Digital Textbooks: Emerging Trends and Practices
Erik Born, GSR, German

If there were a Frequently Asked Questions for classroom instructors faced with the problem of integrating technology into the foreign language classroom, one question near the top of the list would certainly be, "Will a digital textbook replace me?"[1] It is a question asked with good reason, given the increasing tendency of digital textbooks to incorporate one feature after another simulating a traditional classroom activity, such as providing vocabulary for readings, correcting grammar exercises, and guiding students through various stages of a learning sequence. Although apathy and hostility toward textbooks as the dominant medium of classroom instruction is hardly anything new,[2] one of the earliest reflections on the threat and promise of digital textbooks can be found in Gary A. Smith's address to the Computer-Assisted Language Instruction Consortium (CALICO): "Tomorrow's Foreign Language Textbook: Paper or Silicon?"[3] Already in 1991, Smith saw a need to make a plea for nine desirable features of an "electronic textbook" for foreign languages, focusing on the computer's ability to provide randomly generated exercises; to present information in various layers; and to situate conversational examples in concrete situations.[4] While Smith drew the sensible conclusion that "the key to creating the 'electronic textbook' is to integrate [these features] into a coherent and comprehensive system,"[5] a survey of digital textbooks over twenty years ago reveals a surprisingly different outcome. Even though many of the features Smith mentioned have long since been integrated into digital textbooks, the digital textbook market today is not characterized by one "coherent and comprehensive system," but rather by a wide variety of different offerings for teaching and learning materials, some of which take the traditional form of a textbook, many of which do not.

In short, all the components of what could be the perfect digital textbook already exist—only not in one place, and not always in the form of a textbook. Hence, my main research questions have come to focus on the unity and stability of the textbook form in a digital age: Will digital textbooks continue to acquire additional features with the aim of creating some sort of Textbook 2.0? Or, will the textbook as we know it dissolve into a larger ecology of digital materials for teaching and learning? Likewise, reversing the equation of the textbook form and digital technology, to what extent will the medium of the book continue to serve as a stable metaphor for emerging digital trends, ranging from designations like "flexbooks" and "courseware" to even more pervasive print metaphors like page numbers, chapters, and supplementary materials? As a preliminary exploration of these questions, this paper examines four main trends emerging around digital textbooks for teaching and learning languages: 1) open educational resources; 2) 2) predictive analytics; 3) adaptive learning; 4) programmed instruction. Through analysis of exemplary case studies, I argue that these emerging trends signal a historical change not only in

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[1] See, e.g., Peter E. Williams, "Will a Digital Textbook Replace Me?," *THE Journal* 30, no. 10 (May 2003): 25.

[2] Tom Hutchinson and Eunice Torres, "The Textbook as Agent of Change," *ELT Journal* 48, no. 4 (October 1, 1994): 315–28.

[3] Gary A. Smith, "Tomorrow's Foreign Language Textbook: Paper Or Silicon?," *CALICO Journal* 8, no. 4 (1991): 5–14.

[4] Ibid., 8–11.

[5] Ibid., 11–12.

the meaning of textbook content, but even more significantly in the form and function of the textbook itself.

Ultimately, the aim of this paper is to make several larger points about how we might change our dominant mode of thinking about digital textbooks, especially in terms of the problematic assumption that a shift from print textbooks to digital textbooks would constitute some revolutionary moment that would forever alter the course of the academy. While digital textbooks are often viewed as a threat to traditional classroom instruction, raising questions about whether they will eventually replace print textbooks or even classroom instructors, I make a case for viewing our current transitional period of media change as an opportunity for re-thinking the purpose of using any material for teaching and learning in the classroom.

From Multimedia Textbook Supplements to Integrated Multimodal Learning

If the first generation of digital textbooks was primarily concerned with problems of multimedia, such as the question of whether to use embedded content or links to online resources, the second generation of digital textbooks is starting to tackle a host of different problems, which will be addressed in the subsequent sections of this paper. Even though materials for teaching and learning materials have long been multimodal,[6] the traditional distinction between core *textbook content* (i.e., words and images) and additional *textbook supplements* (i.e., audio and video) has become problematic only relatively recently, due to the function of the computer as a single media system capable of storage, processing, and distribution.[7] The more the lines between textbook content and textbook supplements have become blurred, the more the textbook industry has been forced to regroup. Today, instead of audio CDs, transparency slides, and activities workbooks, many textbook companies market "enhanced textbooks," while also selling access codes to "premium resources" stored in password-protected repositories. In my analysis, enhanced textbooks and premium access codes are renewed attempts to perpetuate the distinction between core materials and necessary supplements in order to generate additional revenues.

In fact, our current situation with the textbook market is strikingly similar to that of the 1980s, when "university-owned bookstores absorbed a shift in [institutional] values and tried to balance a legacy focus on providing student services with a need to extract additional revenue from students."[8] This change coincided with the expansion of the used textbook market, the creation of committees to make textbook adoption decisions, and the shift from full-time, tenure-track teachers to a new body of adjunct teachers for whom textbooks were seen to provide a "disciplinary canon," or the foundation of their subjects. Thus, even if teachers have always

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[6] The seminal study remains Louis G. Kelly, "Written and Printed Media," in *25 Centuries of Language Teaching* (Rowley, MA: Newbury House Publishers, 1969), 257–73.

[7] For a unique perspective on the *longue durée* of technology's role in the university, see Friedrich Kittler, "Universities: Wet, Hard, Soft, and Harder," *Critical Inquiry* 31, no. 1 (2004): 244–55. Kittler argues that the university was a uniquely medieval innovation that brought together the three key elements of any media system: *transmission* through explication of ancient manuscripts; *processing* through students' interlinear interpretations; and *recording* through the promotion of students to doctors who would present their own lectures.

[8] Stephen R. Acker, "Digital Textbooks: A State-Level Perspective on Affordability and Improved Learning Outcomes," *Library Technology Reports* 47, no. 8 (November 1, 2011): 43. The following survey of the textbook market in the 1980s is based on Acker's astute analysis.

supplemented textbooks with additional materials, while publishers usually overlooked copyright violations, only in the 1980s did entire "course packs," or "readers," start to replace, rather than merely supplement, textbooks. As a result, the Copyright Clearance Center was born, and textbook companies started marketing "textbook bundles," i.e., required materials and necessary supplements, first split apart but then brought back together in one convenient package. Again, the distinction between the textbook and its supplements is usually a means of creating additional revenues.

In light of these general concerns about the textbook market, one of the most interesting cases to appear recently in multimodal textbook design is that of Kno, a short-lived digital textbook company, founded in May 2009 and acquired by Intel in November 2013 for around $15,000,000.[9] Initially, the company wanted to create a tablet device for university students that would contain all of their various textbooks. Quickly, however, Kno seems to have recognized the difficulty of competing with the industry giants that were starting to produce tablets, and rather than encouraging the further development of textbooks in a native digital format, it started to focus on developing a means of producing digital editions from extant print textbooks. The automated workflow that the company developed for producing digital editions, called "Kno Ingest," extracts information from a PDF file and converts it into flowable text; images are also flagged so that they can be replaced with videos; and end-of-chapter activities get marked up with code that allows them to be integrated into online assessment and grading tools.[10] What Kno's automated workflow ultimately indicates, in my analysis, is one possibility for bridging the perceived divide between print textbooks and digital textbooks. Although print textbooks and digital textbooks are usually viewed as competitors, the case of Kno should serve as a reminder that print textbooks can be quickly "ported" to a digital format, and that print editions and digital editions are still released simultaneously as a result of vertical integration in the publishing industry. Furthermore, it is worth remembering that nearly every print textbook currently on the market is already subject to a digital publishing process—the content remains the same across platforms, and all that differs is the end product and the interface that reaches the end-user.

Another significant trend in the continued blurring of the textbook and its supplements can be found in the development of Augmented Reality applications. Developed primarily in contexts other than that of higher education, augmented reality applications take advantage of the camera function in smartphones in order to provide real-time information about one's environment. For teaching and learning, augmented reality applications often use Quick Response Codes (QR codes) in order to create links between real world objects and virtual content. In April 2012, for example, *New Horizon*, one of the most popular ESL textbooks used in Japan, started incorporating QR codes into the pages of this textbook.[11] Learners use the camera in their smartphones to hover over a section of text in order to launch a video of the corresponding dialogue. While the idea may seem promising, its implementation is somewhat problematic,

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[9] *Kno eTextbooks*, accessed May 1, 2014, http://www.kno.com/.

[10] "Introducing Advance," *Kno eTextbooks*, accessed May 1, 2014, http://www.kno.com/advance-publishers#/overview.

[11] For a demonstration of the *New Horizon* textbook, see *NEW HORIZON AR*, 2012, http://www.youtube.com/watch?v=j4qgT2QJUFA/.

since holding one's phone over a page in the textbook actually obscures the corresponding text, making it difficult to follow along with a dialogue or even to take notes.[12]

An even more impressive application of augmented reality can be found in World Lens, a mobile app that uses a smartphone's camera to scan, identify, and translate foreign language text in real-time.[13] To provide these instantaneous translations, currently available for English, French, Spanish, Italian, German, Portuguese, and Russian, Word Lens uses Optical Character Recognition (OCR), most commonly known in the context of having scanner software turn PDF images into searchable text. Word Lens may have the advantage of preserving textual context by layering virtual information on top of real-world images, but its word-for-word, machine-based translations will probably leave many users wanting.[14] Although Word Lens is primarily marketed to tourists and other travelers who want to read signs and menus in real-time, thereby providing yet another de-motivation for learning a foreign language in a classroom setting, I would argue that the app would be perfectly suited for language learners, provided that they deliberately use it in the "wrong" way. Rather than translating from a foreign language into their native language, language learners could just as easily take advantage of the app's two-way translation capability, translating text from their native language into a foreign language, in order to expand their vocabularies through encounters with their immediate surroundings.

This kind of hacker approach to language learning would present one possibility for breaking with the common attitude toward technology that frames its subjects as "users" or "consumers" who know only how to push buttons on their devices and have to wait around for a new update to come out with additional features before they can use that software in any unexpected manner. If, on the other hand, teacher training were to emphasize the need for instructors to deviate from the operating manual at times, then we would have a better chance of answering the question of whether computers will replace instructors. Ultimately, the use of Augmented Reality applications for language learning is indicative of both a continued shift toward blended learning and a radical change in the meaning of textbook content—not only the imperative that we always keep learning, no matter where we are, but even more significantly, the possibility of transforming the physical world itself into a venue for language learning.

Content Aggregation, Course Material Repositories, and Open Educational Resources

We are currently witnessing a change not only in the meaning of textbook *content*, as is evident in Kno's automated workflow and in the proliferation of augmented reality applications, but also in the meaning of textbook *production*, *distribution*, and *ownership*. These changes are exemplified by the current push for "open educational resources," essentially a combination of "open-access movements" (for opening up content from copyright restrictions) and "open-source movements" (for opening up the source code in programs to easier modifications). Some proponents of open educational resources have argued that the possibilities of open-educational publishing will ultimately empower users who have traditionally been shut out of the loop by the

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[12] Nate Hoffelder, "Augmented Reality Shows Up in a Japanese Textbook," *The Digital Reader*, April 8, 2012, http://www.the-digital-reader.com/2012/04/08/augmented-reality-shows-up-in-a-japanese-textbook-video/.

[13] *Word Lens*, accessed May 1, 2014, http://www.questvisual.com/.

[14] A good indication that this situation will soon improve dramatically can be found in the fact that the same real-time translation technology was presented during the unveiling of Google Glass in November 2013, and that Google acquired Word Lens in May 2014.

textbook publishing industry, transforming students and instructors from consumers of wholesale educational packages into producers of collaborative educational materials.[15] Putting aside the question of whether students and instructors were ever mindless consumers of educational materials, I would emphasize the point that any project aimed at developing a repository of educational resources raises even more urgent questions about adaptability, portability, and obsolescence.

Even if open educational resources do not turn out to be as emancipatory as we might like, they definitely represent a significant change in the history of instructor-developed materials. Traditionally, instructor-developed materials tended to break down into two main categories: *textbooks*, designed with hardcovers and glossy pages so that they would last longer, were supposed to provide the "disciplinary canon" for both teachers and learners, and then sit on their shelves as reference works in the future;[16] *additional materials*, like handouts, photocopies, and slides, were supposed to help fill in the gaps or to update outdated content, but they were designed for specific, context-dependent situations and rarely for some universal audience or for posterity. Databases of educational resources, on the other hand, represent a departure from both textbooks and additional materials, insofar as they place more emphasis on organizing the vast amount of educational materials that are already available online, rather than on creating them from scratch. Hence, databases of educational resources require instructors to think more frequently about questions of evaluating available materials; developing learning strategies; and establishing learning objectives. Furthermore, if instructors can no longer follow a script provided by a textbook author, then teacher training will need to focus more on preparing teachers for handling their new role as something like "curators"—evaluating, selecting, and creating diverse combinations out of available materials, while also figuring out how to involve students at various stages of this process.[17] Ultimately, if instruction becomes more a matter of curating content than creating it or reciting it from a script, then instructors, like curators, will need to focus on finding the most effective ways to establish context.

There has been at least one unintended consequence of open educational resources, evident in a recent lawsuit against the Boundless textbook company.[18] Since 2011, Boundless has been offering what it calls "textbook alternatives," free-of-charge; in addition, the company offers premium editions, for $19.99 each. These "textbook alternatives" are aggregations of materials drawn from various repositories and subsequently "aligned" to popular print textbooks. Predictably, the company was sued by three of the largest textbook publishers in March 2012 for copyright violation. What I find interesting here is that the textbook publishers' claim was not only that Boundless copied their original *content* but even more significantly that it copied an

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[15] Carl Blyth, "From Textbook to Online Materials: The Changing Ecology of Foreign-Language Publishing in the Era of ICT," in *Foreign-Language Learning with Digital Technology*, ed. Michael Evans, Education and Digital Technology (New York: Continuum, 2009), 174–202.

[16] Philippa Mules, "Textbooks: Changing Materiality, Changing Meaning," *International Journal of the Book* 8, no. 3 (September 2011): 147–55.

[17] In using the term "curator," I mean only to contrast the tasks of "creating content" and "curating content." Admittedly, the comparison of classroom instructors and museum curators is rendered problematic by the fact that students are usually active collaborators in the production of knowledge, rather than temporary visitors to an exhibition.

[18] *Boundless*, accessed May 1, 2014, http://www.boundless.com/.

original *form*—namely, the form of the textbook, perhaps the most unoriginal form imaginable.[19] As a result of the terms of their settlement in December 2013, we know only that Boundless survived, even if the company is no longer allowed to present its products as "textbook alternatives" in direct competition with those of the textbook giants.[20] Surprisingly, however, Boundless's ingenious method of aggregating content seems to have escaped unscathed. As the company's most recent motto has it, "Boundless goes way beyond your assigned textbook," a jab not only at classroom instructors for assigning inadequate learning materials but also at the textbook industry for creating them. All of this has massive implications for the epistemology of textbooks. Traditionally, textbook authors were the ones who defined their field and established the canon of topics, which is why the point about the scope and sequence of materials was so important in the Boundless lawsuit. Due to developments in open educational resources, however, instructors are now able to reconfigure the traditional canon of knowledge in their field—with the unintended consequence that a company like Boundless can just as easily come along and monetize the process of reconfiguring and re-contextualizing available materials.

Learning Analytics, Educational Data Mining, and the Quantified Student

For instructors and students alike, processing and filtering information are becoming even more important skills than creating it, due primarily to the vast quantities of educational resources available online. According to the familiar statistics about "Big Data," the size of the Internet was estimated to be around 5 million terabytes nearly a decade ago, and, every day, it continues to expand at an exponential rate. These trends are continuing to make their way into the academy in all kinds of unimaginable ways. A great example of how reading data and predictive analytics are becoming part of the classroom can be found in CourseSmart, the company that provides learning analytics on over 90% of the core textbooks currently in use in American higher education.[21] A joint venture of the world's five largest textbook companies, CourseSmart collects data for each student and for class averages about what it refers to as users' "engagement" with course materials, such as their average session length, the average number of pages they viewed, and the average number of their highlights, notes, and bookmarks. This data is made available not only to students and instructors but also to faculty, provosts, deans, course designers, and, not surprisingly, the textbook companies themselves. As far as I understand it, then, even if instructors using one of these textbooks choose to "opt-out" of data collection for the purposes of their own class, the data will still be available to a variety of other parties. Furthermore, CourseSmart claims that it can predict student course outcomes by feeding this data into a proprietary algorithm, known as the "CourseSmart Engagement Index." While the jury should still be out on the Engagement Index,[22] the obvious problem with the project, from the

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[19] Nick Desantis, "3 Major Publishers Sue Open-Education Textbook Start-Up," *The Chronicle of Higher Education Blogs: Wired Campus*, April 5, 2012, http://chronicle.com/blogs/wiredcampus/3-major-publishers-sue-open-education-textbook-start-up/35994.

[20] Dian Schaffhauser, "Boundless Rewrites the Textbook," *Campus Technology*, February 25, 2014, http://campustechnology.com/articles/2014/02/25/boundless-rewrites-the-textbook.aspx.

[21] *CourseSmart*, accessed May 1, 2014, http://www.coursesmart.com/.

[22] Reynol Junco and Candrianna Clem, *Evaluating How the CourseSmart Engagment Index Predicts Student Course Outcomes*, 2013, http://blog.reyjunco.com/wp-content/uploads/2010/03/FINAL-CourseSmart_Analytics_White_Paper.pdf.

perspective of pedagogy, is that we know that expectations drive performance, the so-called "Pygmalion" or "Rosenthal effect," and when teachers expect that some students will do well and others will do poorly, their expectations often turn out to be proven true.

It is essential here to emphasize the distinction between these kinds of *learning analytics*, which tend to focus on developing Learning Management Systems, and a different kind of *educational data mining*, which focuses more on developing Intelligent Tutoring Systems. To my mind, a more encouraging trend in this context can be found in how computer-based algorithms and feedback loops are currently being used in the context of vocabulary acquisition. Spaced-Repetition Software (SRS) uses a simple algorithm to present vocabulary items in increasing intervals of time based on how well one remembers them.[23] Designed primarily to improve long-term recall, these programs do not merely display a flashcard, but additionally prompt users to evaluate their current knowledge of each vocabulary item. Vocabulary items that the user does not know will appear again in a short amount of time, whereas those that the user knows well will appear at "spaced intervals" over longer periods of time. This seemingly digital magic can be traced back to Sebastian Leitner's system of flashcard memorization developed in the 1970s, and Paul Pimsleur's method of "graduated-interval recall" developed around the same time, both of which rely, in turn, on Hermann Ebbinghaus's description of the "learning curve" (or, more accurately, the "forgetting curve") in the late nineteenth century. In my analysis, comparing these cases further would highlight a key difference in the use of analog and digital technology for the development of intelligent tutoring systems: digital technology allows data to be collected and processed simultaneously, meaning that evaluation gets seamlessly integrated into the learning process—in effect, turning computers into tutors and language learners into the monitors of their own progress.

Programmed Instruction, Adaptive Learning, and Intelligent Tutoring Systems

In my view, the current discourse of "adaptive" learning signals the triumphant return of "programmed instruction," or, the attempt to design programs that will adapt to learner input and carry out a sequence of commands in order to achieve a learning objective. Take, for example, McGraw Hill's SmartBook, an e-textbook with diagnostic statistics and adaptive learning technology that forms part of their LearnSmart Advantage Suite.[24] The SmartBook presents textbook content in four different stages: "Preview;" "Read;" "Practice;" and "Recharge." Using a spaced-repetition technique similar to the one discussed in the previous section, the SmartBook will prompt users to evaluate how well they know material they just read. Using this input, the textbook will then "adapt*"* its content, meaning that it will highlight content based on what a user does not know, while also taking into account what the textbook author has deemed to be high-priority learning objectives. Since its launch in 2009, LearnSmart claims to have 3,000,000 total users who have answered over 2,000,000,000 unique questions in their textbooks, although in the context of foreign language learning, SmartBooks are currently available only for French, Spanish, and Italian. While this kind of adaptive learning technology might help with well-

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[23] Among the countless flashcard programs that use SRS, some of the most popular are Anki (http://www.ankisrs.net/), Course Hero (http://www.coursehero.com/), Memrise (http://www.memrise.com/), and Duolingo (http://www.duolingo.com/).
[24] "Adaptive Learning Experience – SmartBook Interactive," *McGraw-Hill LearnSmart Advantage*, accessed May 1, 2014, http://learnsmartadvantage.com/products/smartbook/.

known pedagogical phenomena like "backsliding," it is still a form of programmed instruction with more bells and whistles.

To my mind, an even more interesting experiment with programming can be found in a project called Smart TXTBKS, currently being developed in the Philippines.[25] Although the name of this project deliberately evokes the familiar kind of textbooks designed for "smartphones," Smart TXTBKS are actually a delivery system for "dumb phones," or "feature phones." The project relies on surplus cell phones and SIM cards that are then re-programmed to contain condensed versions of elementary school textbooks. Textbook content, for subjects like English as a Second Language, can then be delivered to students in the form of 160-character text messages—in effect, transforming a feature phone into an e-reader. Sadly, delivering content in this format means having to cut all the multimedia components out of the digital textbook, though I still consider the project significant for drawing attention to the possibilities of creating low-cost alternatives to expensive gadgets, and for salvaging and re-purposing what are normally perceived to be obsolete devices, an especially significant project given the growing amount of technological waste. Lastly, I would point out that the students in promotional materials for Smart TXTBKS still use pen and paper in tandem with their phones, serving as another reminder that digital technology can play nice with analog technology in the classroom.[26]

Conclusion: Digital Textbooks and Media Change

It is worth remembering that the main rhetorical strategy in the current debates about "print textbooks vs. digital textbooks," as in the larger debates about the alleged "death of the book," tends to be polarizing the issue into a pair of binary alternatives ("for" digital textbooks or "against" them), thereby creating pressure on the addressee to take a side and make a choice. "If only we could weigh up the pros and cons of digital textbooks," these debates seem to suggest, "then every student, parent, and educator would be able to make an informed decision!"[27] Admittedly, I have not tried to make this decision any easier in this paper. Instead, I hope to have contributed to thinking about the question of digital textbook adoption as more than a matter of consumer choice or inevitable technological progress.

My main point of contention has been with the widespread insistence on asking whether digital textbooks *should* replace print textbooks, a question based on the larger assumption that digital textbooks *will* replace print textbooks. Any student of Media Studies would instantly recognize this statement as a form of "technological determinism," the problematic claim that new technologies inevitably replace older ones within a brief span of time, consequently having a revolutionary impact on society. From more recent scholarship in Media Studies, we know that any change from one medium to another is always a more gradual and complex process, more evolution than revolution.[28] If we stop viewing digital textbooks as a replacement for print

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[25] *Smart TXTBKS*, accessed May 1, 2014, http://seeourentry.com/txtbks/.

[26] For a video of the devices in use, see *Smart TXTBKS*, 2013,
http://www.youtube.com/watch?v=7bUGXqhrVrw/.

[27] "Tablets vs. Textbooks," *ProCon.org*, accessed May 1, 2014, http://tablets-textbooks.procon.org/.

[28] For an excellent study of historical attitudes toward the book, though omitting the *text*book, see Priscilla Coit Murphy, "Books Are Dead, Long Live Books," in *Rethinking Media Change: The Aesthetics of Transition*, ed. David Thornburn and Henry Jenkins (Cambridge, MA: The MIT Press, 2003), 81–93.

textbooks or as their competitor in some sort of zero-sum game, then we have a better chance of imagining possible futures in which print textbooks and digital textbooks continue to co-exist or in which all of these various offerings simply continue to raise questions about our use of any teaching and learning material in the foreign language classroom.

Ultimately, if computers seem increasingly more human, and humans increasingly more like computers, then we should find other ways of thinking about the relation between technology and the foreign language instructor. Rather than simply insisting on the difference between the two as another way of denying the possibility that a digital textbook might someday replace classroom instructors, we could concede that computers make more efficient language tutors and move on to examine questions about the role of an instructor beyond that of a "tutor" or a "coach," about the possibilities of blended learning and the need for digital literacy, and, as always, about the purpose of using any material for teaching and learning in the foreign language classroom.