

CHAPTER 2

Review of the Literature

Introduction

This review of the literature will expand upon the themes introduced in Chapter 1, to provide a more thorough examination of the relevant research that informed the design of the study on audio QR codes in foreign language teaching. It is comprised of four major content areas: (1) listening comprehension in foreign language teaching and learning (2) audio-only materials to decrease extraneous cognitive load (3) an overview of technology to support recorded audio materials in language learning and (4) quick response codes that link to audio resources in a transmedia approach.

Selection of Research

The literature in this review of how audio materials have been used to support language acquisition was chosen according to the following inclusion and exclusion criteria. All books and journal articles were written in English. Some sources for the theoretical information on language acquisition theory, cognitive load, and listening comprehension date to the 1980's and 1990's, but all studies related to the use of technology to record and distribute audio materials are dated from the year 2000– 2016 in order to reflect the most recent advances in hardware, software, and network infrastructure.

The journal articles were selected from databases through two institutions of higher learning, the Education Resources Information Center (ERIC), and the Association for the Advancement of Computing in Education (AACE) digital library. Every effort was made to choose studies from peer-reviewed journals, with only one instance (Dourda, et al., 2012) of an

un-published paper from conference proceedings included in the section on previous QR code research.

Originally the selection criteria included the use of audio materials only in middle and high school settings, but the scarcity of studies (especially those with audio accessed via mobile, and QR code use) necessitated the inclusion of studies performed in higher education settings. Similarly, the original criteria for studies involving language learning excluded those centering on second language acquisition, but this decision was revised when searches revealed a lack of studies related to audio materials in foreign language acquisition to include both L2 and FL learning. While there were no set exclusion criteria for methodology, the included studies on audio support for language learning are all either qualitative or mixed-methods studies, so as to contain data on user experience (teacher and/or student) that could better inform the design of this research study as described in Chapter 3.

Listening Comprehension in Foreign Languages

Theoretical Development.

Over the past century, there have been a series of pedagogical shifts in the field of foreign language instruction, some grounded in research and theory, and others in response to changes in educational and societal contexts. Brown (2000) categorizes these differing approaches as behaviorist, nativist, and functional.

Behaviorist methods, such as the Audio-lingual Approach, centered on the learners' production of correct responses to stimuli, and reinforcement of such responses to written and spoken utterances. This method combined structural linguistic theory with ideas from behaviorist psychology (Brown, 2000; Richards & Rodgers, 1986). Practice and repetition of

prepared materials were the primary classroom activities, turning L2 acquisition into a logical and systematic process.

While teaching methods and materials based on behaviorist principles continue to be used in language learning contexts today, research starting in the 1960's on brain processes that take place during learning (Bransford, et al., 1999) added another layer of understanding to how people acquire first and second languages. The nativist approaches based on this research stressed the importance of linguistic input and how it was used and filtered through a person's innate, internalized system of language, or 'language acquisition device' (Brown, 2000, p. 24). Learners are exposed to examples of written and auditory examples of the target language that are designed to be at a comprehensible level. This 'comprehensible input' is designed to be slightly above their existing proficiency level with the L2, such as in Krashen & Terrell's (1983) Natural Approach. In the Natural Approach, students in the early stages of language acquisition are encouraged to listen without pressure to speak or write the second language, much in the same way that toddlers learn a first language (Brown, 2000, p. 108). This idea was further extended into a technique called 'Narrow Listening' in which foreign language teachers provide short audio excerpts of native or advanced speakers of the target language discussing a topic of interest to the learners (Dupuy, 1999; Krashen, 1996; Krashen, et al., 2004). Ideally, linguistic input that is at, or slightly above, the learner's current level of understanding will be "utilised by their developing internal grammatical systems" and become usable 'intake' that is added to their existing schema to enhance their competency in the new language (Allright & Bailey, 1990, p. 120).

Emerging in the 1980's in conjunction with constructivist principles, functional approaches attempted to take into account both the cognitive and affective forces that influence

the acquisition of language. Acknowledging that people use language to “deal with the world, with others, and with the self,” teachers focused on communicative activities that required negotiated communication during language tasks (Brown, 2000, p. 27). Vygotsky’s (1962/1986, 1978) work on providing scaffolding for learners while they engage in a socially-mediated process of language acquisition was also influential in the development of functional teaching methods.

All three of these approaches remain in use in modern language learning settings (Berne, 2004). Whether examples of the target language are called stimuli, input, or scaffolding, it is clear that teachers must carefully choose and expose students to accessible written and audio L2 models. Learners in the early stages of language acquisition require “enormous amounts of listening experiences” in the target language which “need to be experienced aurally” as they are filtered through the phonetic, phonological, and morphosyntactical processors (Tschirner, 2011, p. 27). In a review of the developments in modern research in foreign language listening comprehension, Vandergrift (2007) notes that while native language listeners are able to process auditory input with little conscious effort, learners of a second language “need to consciously focus on what they are listening to, and a large proportion of what they hear may be lost, given the speed of speech and the inability of working memory to process all the information within the time limitations” (p. 193). Students learning a foreign language in a classroom setting do not have access to the abundance of linguistic auditory input in the home and community that would be available to learners of a first or second language. As the limited time students spend in a foreign language classroom is “but a fraction of their overall learning day” (Evans, 2015, p. 12), there has been a call for more research into applications that would help foreign language

learners have access to auditory resources in “independent learning settings” (Vandergrift, 2007, p. 199).

Homework in Foreign Language Learning.

A typical 45–60 minutes class session in middle school leaves limited time for foreign language teachers to present either live or recorded auditory examples of the target language. The American Council on the Teaching of Foreign Languages (ACTFL) stresses the importance of time and exposure to the target language in their most recent document on *Performance Descriptors for Foreign Language Learning*, adding that foreign language educators “often face undue pressure and language learners may face unreasonable expectations when unrealistic language outcomes are set for achievement in short periods of instructional time” (2015, p. 12). The ACTFL also recommends that learners spend meaningful time outside of the classroom engaged in activities with the foreign language, noting that even with regular classroom language instruction from grades 6–12, students can only be expected to reach an intermediate level of proficiency (pp. 12–13).

Foreign language teachers can extend the amount of time that students are exposed to the sounds of the target language by assigning homework tasks that allow them to hear and practice the FL in a variety of ways. Results of studies into the effectiveness of homework completion in relation to growth in achievement by learners of foreign languages are limited and conflicting. The researchers in one study even note that there is a ‘chameleon effect’ when examining homework research in foreign language contexts, as the association with achievement varies greatly with the “measures used and the level of analysis” (Trautwein, et al., 2009). Another study by Chang, et al. (2014) found a positive correlation in student attitudes towards foreign language homework and achievement, but also that increased amounts of time spent on

homework was associated with *poorer* course outcomes. This inverse connection between time spent completing homework tasks and its influence on learning has been noted in research on homework in other school subjects (Bempechat, 2004; Epstein & Van Voorhis, 2001), and supports the idea that homework activities should be designed to be purposeful and short in terms of scope and time required for completion.

Several areas in the literature on foreign language learning and homework stand out as requiring more investigation. Wallinger (2000) recommends more research into extending class time by assigning homework to foreign language learners in all four areas of language skill acquisition (reading, writing, speaking, and listening), noting that traditional homework assignments are most often designed to develop only the skills of reading and writing. Trautwein (2008) states that task-specific homework research has been neglected, and calls for more studies in areas where the ‘attractiveness of the assignment’ might have a positive influence on student emotions and therefore positively impact completion and achievement (p. 87). As recently as 2014, Chang, et al. asserted that apart from their research into how homework affects achievement in foreign language learning contexts, there were *no* previous studies that examined how “explicit, non-interactional reinforcement” would influence acquisition of a foreign language (p. 1049). Consequently, the investigation of novel, non-interactional ways for learners to gain exposure to the target language outside of the classroom may add to the knowledge base in these less-researched areas of FL listening comprehension.

Audio-Only Materials and Cognitive Load

Cognitive Load Theory.

When designing recorded listening comprehension materials and exercises for use by students both inside and outside of the classroom, teachers must decide whether to use a video or

audio-only format. In determining whether the addition of visual clues to the language utterances is helpful or distracting for comprehension and retention, teachers should consider the implications of cognitive load theory and how it relates to the sensory modality in which the input is received. Originally developed by Sweller (1998), cognitive load theory, or CLT, examines the cognitive processes by which information is transferred from the working memory to the long-term memory. Sweller postulates that there are limits to what the working memory can process when tasked with unfamiliar information obtained through sensory channels, and identifies three types of 'load' that can add to or decrease the processing demand on the brain: intrinsic load, extrinsic load, and germane load. In an updated account of developments in CLT research, van Merriënboer & Sweller (2005) explain the effects of intrinsic and extraneous loads:

Novel information must be processed in working memory in order to construct schemata in long-term memory. The ease with which information may be processed in working memory is a focus of CLT. Working memory load may be affected either by the intrinsic nature of the learning tasks themselves (intrinsic cognitive load) or by the manner in which the tasks are presented (extraneous cognitive load). According to the 1998 version of CLT, intrinsic cognitive load cannot be altered by instructional interventions because it is determined by the interaction between the nature of the materials being learned and the expertise of the learner. (p. 150)

Germane cognitive load also relates to how new information is presented, and is described as the type of processing that occurs when new information is presented to learners in variable ways. Although this type of presentation does increase cognitive load, it is seen as a positive in terms of instructional design because the variety of input may help the learner "construct cognitive

schemata” that will lead to an ability to later transfer this information to new situations (van Merriënboer & Sweller, 2005, p. 161).

The implication of these concepts on the development of instructional materials is that the way new information is presented to learners will have a strong influence on retention and later application. The new input reaches learners through their eyes and ears, but the “visual and auditory working memory are partially independent” (van Merriënboer & Sweller, 2005, p. 150).

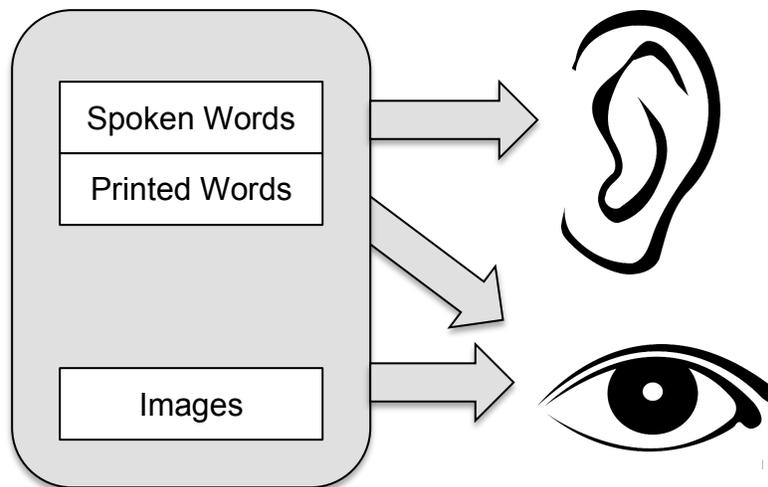


Figure 4: Sensory input received by auditory and visual channels

When one of these channels becomes overloaded with sensory input (for example, if new information is presented in text and images that are both processed through the visual channel), the cognitive load increases and it becomes less likely that the new information will pass into the long-term memory. Sensory input received from one channel can also add to the extraneous load and distract the learner from successfully processing input through the other channel; this might occur, for example, when a moving image requires so much visual focus that audio retention suffers.

Building on Sweller's (1998) ideas on reducing cognitive load, Mayer & Moreno (2003) applied several of his key CLT concepts to the design of multimedia materials for learning. They present a simple definition of multimedia learning as "learning from words and pictures," and suggest that instructional designers should have a goal of aiding meaningful learning, which will lead to students developing a deep understanding of material that can later be recalled and used to solve novel problems (p. 43). They discuss ways to avoid cognitive overload by considering the amount of essential processing required to perform and make sense of a task, and the negative presence of distracting features that require incidental processing not directly related to learning (p. 45). The term 'weeding' is described by Mayer & Moreno as the process of eliminating interesting but extraneous material that might interfere with the learning task (p. 46). This might mean removing background music, images or animations not directly related to the content, or choosing either on-screen text or images (as opposed to both) that might compete for attention through the visual channel. Thus, when designing multimedia materials, teachers must streamline the materials to avoid cognitive overload that will interfere with instructional objectives.

Language Learning and CLT.

In foreign language instruction, listening comprehension activities may have a variety of objectives, including the overarching goals of (1) understanding of spoken interpersonal communication and (2) an ability to derive meaning from spoken texts (ACTFL, 2015). In order to achieve these objectives, learners must first have practice with auditory input of the FL that allows them to discriminate individual sounds, recognize new vocabulary (words and phrases) and grammatical structures, and interpret stress and intonation (Gomez Martinez, 2010). Language learning is by nature a complex process with a high amount of intrinsic cognitive load

(Shadiev, et al., 2015). Anxiety among many learners about using the target language is also noted by Chen & Chang (2009) as likely to increase the cognitive load for learners. Teachers must therefore decide carefully whether the inclusion of visuals in the materials they create for an auditory task will facilitate listening comprehension skill, or whether the presence of moving or still images would instead add too much to the extraneous cognitive load.

There are few studies on CLT in relation to listening comprehension, and the results of the existing studies do not show a consistently strong rationale either for or against the addition of visuals in learning materials. In a study centered on cognitive load and multimedia materials in language learning, Mayer, Lee & Peebles (2014) found that college students of English as a second language performed significantly better on comprehension tests when an audio narration was accompanied by a video that gave the learners more clues to word meaning. However, in another CLT study specifically aimed at discovering the effects of distraction on memory (both auditory and visual), Vredeveldt, et al. (2011) reported that having subjects close their eyes when presented with new information decreased cognitive load and led to better memorization, possibly because it caused the participants to create their own visualizations of the material. Plass, et al. (2003) provided college students studying German as a foreign language with visual annotations of new vocabulary words, and found that for low-ability learners, processing the verbal and visual information might “lead to insufficient cognitive resources for the construction of referential connections between the verbal and visual information” and note that, in agreement with multimedia design principles and CLT, providing the extra visuals “can potentially have deleterious effects” (p. 236). In a study with pre-service English teachers, Coniam (2001) examined the role of audio and video in testing of listening comprehension skills. The participants preferred the audio-only version of the test, stating that they found the video

distracting and unhelpful in increasing comprehension of the spoken text. Rahmatian (2011) separated adult students learning French as a foreign language into two groups, with one receiving an audio-only transcript and the other viewing the same transcript in video form. The results showed some benefits to the video in providing context for the learners, but also that in some cases the video was distracting and that the audio-only materials helped several students with concentration.

Gaps remain in the understanding of how multimedia materials affect cognitive load and learning in all subject areas, but particularly in the realm of language learning. Coniam (2001) suggests that more investigation into the nature of the video itself is needed before conclusions can be drawn about its superiority or inferiority to audio-only materials. Kalyuga (2012) notes the absence of studies on cognitive load in formal learning situations, specifically calling for more research into “how to use spoken text in instructional materials” (p. 156). In 2003, Mayer & Moreno discussed future directions for research into minimizing cognitive load during learning, and cited the need to examine “the role of individual differences in visual and verbal learning styles in influencing cognitive overload” (p. 51). Several studies center on the potential effects on cognitive load when adding written text as a visual, but do not discuss the impact of moving or still images combined with audio narration on retention (Shadiev, et al., 2015; Leveridge & Yang, 2013).

This study aimed to explore the use of audio-only materials for foreign language listening comprehension exercises as a technique to lessen the distractions of extraneous visual information and therefore increase concentration while decreasing cognitive load. The following section reviews the ways that audio materials for language instruction have been created and disseminated by teachers for use both in and outside of the classroom.

Technology to Support Recorded Audio Materials

Recorded Audio in Language Labs.

In a comprehensive review of the history of language labs in foreign language instruction in the United States, Alexander (2007) highlights both the technical advances and theoretical changes that influenced the way that these learning spaces and associated technological resources evolved. Although recording and playback of the human voice was possible even before the turn of the 20th century, Alexander credits the breakthroughs in technology, such as portable radios and recordable cassette tapes, in the 1950's and 1960's as the turning point for the use of recorded audio in military and school language labs as a regular part of instruction (pp. 2–3). He goes on to discuss the diminishing use of foreign language listening labs in the 1970's and 1980's, despite continuing advances in technologies, as a result of teachers adapting more constructivist-based, communicative approaches to language teaching.

This shift away from requiring students to listen to audio recordings in dedicated language labs is also noted by McDonough (2001) as occurring in the early 1980's, when school pedagogy evolved from the transmission method of education to a model in which social and environmental influences were seen as having a critical impact on learning (p. 76). Parallel to the changes in educational contexts were the advances in microprocessor technology that increased the functionality and decreased the cost of desktop computers, thereby prompting school administrators to purchase “vast amounts” of computers by the 1990's (Cuban, 1986; Cuban, 2001, p. 72). With the availability of professionally produced educational software on compact discs (CD-ROMs), foreign language audio resources moved out of spaces designated solely as language labs and into multi-purpose computer labs and classrooms (Chan et al., 2011, p. 12). The pedagogical technique of ‘computer-assisted language learning’ (CALL) emerged to

support second language acquisition (such as the teaching of English as a second language) and foreign language instruction in K–12 schools (Otto & Pusack, 2009).

Audio on the Internet

With the development in the 1990's of the Internet, a new means by which to access and share audio resources for language learning came into use. By the early 2000's, the Internet evolved into what is now termed "Web 2.0," or 'the read-write' web; which provided language teachers and learners access to prepared and authentic examples of the target language (Rosen & Nelson, 2008). Online resources have expanded since that time and now offer multiple ways for learners to access audio and video samples in the new language, including: professionally developed language-learning web sites, user-created YouTube videos, multi-media in wikis and blogs, social media sites, and communicative web applications such as Skype and Google Hangouts (Chan, et al., 2011). While online resources are increasing, they do not always meet the needs of the learners or match well with the curriculum. Although Web 2.0 functionality does allow for teachers to host their own materials, Godwin-Jones (2013) notes that online language learning materials are "often difficult for individual instructors to create themselves" (p. 9).

Mobile-Assisted Language Learning with Audio

Mobile learning has been defined as "learning across multiple contexts, through social and contextual interactions, using personal electronic devices" (Crompton, 2013, p.3). There is great potential to use mobile technologies as learning tools; Rikala (2012) proposes that 'at best, mobile technologies facilitate learning outside of the classroom, and learning materials are no longer limited to textbooks' (p. 1). Mobile phones combine always-on connectivity with a barrage of functions that increasingly are turning them into 'proxies' for computing machines

such as laptops and tablets (Pahalov, 2014, p. 5). Cell phones have been widely adopted by the public for communication purposes since the 1990's, but it was not until the arrival of 'smartphones' that "emerged as hybrids of PDAs (Personal Digital Assistants) and mobile phones the early 2000's and exploded onto the world scene after the release in 2007 of Apple's iPhone" (Woodcock, et al., 2012) that they became more accepted as learning tools.

Smartphone ownership has been increasing steadily over the past few years, with a recent study by the Pew Internet Research Center estimating that 73% of U.S. teenagers (ages 13–17) already own their own mobile, Internet-capable device (Lenhart, 2015). Interestingly, the lack of access to technology and the Internet no longer seems to correlate with lower socio-economic status; Madden et al. (2013) state that teens "who fall into lower socioeconomic groups are just as likely and in some cases more likely than those living in higher income and more highly educated households to use their cell phone as a primary point of access" to the Internet (p. 8). Statistics from the Lenhart study also included breakdowns by race/ethnicity, with results indicating that "African-American teens are the most likely of any group of teens to have a smartphone, with 85% having access to one, compared with 71% of both white and Hispanic teens" (Lenhart, p. 2). Naismith (2005), in considering the use of smartphones as learning tools, notes that teens usually "keep them at arms reach" so they are readily available for "capturing and communicating" experiences via the built-in multimedia capabilities: taking still images and video, or recording and playing audio (p. 7).

Mobile-assisted language learning (MALL) techniques have been used with varying degrees of success over the past ten years, with podcasting as the traditional choice for the delivery of audio materials (Rosell-Aguilar, 2013; Hoven & Palalas, 2011; Aqib & Asim, 2012). In alignment with the research above on the need for additional target language input for early-

stage learners, Abdous et al. (2012) note that “language learning has been identified as one of the disciplines most likely to benefit from podcasting’s integration and use” (p. 45). In this technique, teachers record and upload audio content to an Internet server, and students subscribe to the podcast via ‘Really Simple Syndication’ (RSS), which enables them to automatically receive updated content when they connect their mobile devices to the Internet. Unfortunately, podcasts are somewhat difficult and time-consuming for teachers to produce. In a study involving podcasting in an institution of higher learning, Middleton (2009) notes that the faculty members did not regard the “RSS model of distribution” as useful (p. 153), and that both students and faculty had concerns about the amount of technical expertise required to create and access the podcasts. In Burston’s (2013) examination of MALL studies, the following contradictory results of podcasting use in second and foreign language contexts emerged over the 23 studies that specifically involved podcast use: a positive attitude toward mobile access to the materials, but then a strong preference to access the content via desktop computers rather than mobile (.mp3 or cell phone) devices. The impact of listening to the podcast on language acquisition and/or grades in formal classes was inconclusive in most of the studies, prompting almost all of the authors to call for more research into ways to produce and use supplemental audio materials effectively in language learning contexts.

In summary, there is a need to experiment with additional ways for students to retrieve audio materials hosted on the Internet. Mobile technologies are emerging as the primary way that middle and high school students connect to the Internet, with 91% of all U.S. teens reporting that they use mobile devices for Internet access, and 94% of these “mobile teens” going online at least daily (Lenhart, 2015, p.2). Additionally, such online instructional audio materials should be relatively straightforward for language teachers to create and disseminate, without the need for

specialized hardware resources, expert technology skills, or excessive time. Godwin-Jones (2013) advises that language teachers must acknowledge that technology is becoming an “integral aspect of current language pedagogy” and therefore must look at a variety of options to find out which are most helpful to student learning (p. 15). One such emerging technology that may address both the issues of learner access and teacher ease of creation is a “quick response code” that can link to audio resources hosted on the Internet.

Quick Response (QR) Codes

Industry Development and Use

As noted in Chapter 1, quick response codes, hereafter called QR codes, have been used in industrial applications since the mid-1990's, when they were developed in Japan to assist in the identification of manufacturing parts (Shin, et al., 2012). Liu, et al. (2010) note several advantages of 2D bar codes (such as QR codes), over traditional 1D bar codes (such as those scanned for UPC information), including: their abilities to contain a much greater amount of information, the speed at which information is decoded when scanned, and the fact that decryption software to read the information stored in QR codes is either pre-installed or easily accessible via downloaded applications on most consumer mobile devices (p. 38).

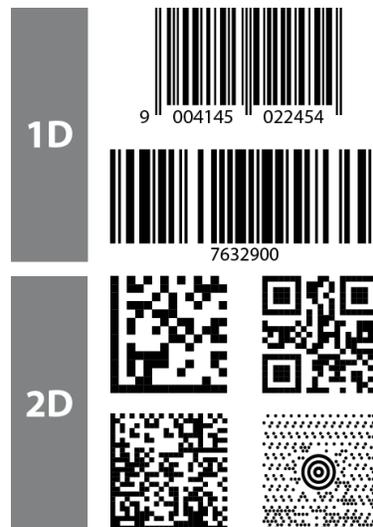


Figure 5: 1D and 2D bar codes

QR codes have been gaining in popularity and use, now appearing frequently on transportation tickets, business cards, and tags for tracing livestock and agricultural products. Apart from identification purposes, QR codes can be used to allow consumers quick access to multi-media materials. Product instructions may include QR codes that link to additional video or audio examples, and QR codes included in any form of print advertisement can route

consumers instantly to a product web site (Law & So, 2010; Shin et al., 2012). QR code use has recently expanded into the medical arena, as doctors in some institutions can scan a QR code on a wristband and gain instant access to a patient’s medical records and history (Mersini, et al., 2013).

Creating and Scanning QR Codes.

QR codes are easy to create using a growing number of free web applications, such as qrcode.com, kaywa.com, qrstuff.com, and qr-code-generator.com. These sites allow users to produce QR codes and then download the finished barcode to print or embed into documents. The QR code can be set to link to different types of content, including a traditional URL that will take the user to an Internet page, a virtual coupon, an audio file (.mp3), or a social media account. Once the destination or type of content is entered, the creator of the QR code clicks one button to make the 2D barcode appear, and can then either download or embed the finished image into a document or web site.

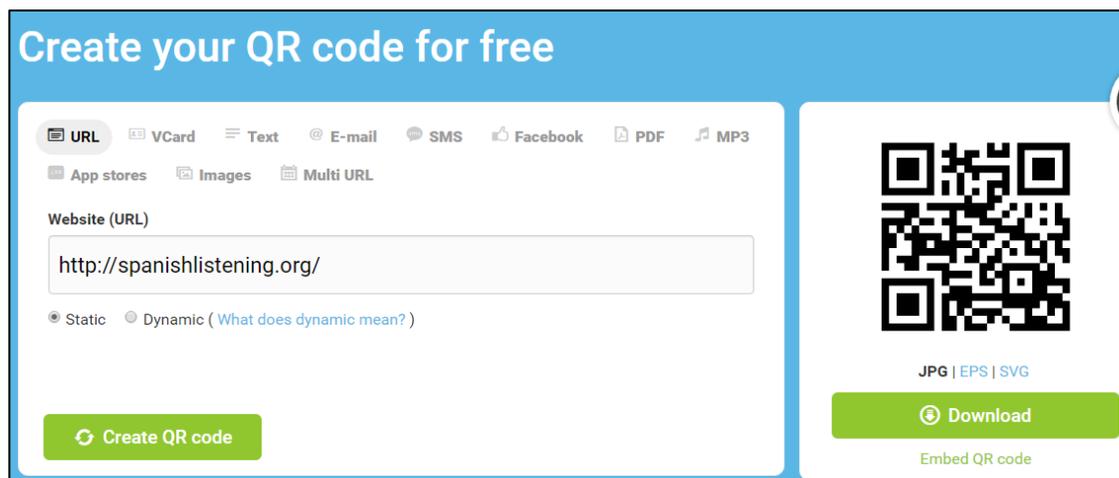


Figure 6: Options for linking to content when creating QR codes

In order to decode the information embedded in the QR code pattern, the user must possess a device that contains a camera, and has either a built-in capability to use the camera as a scanner or the ability to download an application specifically designed for scanning QR codes.

These applications are readily available for the major developer platforms of Apple and Android, with a recent query resulting in more than 100 free options for QR scanning applications on each platform. After opening the application and scanning the QR code, the user is taken instantly to the content via an Internet browser or another built-in function of the mobile device, such as a media player or text display. Although the speed at which the information is brought to the mobile device after scanning varies depending on the stability and strength of the wi-fi or cellular data connection, the actual decoding of the information embedded within the QR code itself takes only an average of 23 micro seconds (Liu et al., 2010).

Transmedia Materials and Use in Educational Contexts

Burns (2016) uses the term ‘scannable technology’ to describe the “interaction of mobile devices and a trigger image” that allows users to connect with content (p. xv). While this term refers to the components needed to encode and then decode the target information, the actual process of moving between paper and digital resources is known as ‘transmedia navigation’ (Cohen, et al, 2012; Leone & Leo, 2011). Several researchers note the practicality of using mobile phones as a bridge between the “analog and digital worlds” (Baik, 2012), observing the availability and flexibility of both paper and Internet site resources (Chao & Chen, 2009). The paper starting point that contains written information and trigger images, such as QR codes, has even been described as a kind of ‘nuclear’ text from which users can access other linked ‘intertexts’ via their mobile devices (Abascal, 2015). These linked resources can be designed or chosen from a variety of media options to best accompany and illustrate the textual information; for example, a video might make a scientific explanation more accessible, an audio recording of a speech could enhance meaning through intonation and inflection, or a simulation or virtual manipulative could be linked to a mathematical problem as an aid to problem-solving. With

careful instructional design, each new linked resource makes a “distinctive and valuable contribution to the whole,” as the “transmedia story unfolds across multiple media platforms” (Abascal, p. 2).

Transmedia materials may offer advantages over those that require students to use a single prescribed instructional medium for a given task. Worksheets and books with transmedia links to outside content can provide options for learners to easily explore their choice of resources in various formats. This student-centered approach appeals to those with different learning styles or preferences. Adding transmedia links also allows teachers to differentiate instruction for learners with a wide variety of cognitive, physical, or behavioral needs (Leone & Leo, 2011; Cohen, 2011). By providing opportunities for student choice and presenting content in formats that can be accessed through different modalities, teachers align their pedagogical practice with the recommendations in the Universal Design for Learning framework (Center for Applied Special Technology, 2015). Cohen suggests that teachers consider building “T-books” (transmedia books) that contain pages at the end with templates that students can use to build working models (for example, a set of working gears), and QR codes linked to videos within the text showing how to construct the models and demonstrating the learning concepts. This kind of interactive resource is not only engaging, but it allows students to use higher order thinking skills, including creativity, when processing new information.

Transmedia materials can be also be used in authentic contexts for situational learning. Kamarainen, et al. (2013) set up triggers at a center for ecology studies and instructed students to scan them to retrieve additional information and instructions for on-site tasks during a field trip. Adkins, et al. (2013) placed QR codes linking to videos showing the correct way to perform physical movements near the associated exercise stations during a physical education class. In

another outdoor education context, Lai et al (2013) performed a study in which students walked around school grounds with a map indicating the location of QR codes that they could scan to connect to Internet resources about the local wildlife and culture.

Law & So (2010) point out that a key benefit of QR codes is that they allow for independence from both the location and time constraints of traditional schooling, and suggest that QR codes be used more widely in informal learning contexts (p. 87). Transmedia materials can enable the kinds of “untethered” learning experiences that Evans (2015) claims 21st century learners themselves envision: “technology-enabled learning experiences that transcend classroom walls and that aren't limited by traditional print or location-dependent resources” (p. 14).

Transmedia using QR Codes for Language Learning

Recent studies involving QR codes in first and second learning language contexts are showing promising results in higher education contexts. Chen et al. (2011) conducted research with Taiwanese university students studying business English. The students used QR codes to display scaffolded questions dispersed through texts that were meant to enhance reading comprehension. Leone & Leo (2011) designed QR codes linking to a variety of sources, such as audio dialogues and videos, as supplements to classroom activities in a refresher English course for Italian teachers of EFL. In another study conducted with university EFL students, QR codes linked students to a server with language learning software meant to be accessed via mobile phones (Liu, et al., 2010). User reaction to the QR codes and supplemental materials in these studies was positive, though there were some scanning and wi-fi technical issues that made access difficult sporadically. Improvements in infrastructure and mobile devices in the past five years have led to advances in the speed and coverage of wi-fi networks that would likely negate these problems if the studies were replicated today.

Studies involving QR codes and K–12 first and second language learners are scarce. Arikan & Ozen (2015) examined the use of QR codes to help fourth grade students in a Turkish private school for learn new vocabulary words in English. Students scanned QR codes during class time and were shown videos and textual explanations related to the new vocabulary. These learners showed a statistically significant increase in recognition of the vocabulary when pre-intervention and post-intervention test scores were compared. Interestingly, the teacher in the study chose not to continue the use of the QR code supplements after the study despite the student engagement and increase in learning, because of the perceived barriers of time needed to complete the activities and distraction by the students in the class causing management issues (p. 550). In a study with primary and secondary students in Finland, Rikala & Kankaanranta (2012) looked at students performing tasks enhanced with QR codes in a variety of subjects and contexts, including scavenger hunts in the school hallways, physical education exercises, and collaborative research projects involving heavy first language use. The results of the study showed similar interest and engagement in the transmedia materials by the students, but again negative feedback was reported on the part of the teachers related to both the time required to set up the tasks and the technical problems that some students encountered when some of the multimedia resources did not play correctly on their devices. Dourda, et al. (2012) designed a game-based environment in which Greek primary school students studying English as a foreign language used QR codes to link to ‘hints’ that would further their progress while they learned English. They also found improved academic achievement and engagement on the part of the students, and praised the fact that teachers with no specialized technical knowledge were able to design the activities. In an examination of the possibilities for QR codes to enhance literacy instruction for native speakers in middle school, Stuart, et al. (2014) discuss how students

recorded audio book reviews through the web site Vocaroo and added the corresponding QR code to the cover of school library books. No studies were found involving listening comprehension activities that were accessed via transmedia materials for middle or high school students.

Mobile, Transmedia, and Listening Comprehension

Leone & Leo (2011) noted positive impacts on the “integration of paper-based and digital learning material through QR code” (p. 338) and state that little literature is available about this integration of the two media and their potential to help language learners (p. 323). The lack of studies centering on transmedia applications in language learning, and listening comprehension in particular, is not surprising, given the recent nature of the innovations in mobile hardware and software.

Yet there are some in the field of language acquisition who admonish teachers and academics for not fully investigating the potential of the transmedia approach to designing learning materials. Robin (2007) predicted almost ten years ago that hardware technologies already in use by students in their everyday lives could be utilized for foreign language listening comprehension activities. He also noted the possible benefits to student control over audio delivery of instructional materials, pointing out that teachers could make better use of authentic materials if students had the ability and time to listen to samples repeatedly (p. 110). Otto & Pusack (2009) note that language teachers have a tradition of embracing technological tools that were not designed specifically for instructional use and ‘discovering’ how they might enhance student learning (p. 790). Abascal (2015) writes that designers of instructional content are not “taking full advantage of transmedia,” especially in light of the growing numbers of students with access to mobile technologies (p. 16).

Summary

The inter-connectedness of our modern global society is reflected in the call by educational policy makers for K–12 students to graduate with competency in the ‘21st century skills’ of communication, collaboration, and cooperation in order to be successful in their future careers (Kay, 2010). Godwin-Jones (2013) lays some of this responsibility specifically on teachers of foreign languages, maintaining: “If we don’t focus on finding ways for language learning to be part of what has become an essential thread of our students’ lives today, we are unlikely to be successful in positioning our students for success in a multilingual, multicultural world in which language maintenance and language learning aptitude have become so important” (p. 16).

A key aspect of foreign language literacy is being able to understand and respond to the spoken word in authentic contexts. The literature above presents the possibility that instruction in listening skills can be extended through homework practice activities, and includes the assertions by scholars that this is a less-researched area in the field of foreign language instruction. Sweller’s (1988, 2001) cognitive load theory provides a rationale for designing audio-only materials that facilitate a focus on and retention of new sounds, words, and phrases without interference from the visual channel.

Such audio recordings can now be accessed quickly and easily by students using mobile technology to scan paper resources for trigger images, such as QR codes, that link to supplemental materials. This relatively new technique of scanning links to multimedia content from paper or other physical objects is known as transmedia navigation. Investigation into the possibility of using transmedia materials for the enhancement of listening comprehension in foreign language learning is rare, and almost non-existent for middle and high school learners.

One benefit to this approach is the fact that most students in this 12–18 year old age group now already own, or have access to, mobile technologies that would allow for them to complete this kind of exercise outside of the classroom. In 2007, Robin wrote, “in the immediate future — the next five to ten years — the frontier in language learning and technology will not be found in what program does what better, but rather which students use off-the shelf technology to best facilitate their own learning in their own learning style (p. 109). Looking into ways that students can be encouraged to use the multimedia capabilities of their smartphones and tablets may help in-service and pre-service language teachers start to view smartphones as powerful tools for learning, instead of merely as distracting ‘toys’ or ‘entertainment devices’ (Kolb, 2008).

This study aimed to address the research gap noted throughout this chapter, specifically how well QR codes can enable transmedia navigation, as a means by which foreign language learners can easily access audio excerpts outside of the classroom. Vandergrift (2007) calls for more research on exactly this combination of emerging technologies and FL listening pedagogy, writing, “How listeners use new technologies, the choices offered to the listener in accessing the text, and how the listener exploits those choices continue to be important avenues for research into listening comprehension in multimedia environments (p. 206). The next chapter will present the design of the study that was meant to provide data to help answer the research question: *What are the benefits and barriers to using Quick Response (QR) codes, that link to audio resources, as a means by which to support students’ listening comprehension skills in the beginning stages of foreign language acquisition?*

