           "xMOOC", replacement ="eXtended MOOC",
                           "cMOOC", replacement ="Connectivist MOOC",
                           "iMOOC", replacement ="Interactive and/or Inclusive MOOC",
                           "MOOC", replacement ="Massive Open Online Course",
                           "CALL", replacement ="Computer Assisted Language Learning",
                           "MALL", replacement ="Mobile Assisted Language Learning",
                           "EFL", replacement ="English as a Foreign Language",
                           "ESL", replacement ="English as a Second Language",
                           "ESP", replacement ="English for Specific Purposes"
                           "LSP", replacement ="Language for Specific Purposes",
                           "L2", replacement ="Second Language",
                           "OER", replacement ="Open Education Resource",
                           "CLIL", replacement ="Content and Language Integrated Learning",
                           "m-", replacement ="Mobile "}
   5. Capitalize all keywords in keywordObject
   6. Remove from keywordObject all main expanded keywords between parentheses
      (since they occurred after their corresponding acronym: reverse list of Step 4)
}
```

Figure 2: Pseudocode of the function that normalizes keywords in the R program written.

These three files (which can be found at: https://bit.ly/2uvFNYp) contain one column for each of the parameters analyzed (year and title of the paper, language in which it was written, language being taught, Common European Framework of Reference for Languages [CEFR] level, institution, country, keywords, etc.), and provide the corresponding

information for each paper in a dedicated row. In particular, the column "Keywords" contains in each of its rows the list of keywords included in each paper to classify and index it. It should be noted that both acronyms and the words/terms they stand for have been considered to be the same keyword. In effect, the purpose of the study was to identify and explore topics, instead of detailing and/or accounting for the forms of the keywords from a terminological point of view.

Thus, this program takes the keyword column in each of these three files and creates a new Excel file for each of them that contains several different sheets. The contents of these sheets are always the same, namely (1) a first column with a (possibly multiword) keyword; and (2) a column with the frequency of the associated keyword in the time period considered. The time period considered are (A) the whole range of years for which a paper in the field has been found, in the case of the first sheet; and (B) a given year within this range, in the case of the remaining sheets (one sheet each).

Hence, the output of the program are these three Excel files with a varying number of sheets, all of which (except for the first one) are named after the year of the keywords being tabulated in it. The three resulting Excel spreadsheets can be found also at https://bit.ly/2uvFNYp.

Mobile-assisted Language Learning (MALL)

The WoS database (Clarivate Analytics, 2018) was researched for the occurrence of the terms Mobile Assisted Language Learning (MALL) and Mobile Language Learning (MLL). In the second part of the research, the 2014 papers found from 2004 to 2018 (only the first two months of 2018 were considered due to time constraints) in the WoS database were further analyzed to gain some insights into the terms mentioned above. The papers retrieved were researched according to the number written per year, the target languages per year and the country where the paper was written. An attempt which was also made to identify specific research groups, included two other results, one from 2016 and another from 2009 (that is, the Human Language Technology Research Group (South Africa, 2016) and the Communications and Signal Processing Research Group (Mexico, 2009), revealing an absence in regulated research. Another area the research focused on was the keywords provided by the authors, which revealed trends and tendencies on MALL and MLL.

The terms were found to exist in 214 articles written from 2004 to 2018. The vast majority of them were written in English. However, one was written in Chinese, three in Spanish, and two of them were presented in two versions, namely English/Spanish and Spanish/Catalan, respectively.

In most of the articles the language taught was mentioned. As the bar chart in Figure 3 indicates, learning English as a second/foreign language was the desideratum in most of them (i.e., 127 articles), which does not come as a surprise since it is an international language, useful in studying, working and communicating on a global scale. Other popular

languages like Chinese, Spanish, German, French, Italian and Russian, as well as Japanese, Korean, Arabic, Malay, Indonesian and Serbian/Croatian were also studied in relation to MALL.

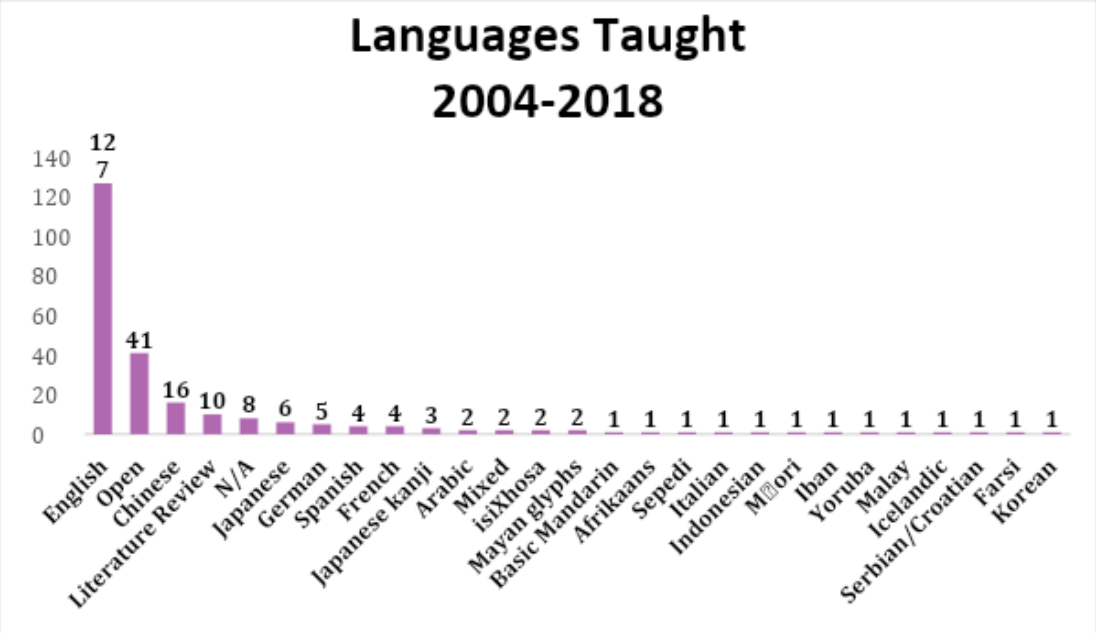

Figure 3: Languages taught using MALL from 2004 to 2018.

An interesting fact was that MALL or MLL were also deployed to teach less popular or disappearing languages such as isiXhosa, Afrikaans, Seredi, Māori, Iban, Yoruba, Farsi, Icelandic, and Mayan glyphs. Finally, another interesting fact is the large number of papers where there was no restriction made to the language being studied (marked as Open) and the ones where the language taught was not mentioned (marked as N/A).

Concerning the paper production, the year with the largest production was 2016, with a total of 51 papers, also boasting the greatest diversity in languages taught together with the ones written in 2009. The smallest production was in 2004, which was also the oldest paper on MALL/MLL retrieved from WOS. The graph in Figure 4 demonstrates a gradual increase from 2004 to 2016, interrupted by slight fluctuations, which cannot alter the upward trend in the production of the papers.

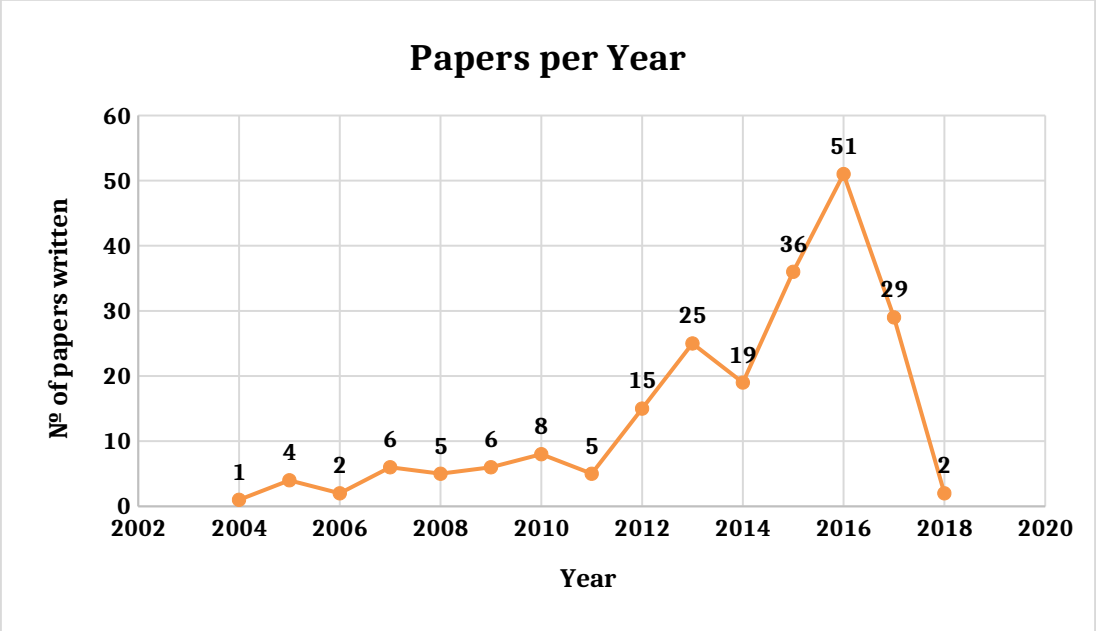

Figure 4: Papers produced in the area of MALL from 2004 to 2018.

Nevertheless, a remarkable and unanticipated observation is the rapid decrease from 51 papers in 2016 to 29 in 2017 and a mere 2 in 2018. Since only the first two months of 2018 were analyzed due to time constraints, the result can be extrapolated, so that if those 2 papers are multiplied by 6, there could be an upper bound of 20 papers in 2018, which shows a consistency with the downward movement. Paying attention to the respective keywords, it can be speculated that such slump is justified by a stagnation in innovative, implemented research and/or a wider variety of languages and skills taught.

Regarding the target languages, the statistics delineate a positive shift from 2009 onwards. With the exception of 2011, there is a tendency towards a wider spectrum of languages, which also encompasses less widely known languages or even disappearing ones.

Regarding the language levels tested, the studies touched on all levels and educational stages, from beginners to proficient learners and from preschoolers to tertiary education. However, the vast majority of them were conducted in tertiary education (also referred to as higher education here), and there was a limited number devoted to adult education outside formal education settings, i.e., informal learning.

Nevertheless, in some articles the language taught was not mentioned, and in others more than one was taught; besides, a few papers were literature-based research. Moreover, in several studies the language chosen was not significant as the focus of the study was on issues such as metacognition, cognitive load, LMOOCs, assessment, specific mobile applications, social context, or learner/teacher perceptions. The analysis, which was limited to the titles, also revealed the focus of each study regardless of the language taught and the environment which ranged from traditional classrooms to blended and distance education settings.

Thus, firstly, although MALL/MLL covers learning via all possible mobile devices, many studies only mentioned smartphones, while in several others only tablets were used. In addition, all parts of learning a language (that is, speaking, listening, writing, grammar, vocabulary and pronunciation) were explored; nevertheless, vocabulary was the most frequent.

Secondly, teaching a language in some of the articles was associated with using social media, augmented reality and QR codes, instant messaging, group blogging, podcasting, or even interactive television in the older ones.

Thirdly, language learning challenges and strategies were the main concerns of several studies, with some of them specializing on disorders such as dyslexia, or distinct groups of learners such as migrants.

Fourthly, terms and issues such as game-based/project-based learning, ESP/LSP/idioms, the integration of MALL into the curriculum, and the use of dictionaries, as well as motivation, modalities/multiple literacies, data-driven learning and security challenges, also occasionally appeared in the literature. Furthermore, a tendency towards differentiated, personalized, self-directed as well as autonomous and collaborative learning was among the findings of the research.

Fifthly and, finally, the aim of some studies towards enhancing informal, vocational and workplace-related learning, as well as the occurrence of the terms micro-learning and ubiquitous learning, indicated the current tendencies in mobile (assisted) language learning.

Regarding the paper production, and as shown by the bar chart in Figure 5, Taiwan as the most prominent market, leads the way, followed by papers produced as result of international collaborations among researchers from different universities. The latter demonstrates a tendency towards global partnerships so as to combine the knowledge and achieve more thorough results. China and the USA also have a great production of papers and so does Spain, which seems to pride itself on TELL research, although it is a smaller country. Thus, as shown by and , it seems like Taiwan and Spain had projects dealing with MALL and, once the projects ended, reference to MALL decreased. Finally, something anticipated but unsatisfactory is the moderate or poor production by the vast majority of the countries.

The keywords extracted from a total of 204 papers in WoS were processed using the program which was previously described (Methodology section: Figure 1 and Figure 2). It should be stated at this point that in eleven of the papers, keywords were provided by the database and not by the authors, which is something that may affect accurate filtered research, since they may be generalized or not reflect the authors' aim precisely. In addition to that, thirteen papers did not include any keywords, which may provide a challenge for a researcher.

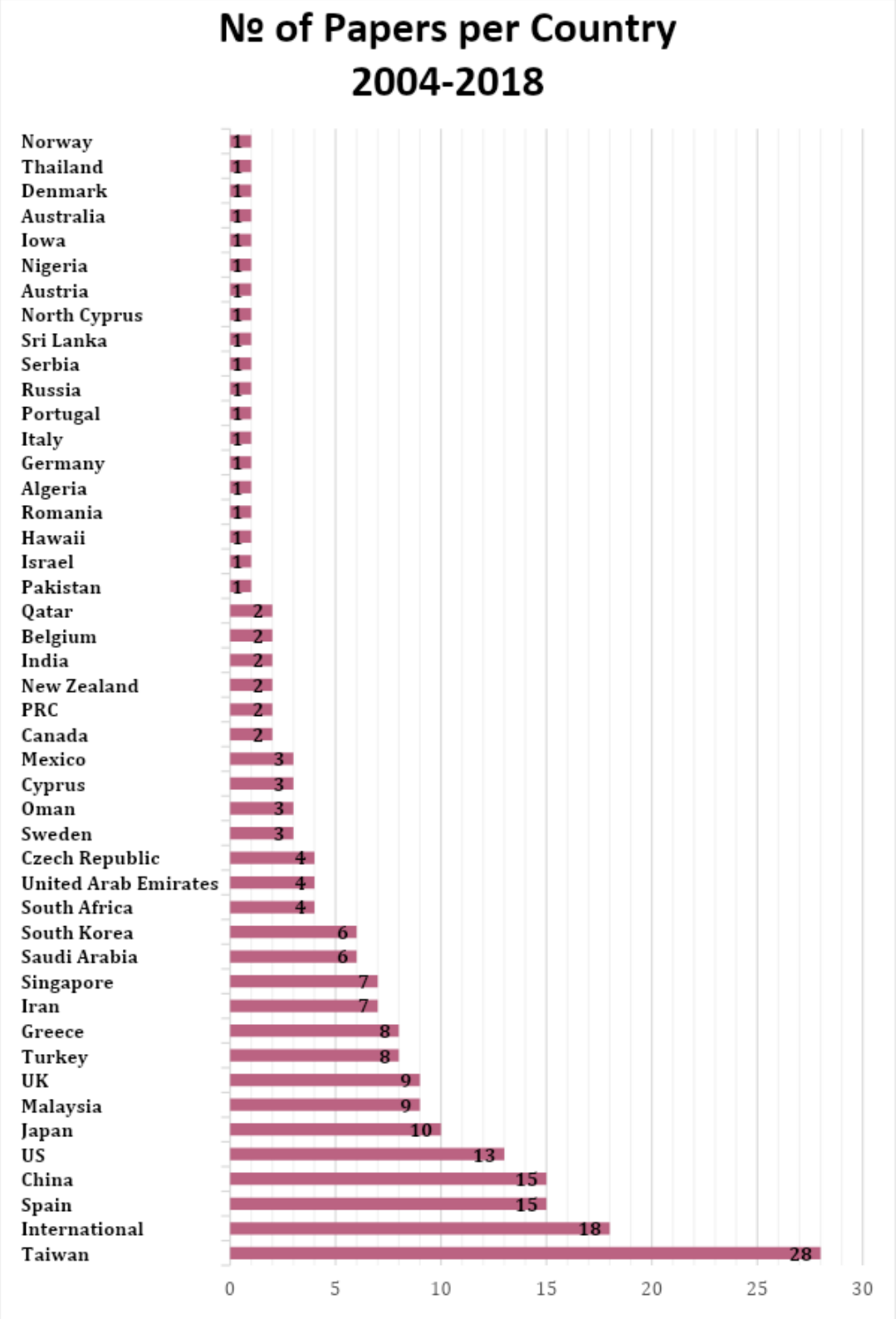

Figure 5: MALL papers produced per country from 2004 to 2018.

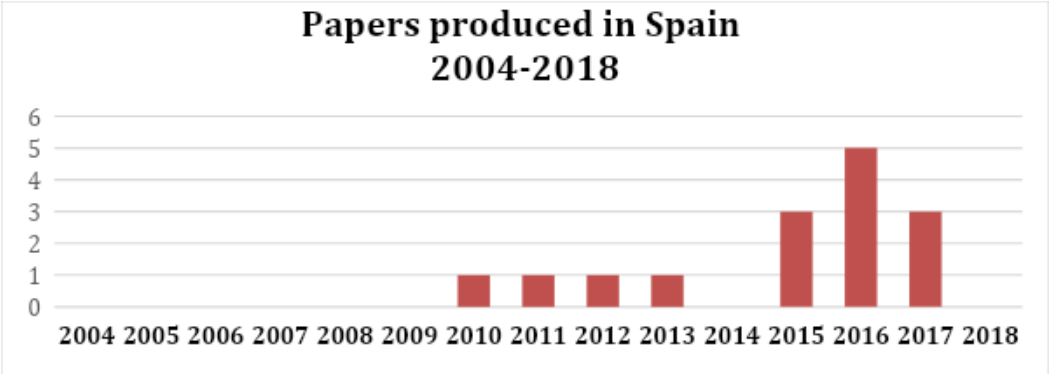

Figure 6: Papers produced in Spain from 2004 to 2018.

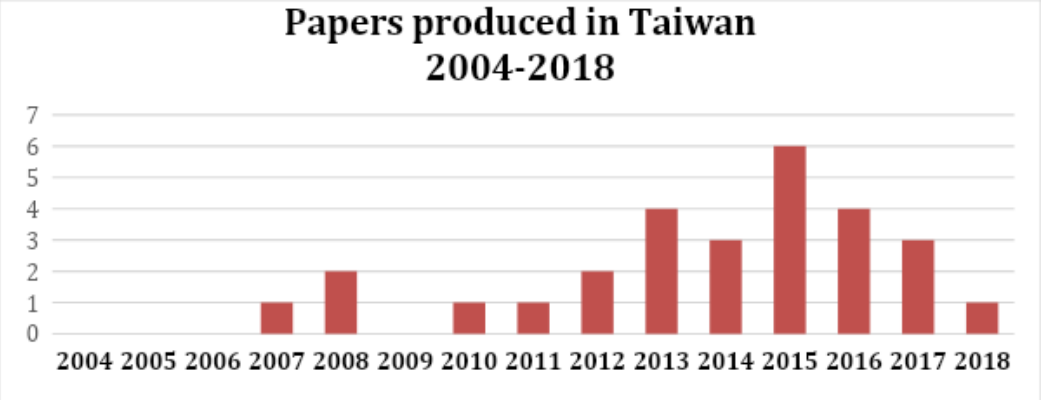

Figure 7: Papers produced in Taiwan from 2004 to 2018.

As shown in the two graphs below (Figure 8 and Figure 9), the most frequent keywords through the years 2004-2018 were "Mobile Assisted Language Learning" and "Mobile Learning". A finding to note is that the term "Mobile Learning" appeared from 2005 to 2009, whereas "Mobile Assisted Language Learning" (or its equivalent term, "MALL") was used from 2010 to 2018. Therefore, it can be inferred that in the earlier years, "language" or "language learning" were considered terms independent from mobile learning, while later they started being regarded as one area. The word "other" on the chart, which has the highest frequency through the years, represents the set of keywords that only appear once in the sample for the time frame associated to the Excel sheets generated, and thus, those keywords are considered irrelevant.

Figure 8: MALL keyword frequencies from 2004 to 2018 (a).

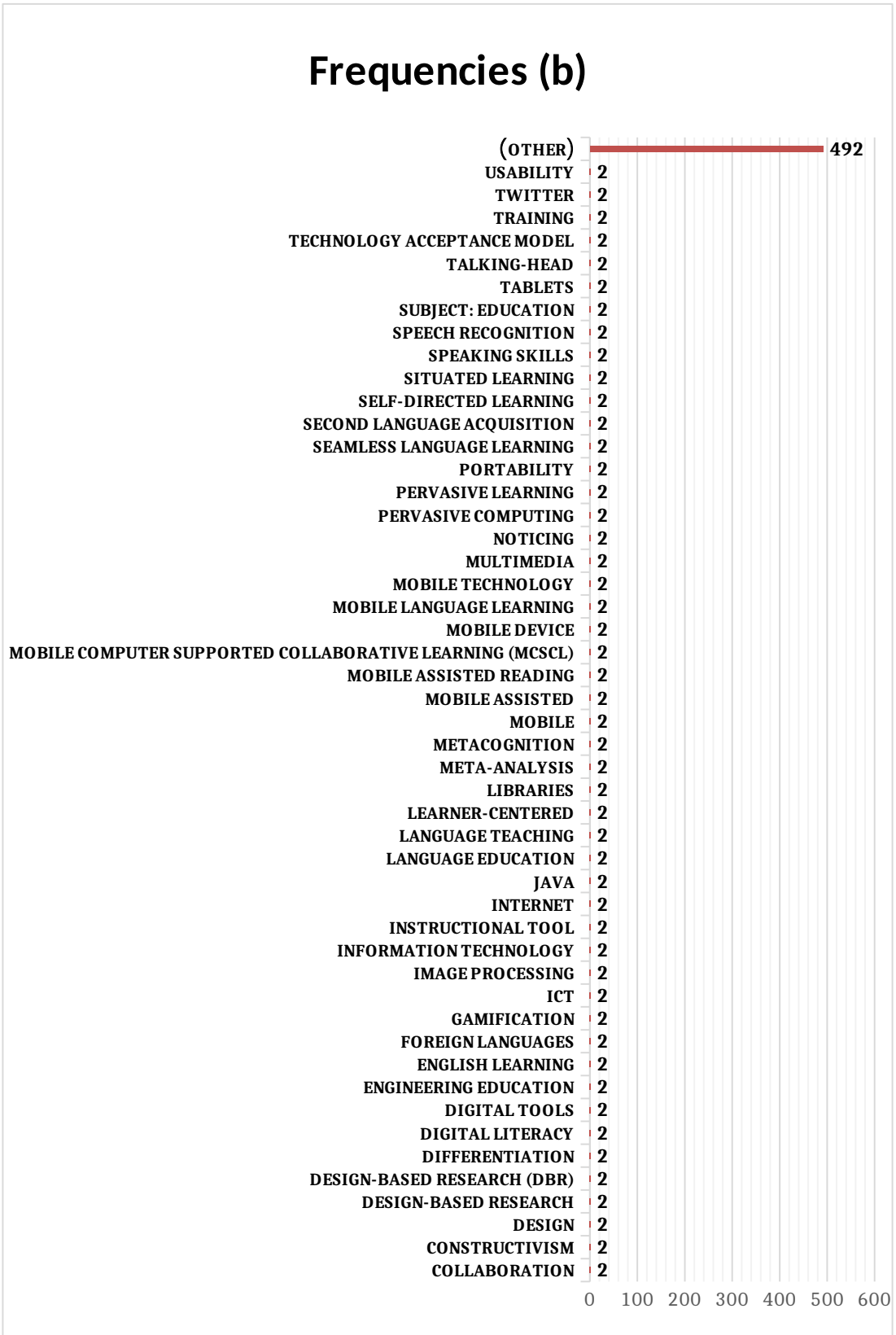

Figure 9: MALL keyword frequencies from 2004 to 2018 (b).

Furthermore, observing the changes of the keywords throughout the years, there seems to be a compliance with the technological advances and the ever-changing needs in MALL. In other words, except for the term "ubiquitous learning" which appears from 2005 onwards,

the keywords "informal learning", "nonformal learning", "gamification", "incidental learning", "smartphones", "blended (learning)", "autonomous learning", "lifelong learning", "augmented reality", "animation", "Twitter" and "Instagram" are utilized from 2013 to 2018.

Finally, two findings considered significant for MALL are the absence of keywords concerning learning theories other than (ecological) constructivism, and the very few instances of models measuring technology acceptance.

Language Massive Online Open Courses (LMOOCs)

Regarding the LMOOCs area, searches were undertaken on Linceo+ (UNED, 2018), the "Title" and "Topic" fields of WOS (Clarivate Analytics, 2018), and the "Title" and "Keyword" fields of Scopus (Elsevier, 2018), for the terms "LMOOC", "Language MOOC" and "Language Massive Online Open Courses". The number of papers retrieved in each case is shown, respectively, in Table 1, Table 2 and Table 3.

As shown in these three tables, firstly, the term "LMOOC" was found in no more than 7 articles in total across the three platforms queried. Secondly, the query "Language MOOC" retrieved more than 3,600 articles from Linceo+, up to 196 articles from WOS and 54 articles from Scopus. Lastly, the query "Language Massive Online Open Course" returned more than 55,000 articles in Linceo+, up to 149 articles in WOS and only 3 articles in Scopus.

SEARCHED TERM(S)	**Linceo+**	
	Nº of search results (papers)	**Nº of relevant results (papers)**
LMOOC	7	6
Language MOOC	3628 (ordered by relevance)	30 [only first 100 results analysed]
Language Massive Online Open Course	55540	[not analysed]

Table 1: Total and relevant results obtained in Linceo+ for the LMOOC term.

SEARCHED TERM(S)	**Web of Science (WOS)**		
	Fields searched	**Nº of search results (papers)**	**Nº of relevant results (papers)**
LMOOC	TITLE	0	0
	TOPIC	1	1
Language MOOC	TITLE	18	15

Language Massive Online Open Course	TOPIC	196	63
	TITLE	9	8
	TOPIC	149	A subset of the TITLE ("Language & MOOC") relevant papers (except for 3)

Table 2: Total and relevant results obtained in the Web of Science for the LMOOC term.

SEARCHED TERM(S)	**Scopus**		
	Fields searched	**Nº of search results (papers)**	**Nº of relevant results (papers)**
LMOOC	TITLE	1	1
	KEYWORD	1	1
Language MOOC	TITLE	24	18
	KEYWORD	54	A proper subset of WOS relevant papers (except for 3)
Language Massive Online Open Course	TITLE	0	0
	KEYWORD	3 [1 duplicated]	0

Table 3: Total and relevant results obtained in Scopus for the LMOOC terms.

However, not all the papers retrieved in these searches have been relevant for the present research, since the main aim in this area has been to focus on papers introducing (a) MOOCs created specifically for language teaching/learning; (b) the approaches, methodologies and best practices followed to develop them; and/or (c) the ways and strategies to evaluate the language skills and improvements acquired by means of LMOOCs.

Hence, while some papers have clearly fallen into the search scope or out of it (e.g., articles dealing with programming language MOOCs), it has taken some time to determine the degree of relevance of many of the papers retrieved. Thus, when it has not been obvious, the degree of relevance of a paper has been manually determined by checking the paper's abstract.

In this manual inspection, it has been found that most of the papers with a questionable relevance deal with:

- the application and/or repurposing of some previously created, non-language-related MOOCs for language teaching;
- the behavior of different kinds of users in non-language-oriented MOOCs, according to their relationship with the MOOC's language of instruction (native or second language speakers);

- the role that the mother tongue plays on succeeding to complete a given MOOC; in other words, the strong dependency of MOOC-participants' learning success (and, thus, also drop-out) on their mastering of the MOOC language of instruction and/or of their command of this language as a second language;
- language as a barrier to be overcome in the context of MOOCs in an international scenario.

Regarding the present study, both these papers and the ones clearly out of scope have been discarded. Accordingly, the highest number of relevant papers for this research was achieved by searching "Language MOOC" within the "Topic" field of WOS (that is, 63 relevant papers – see Table 2). This is due to the fact that, unfortunately, the simple terms "Language" and "MOOC" (or alternatively, "Massive Online Open Course") co-occurred by chance in most cases. This is why no more than 100 articles from the Linceo+ results (see Table 1) required further inspection; in addition, more than 2/3 of the papers inspected have been found to be clearly irrelevant. As for the searches in Scopus, as shown in Table 3, it has been found that the set of relevant papers retrieved are basically subsets of the set of 63 relevant papers retrieved from WOS.

Therefore, the 63 relevant articles retrieved from WOS were used to make a preliminary statistical study in the area of LMOOCs. Thus, firstly, it has to be noted that all of these papers have been published between 2014 and 2018. The distribution of these papers through the years (see Figure 6) is as follows: 4 articles in 2014; 10 articles in 2015; 20 articles in 2016; 24 articles in 2017; and 5 articles in 2018 (though the count for 2018 is only partial, since it is restricted to the first months of the year). Therefore, thus far, the number of articles has been increasing every year.

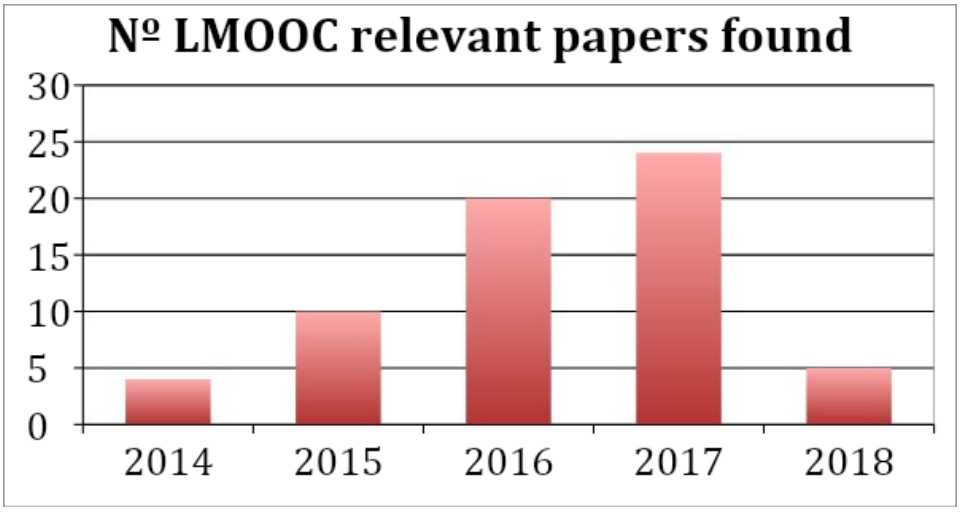

Figure 10: LMOOC relevant papers per year.

Secondly, upon closer inspection of these articles, it can be observed that their main key topics are the following:

1. Providing some recommendations in order to develop and use LMOOCs (e.g., accessibility, effectivity, motivation and/or the role of the instructor, or ethics and aesthetics);
2. Discussing the (potential) usefulness and better approaches and scenarios for using LMOOCs;
3. Reporting the development of a new LMOOC.

Unfortunately (and most surprisingly), only a few relevant papers show results of the application of a given LMOOC.

Thirdly, the languages taught in the analyzed LMOOC papers include English (more than 10 papers), Korean (6 papers), Spanish (4 papers), Portuguese (1), French (1), Italian (1), Russian (1) and Japanese (1). However, there are a lot of theoretical papers, which do not refer to any particular language. Furthermore, these theoretical papers do not provide actual results on the design and/or use of LMOOCs for a given language, level and/or type of users.

Fourthly, the papers describing these experiences in detail were mainly written in English (see Figure 7).

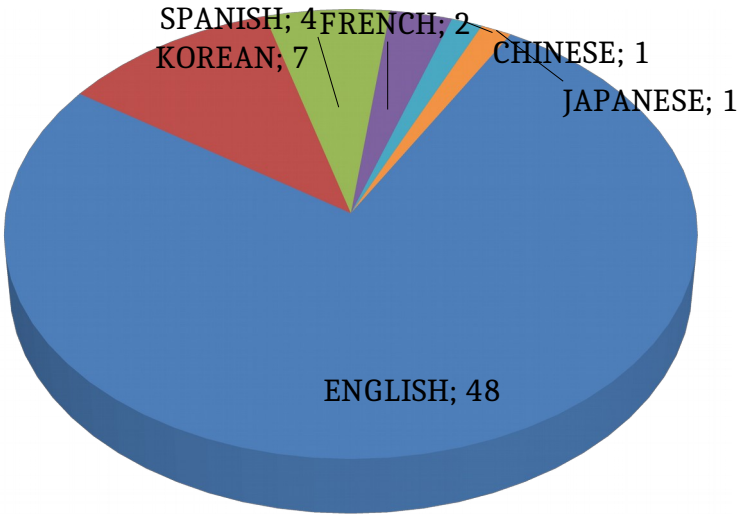

Figure 11: Language in which relevant LMOOC papers were written.

Fifthly, the countries from which these papers come from are primarily People's Republic of China and Spain (followed by England and/or the United Kingdom and the USA). The whole set of countries are shown in Figure 8.

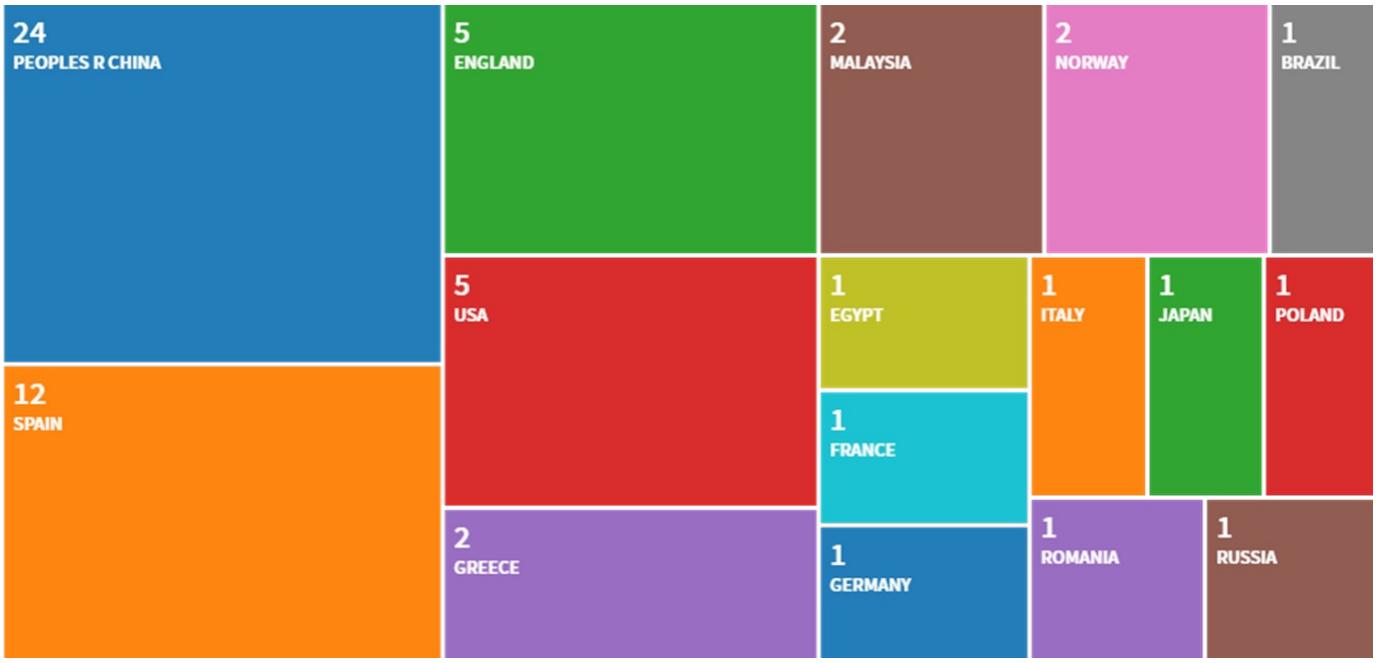

Figure 12: Countries from which LMOOC relevant papers come from.

Finally, tertiary (or higher) education is the level being taught most commonly for the languages involved. Nevertheless, remarkably, the level of education is unrestricted in most papers.

In addition, the keywords of the set of relevant papers found in more than one of the three platforms (WoS, Scopus and Linceo+; 52 papers in total) were also processed using the program presented in the Methodology section (see Figure 1 and Figure 2). The most frequent keywords across the years are shown in Figure 13 (see next page).

Regarding the yearly statistics presented in the Excel results file, it can be observed that, surprisingly, the term "Language Massive Open Online Course" (or its acronym, "LMOOC") is not assumed to fully represent the field yet, since it has never been the most frequent term. In effect, in most years, its hypernym "Massive Open Online Course" is used instead, in combination with other keywords including the word "Language", such as "Language learning".

Social and Open Language Learning (SOLL)

Searches were undertaken in the Web of Science (Clarivate Analytics, 2018) and using Scopus (Elsevier, 2018) for the terms "Social and Open Language Learning", "Social Language Learning", "Social and Open Learning", "Social Learning" and "Open Learning". These terms were found in a total of 85 articles from 2010 to 2018. The majority of them were written in English, although one had been written in Portuguese.

Regarding the paper production, which is presented in the bar chart in Figure 14, the lowest number is attributed to 2018 (the first months) and 2012. There is a slight fluctuation from 2010 to 2015, followed by a sharp rise from 2015 to 2016, which was the year when the highest number of papers was generated. A significant remark is the substantial decline

from 2016 to 2017, which, although it seems gentle, it may demonstrate an inconsistency with the current trends, given that SOLL is a fairly new area in TELL.

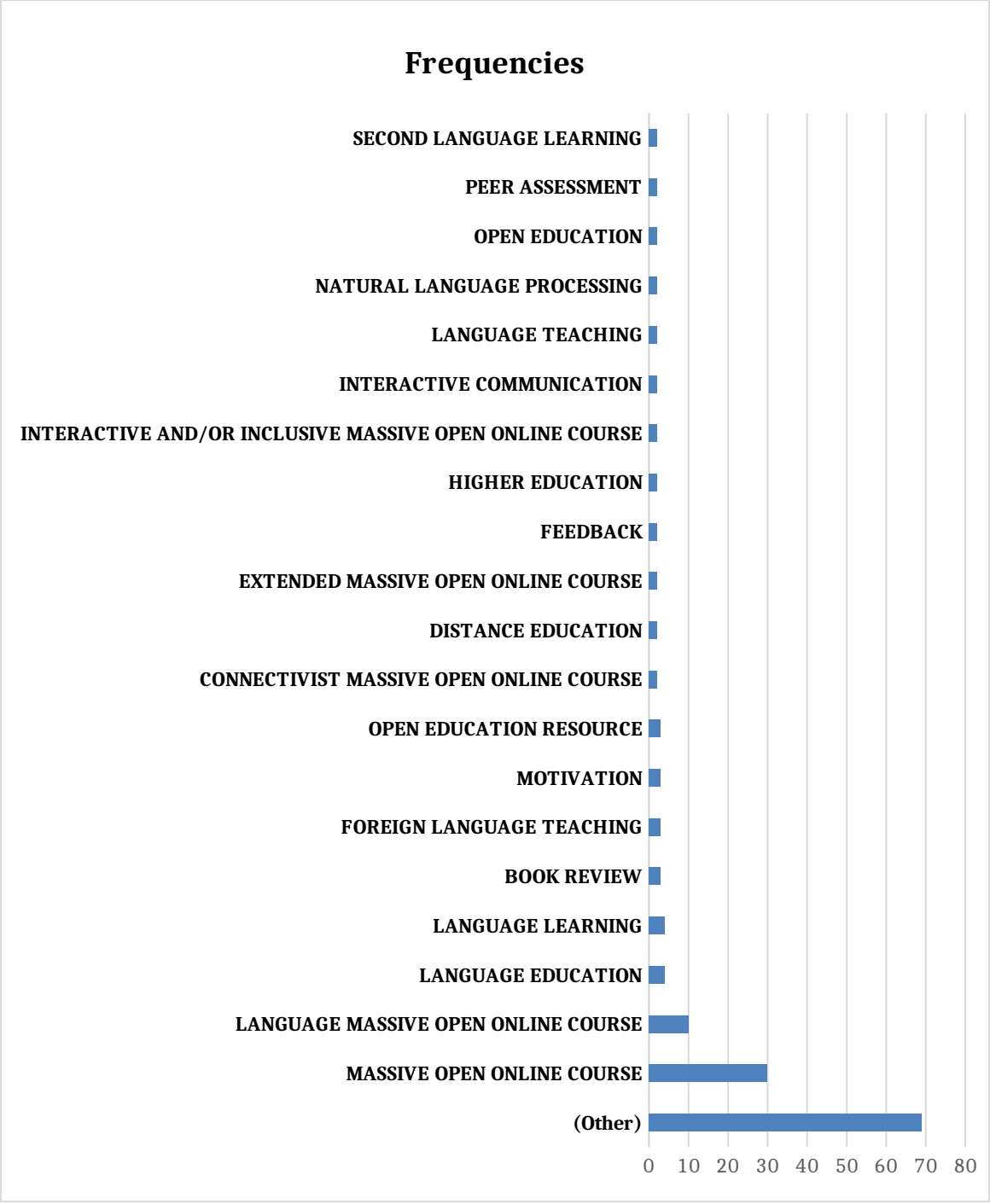

Figure 13: Main keyword frequencies among the most relevant LMOOC papers in the study.

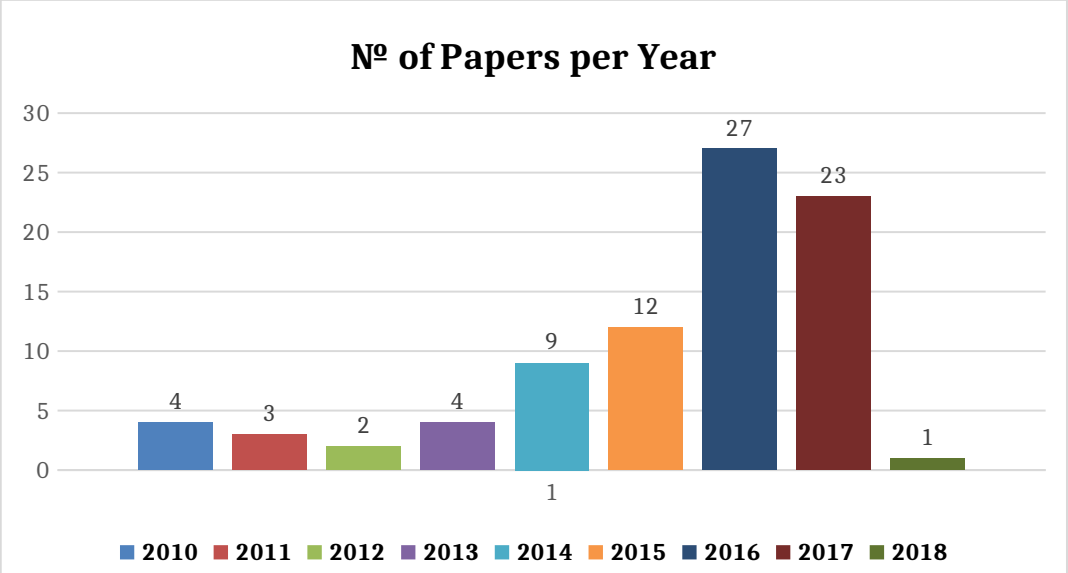

Figure 14: SOLL papers produced per year.

Given that "language learning" was not included in all the search terms, then it should be noted that 31 papers did not focus on languages at all (see Figure 15). Of the remaining 54, 18 considered the teaching/learning of English, 2 focused on Spanish and other individual papers focused on the teaching/learning or English/Arabic, Chinese, French, Japanese, Romanian and Spanish/French.

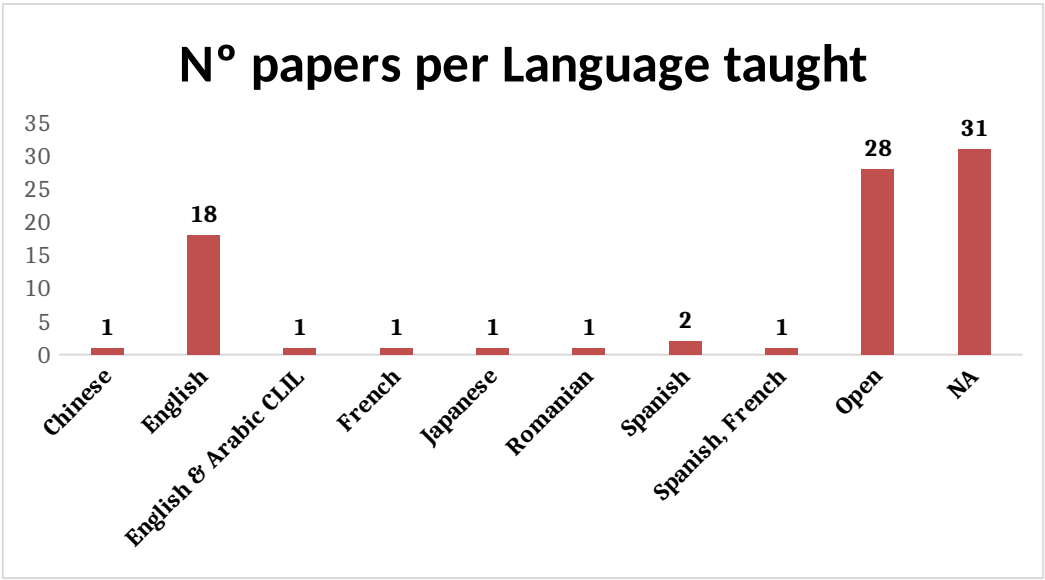

Figure 15: Languages taught by SOLL from 2010 to 2018

A further 28 were open (in the sense of not being restricted to one language) and covered general issues regarding language learning in an open social learning context. Except for the highest number, the largest variety of languages is also ascribed to 2016, with 2017 following, and 2010, 2011, 2013 and 2018 only dealing with one language; at the same time

having papers where the language is open or not available as information. Therefore, the statistics illustrate a considerable trend towards an absence of language-specified papers in an open and/or social learning context.

For the papers on different aspects of language learning, 12 focused on language learning in higher education, 3 in secondary education and 1 in primary education. A further 38 papers were not restricted to a particular educational level. It is possible that higher education was the most popular educational category for a couple of reasons. Firstly, that students at that level are adults and, therefore, more readily engaged in online open social activities, younger students would need special guidance or at the very least have their identities hidden. Secondly, given that the researchers publishing the papers are themselves university lecturers, it is easier for them to use their own students or those of colleagues at the same institution.

As is not surprising by the nature of the searches undertaken, while language learning was, for the majority of the papers, the domain in which the research was undertaken, the emphasis was on how open and social learning could improve the development of language competences. While it is beyond the scope of this paper to delve into the details of these articles, it can be concluded that social interaction in and around the target language does help students improve their related knowledge and skills. A lot of papers focus on different pedagogical aspects of social learning, whether for language or education in general, and no single learning theory is dominant over the rest.

There are also a range of topics related to open and social learning that are recurrent in the papers. Firstly, how courses and learning scenarios can be designed to include this type of learning, in terms of the structure of the courses and the support given to promote its use. Such support can come from the teachers or be provided by peers in the course. Secondly, the students' perceptions on the taking part in these learning activities are also discussed together with the way in which they can affect their motivation. Any activities within a course that are perceived as being valuable by students, with an increase in their motivation to undertake them, will arguably increase their engagement in the course and, therefore, improve the student learning and competence development. Thirdly, as part of the pedagogic focus on open and social learning, consideration is given to how this can promote collaboration between the students. This is important in general terms, since it can help students consolidate what they have learnt individually. Specifically, in the case of language learning, if the collaboration is undertaken in the target language, then it will reinforce learning because the language will be both the object of the learning and also the communication vehicle used. Finally, some consideration is given to the way in which open social learning can be used to extend the learning out of the context of the classroom, thereby encouraging the students to engage in the learning activities for a longer period.

Regarding the paper production, and as presented by the chart below, the USA, Spain, and the UK are the countries with the highest production of papers from 2010 to 2018.

Although that may be expected, what is considered surprising is the low production in all other countries, and especially the ones that normally display interest in TELL research, such as Taiwan and China.

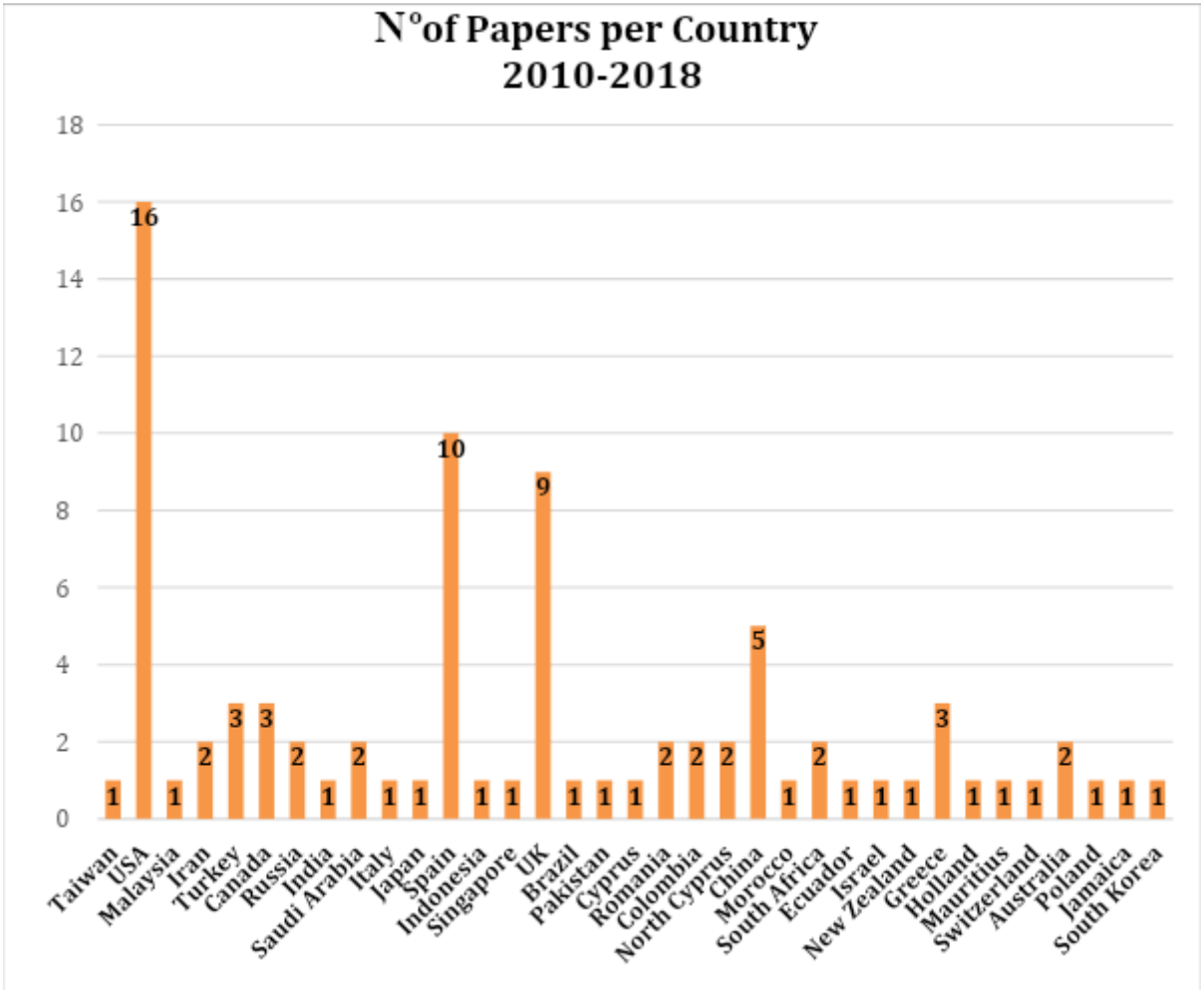

Figure 16: SOLL papers produced per country from 2010 to 2018

The processing of the keywords, which were extracted from WoS and Scopus, using the program described in the methodology section (Figure 1 and Figure 2) revealed some trends and tendencies across the years (see Figure 13 and Figure 14). Firstly, the highest frequency shown in the graphs below is attributed to papers where the keywords were not available (NA), and to others where the keywords appear once in the sample for the time frame associated with the excel sheets generated, and therefore, they are regarded as irrelevant and marked as "(other)" on the bar chart.

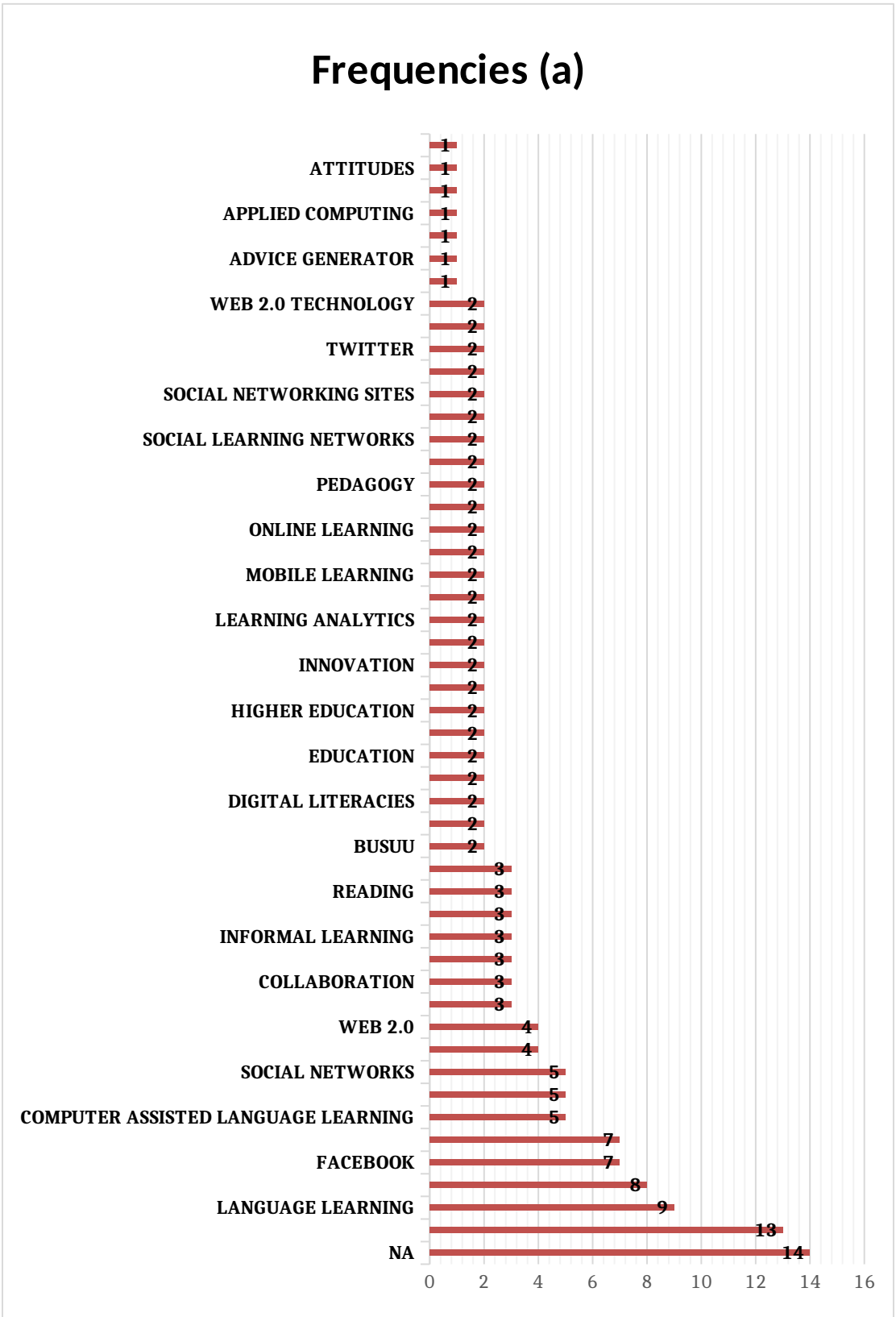

Figure17: SOLL keyword frequencies from 2010 to 2018 (a)

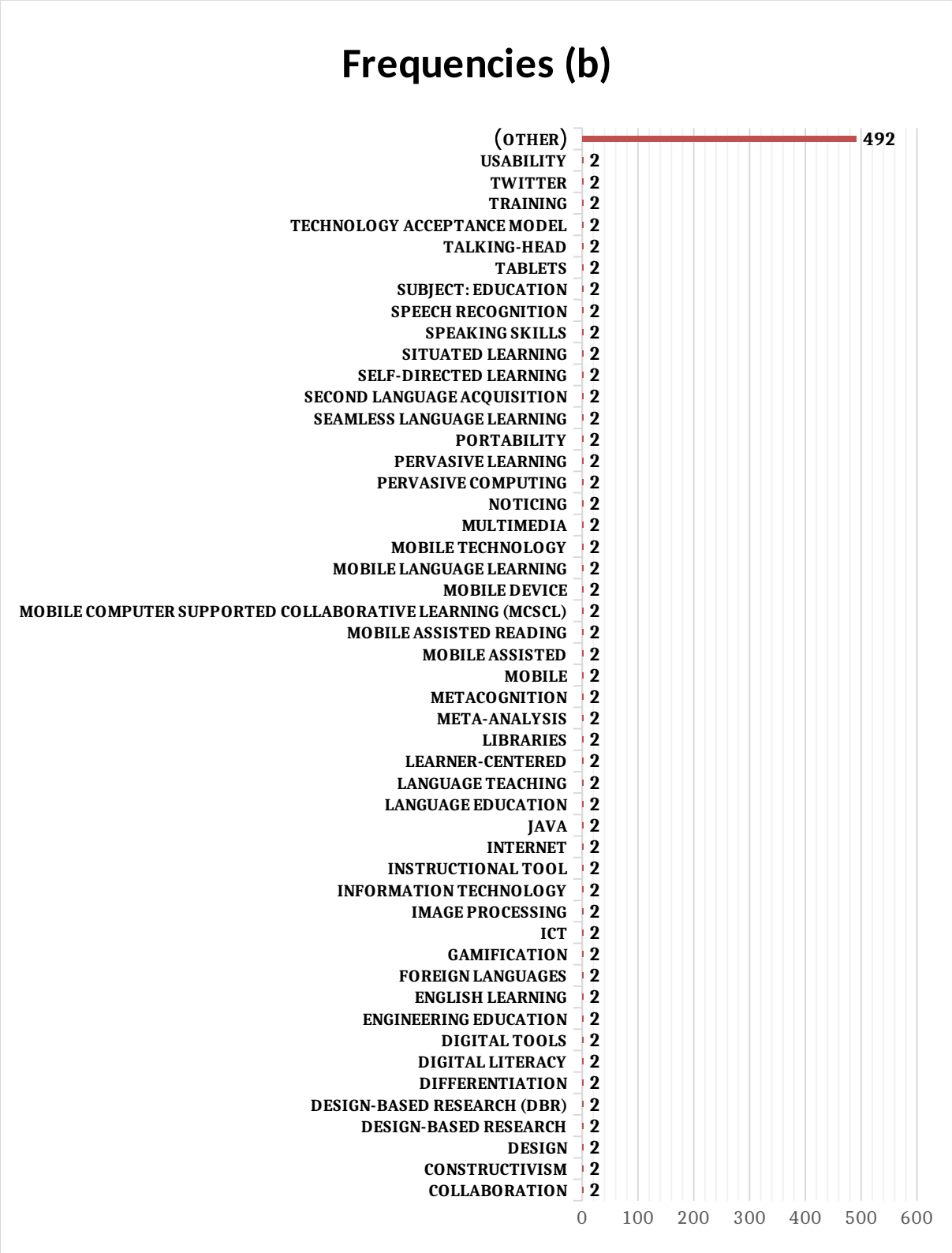

Figure 18: SOLL keyword frequencies from 2010 to 2018 (b)

As for the available keywords, the most prominent is “social media”, followed by “language learning”. Observing the evolution of keywords across the years, the term “web 2.0” is found from 2010 to 2017, while some of its tools, such as “wikis” and “blogs”, are mainly used from 2010 to 2013. Another significant observation is that from 2010 to 2014, the

keywords mainly concern tools and they are rather vague. However, from 2015 to 2018 they become more specific and there is also an interest in the more pedagogical aspects of SOLL with the use of the keywords "theories of learning", "theories of language" and "pedagogy".

Finally, whereas the keywords which indicate social features are used from 2010, the ones that concern open learning appear from 2013 to 2018, with a clearly ascending tendency to even more specialized aspects of open learning.

Final Remarks and Conclusions

This paper has presented the results obtained from an initial analysis of nearly 500 articles on TELL (MALL, LMOOCs, and SOLL). These articles were retrieved mainly from the Web of Science (Clarivate Analytics, 2018), Scopus (Elsevier, 2018), and some of them were also retrieved from Linceo+ (UNED, 2018).

All of them have been published from 2004 to 2018. According to these references, MALL is the oldest area of these three, whereas LMOOC is the youngest. In any of these three areas (MALL, LMOOCs, and SOLL), most commonly, English is the language being taught/learnt, the language of instruction and the language of publication/dissemination. However, Asian languages (Korean, Japanese and Chinese), together with Spanish, are also being learnt/taught more frequently and used for dissemination in the three TELL areas.

As for countries, Spain is the most productive in all the three areas, since it is placed among the first 3 most productive countries, whereas USA and China are among the first 4, and UK is among the first 5 (in all the rankings for the three areas analyzed).

Regarding the educational level, the most frequent one in the selected references for these TELL applications is the tertiary (that is, higher education). As pointed out above, a reasonable cause for this is that the researchers publishing the papers are mainly university lecturers, and they can easily use the courses and students in their universities for their research. Nevertheless, in most papers of the areas analyzed, the language level taught and/or learnt is not relevant or not sufficiently highlighted. This is argued to be a possible defect in the work being carried out in TELL.

It should also be noted that there is a large number of articles that do not clearly state the language being taught and/or the languages to which the research applies. Since language teaching and/or learning is not completely language-independent, it follows that research in TELL should take this variable into account from the very beginning. Therefore, it is most likely that language-independent research needs to be supplemented with some further work to determine its actual application scope.

As far as the keywords used to categorize and/or classify the contents of the papers, the main conclusion drawn from the analyses carried out on them are the following:

- In the area of MALL, the most frequent keywords across through the years 2004-2018 were "Mobile Assisted Language Learning" and "Mobile Learning". However, whereas the term "Mobile Learning" appeared from 2005 to 2009, "Mobile Assisted

Language Learning" (or its equivalent term, "MALL") has been more used from 2010 up to 2018 and, thus, it is already a consolidated term thus in the area of TELL. The high number of cooccurring keywords marking different modalities of learning (such "ubiquitous learning" or "informal learning") show the richness in the lines of research in this sub-area of TELL and its most promising future.

- In the area of LMOOCs, quite on the contrary, the term "Language Massive Open Online Course" (or its acronym, "LMOOC") is not as frequent as expected. This is a bit surprising, but this might simply suggest that is still an emerging field within TELL, which requires further and intense attention and/or research.
- In the area of SOLL, a large amount of the keywords (when present) are used to label no more than one of the papers selected for this research. Those occurring more than once show a late ascending tendency of authors (starting between 2013 and 2015) to focus on the more pedagogical aspects of SOLL and more specialized aspects of open learning.

Finally, the authors' initial assumptions in this research, of publication bias, were not found to hold (at least not towards positive studies). The opposite can be said in that more positive studies are missing in the three areas analyzed.

Thus, to conclude, it could be stated that:

- Even though MALL is being applied to a few endangered and low-resourced languages, in general, TELL applications are still restricted (in general) to mainstream languages. Apart from lack of funds, this might be due to the low amount of OERs and/or digital resources that can be reused for this purpose.
- TELL is still lacking some experimental, positive studies to support the area and the claims/ideas in previous, more theoretical and/or visionary studies. Furthermore, it seems that there is much scope for the application of TELL in lower educational levels (that is, below tertiary level).
- Finally, it is quite surprising that Spanish, Chinese and/or French are so poorly represented in the references analyzed (as language taught/learnt). Some thorough research should be carried out in order to determine why this is happening and what the consequences might be for those languages for which no appropriate, suitable TELL resources are generated in the near future.

Endnotes

[1] **Acknowledgements:** This research has been partially funded by (1) the **SWITCHED-ON project** ("The empowerment of massive open social language learning through mobile technology: harnessing interactions, transcending boundaries",), and (2) the **MOONLITE project** ("Massive open online courses enhancing linguistic and transversal skills for social inclusion and employability"), financed, respectively, by the Spanish Ministry of Economy

and Competitivity, ref no. FFI2016-80613-P. and by the Erasmus+ Programme (Key Action 203 – Strategic Partnerships for Higher Education), ref. no.: 2016-1-ES01-KA203-025731.

[2] The relevant references eventually used and superficially analyzed in this research have been included in the following Google Drive folder: https://bit.ly/2uvFNYp.

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