

Proposal Draft

**QR Codes for Audio Support in
Foreign Language Learning**

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CHAPTER 1 – OVERVIEW OF THE STUDY

Introduction

According to the National Council of State Supervisors for Languages (NCSSFL), twenty-five states currently either require or recommend that students enroll in foreign language courses in high school in order to qualify for graduation, college admission, advanced diplomas, or scholarships (NCSSFL, 2012). The need for competence in a second language is also often cited as a necessary “21st century skill” for graduates entering a job market in a more interconnected, global economy (Kay, 2010; Lemke, 2010). There is a persistent minority of students at the middle and high school levels who experience difficulty acquiring a foreign language, despite a high degree of effort and academic success in other subject areas (DiFino & Lombardino, 2004). While some research suggests that there is a specific disability associated with learning difficulties in foreign language acquisition (Sparks, Ganschow & Pohlman, 1989; Gazaleh, 2011), other studies have contradicted previous hypotheses or changed the focus to the consideration of problems that students encounter in both native and foreign language study (Sparks, 2006). One common factor that appears in much of the research is that many students who are less successful in learning a foreign language in school have deficits in auditory discrimination and oral production of the target language (DiFino & Lombardino; 2004, Palladino, 2008; Sparks, 2006).

The role that exposure to audio and visual media plays in foreign language acquisition is not agreed upon by educational scholars, with some arguing that media are simply vehicles by which to deliver instruction, and therefore not inherently valuable or influential in increasing academic performance apart from their use by a skilled instructor (Clark, 1983, as cited in Chan, Chin, Nagami and Suthiwan, 2011, p. 8). Others consider such resources valuable as part of a

wide variety of ‘comprehensible input’ that teachers provide to learners in order to strengthen their skills in both listening comprehension and speaking with native-like pronunciation, cadence, intonation, and fluidity (Rahmatian, 2011). Modern organizations centered on best professional practices for foreign language instruction, such as the American Council on the Teaching of Foreign Languages (ACTFL), recognize the importance of providing such auditory and visual input through the use of new technologies and formats, including texts both in oral and video format, the Internet, podcasts, digital media, and mobile phones (ACTFL, 2013, p.20).

Study Overview

The proposed mixed-method study with middle and high school teachers of foreign languages first seeks to understand the current practices of teachers in providing auditory input for students by anonymously polling a large ($N > 30$) group of practicing teachers on their pedagogical use of media resources. The next phase of the study includes face-to-face interviews with 6-10 practicing teachers to explore similar questions about media creation and distribution for use with students. At the conclusion of the first interview the teachers will be trained to create and distribute custom audio samples by the use of a quick response (QR) code and the Internet site <http://qrvoice.net> (see Figure 1). A follow-up interview after the teachers have tried one of three possible activities that use the QR code audio samples and mobile technology in the classroom will center on the teachers’ facility with creating the materials and their perceptions of the usefulness of this delivery method.



Figure 1: QRVoice.net interface with QR code

Research Questions

The following proposed research questions will be addressed in the study and analysis:

1. How do foreign language teachers currently provide auditory input in the target language to their learners?
2. What are the barriers that foreign language teachers face when creating and distributing customized audio examples in the target language via technology?
3. Are QR codes an efficient and practical way (in terms of technical know-how, time needed to create materials, and student access) to deliver and access audio support in face-to-face foreign language learning contexts?

Research Gap and Significance of the Study

Modern textbooks used in public secondary school settings often include multi-media resources either in the form of physical materials such as compact discs (CDs) or digital versatile discs (DVDs). Others include web-based resources that students access via an electronic version of the text or by entering an Internet access on a web browser. It is unclear, however, as to how and how often foreign language teachers are using these resources for instructional purposes in the classroom, as reference materials, or as part of assignments required for homework. A recent search for research related to this topic yielded few results; the one study that specifically centered on the use of multi-media textbook aids investigated university students' – rather than instructors' - perceptions of their usefulness for learning (Mathew & Alidmat, 2013). Therefore, the first task in the proposed study is to investigate current instructional practices of foreign language teachers related to the use of such multi-media resources by polling a large group of practitioners on this topic.

Foreign language teachers who do not have access to such materials, or who choose not to use them because of the poor quality or misalignment with the course learning objectives, may seek to create and distribute custom audio and visual materials to their students. New technologies such as digital voice recorders and video recorders on mobile devices such as tablets and 'smartphones' have made creating custom media samples easier, but still require time and some level of technical expertise to master. The additional barriers of hosting and distributing the custom media files to students remain, even for teachers who manage to successfully create these resources. The proposed study includes questions both in the online survey and personal interviews to learn more about the interest and abilities of middle and high school foreign language teachers to create and distribute media resources.

Lastly, some educational theorists (Mousavi, Low & Sweller, 1995) and leaders in the field of multi-media design for educational purposes (Clark & Mayer, 2008) argue that there are benefits to presenting audio materials separately from visual (i.e. still images and video) resources in order to decrease the ‘cognitive load’ on the visual channel through which learners absorb new information. To explore teachers’ perceptions about the importance and effectiveness of audio-only supports that they provide to foreign language learners, there are questions about this topic in both the survey and the interviews. Additionally the research includes a training for the participating teachers on the use of a possible technology tool to create and to allow students access to audio-only media support.

While there have been a number of studies in recent years centered on mobile support for language learning, most have been situated at institutions of higher learning, center on learning English as a foreign or second language, and involve specifically designed mobile applications (Wu, 2015; Aqib & Asim, 2012; Woodcock, Middleton, & Nortcliffe, 2012; Nah, White & Sussex, 2008). Although QR codes have been successfully implemented in the business and marketing contexts since the early 1990’s (Shin, Jung, & Chang, 2012), they are a relatively new pedagogical tool, so there are very few studies regarding their use to help students access academic support materials. Some educators have studied the use of specific applications that are designed to be accessed via QR code (Tsung, Tan, & Chu, 2010; Kamarainen, et al., 2013), and others have written about the potential for using the transmedia approach that allows for connection to audio supports, but have not studied the implementation of this approach (Law & So, 2010; Leahy, 2013; Crompton, LaFrance & van ‘t Hooft, 2012).

Uncovering the current state of instructional practice with multi-media resources - and in particular focusing on the use, creation, and distribution of audio resources – will inform the

practice of practicing and pre-service teachers of foreign language at all levels and modes (face-to-face, online) of instruction as they explore ways to create and distribute audio media support to their students.

CHAPTER 2 – REVIEW OF THE LITERATURE

Introduction

The following articles review the evolution of how teachers have provided audio media examples during the instruction of foreign languages. The literature then centers on the possibilities for creating and using QR codes to provide access to audio supports via mobile technology during the acquisition of a foreign language in secondary schools.

Definition of Terms

Auditory Input

For the purposes of this study and paper, ‘audio’ or ‘auditory’ input will refer to examples of the target language that are spoken aloud either by human or computer voice without the addition of static or video images. The exploration of audio resources in this paper generally excludes that delivered through specifically-designed software or computer-assisted language learning environments, including online courses.

Quick Response (QR) Code

A QR code is a 2-dimensional bar code that consists of a series of black and white squares. The larger squares in the corner hold no data, but instead serve as guides for the alignment of the code when scanned by a camera-enabled mobile device. QR codes can link to many different kinds of digital resources, including a web page, image, video, audio track, phone number, text message, contact information, or plain textual content.

The Evolution of Theory and Practice in Using Audio Media for Language Learning

Pre-Media Approaches

The Audio-Lingual Method

Audio-lingual approach and the shift toward more communicative methods.

*Language Labs****The Communicative Approach and Comprehensible Input***

Importance of input for language acquisition; various ways that media can support FL learning:

“To acquire listening and speaking proficiency, the input must be oral, for example, the voice of the teacher, voices of native speakers, radio and TV broadcasts, books on tape, movies, and video clips. Exposure to input means being exposed to target language texts while trying to understand them. P. 26” Also discusses previous difficulties in creating media resources (Chan, Chin, & Nagami, 2011).

Current and Emerging Theory and Practice in Providing Audio Input for Language Learners**Cognitive Load Theory**

This theory developed by John Sweller (1988) examines cognitive problem-solving and puts forward the idea that learning can be described as the process of solving a problem, or moving from the “problem state” to the “goal state” (p. 260). If learners overload their ‘cognitive processing capacity’ during attempts to solve the problem, this may prevent learning from taking place, as the brain has no ability to create schema while it is occupied with other tasks (p. 261). As a result, the learner may successfully ‘solve’ the problem yet still not gain knowledge that one might expect would result from this kind of traditional problem-solving practice commonly used in educational settings (p. 284).

The implications for this theory are that teachers should design instruction and materials to reduce the cognitive load placed on the learner as much as possible so as to allow him to maintain enough cognitive processing capacity to spend on the building of knowledge schema.

In recent years, Sweller and others have built upon the original theory...

Mayer's Multimedia Principles

*Overview of multi-media principles and e-Learning
Discuss Modality Principle and Redundancy Principle*

Provide recommendations for audio supports alone apart from video; benefits and drawbacks

Associated research

Examined video and audio supports in foreign language learning. Video found to be more effective but some evidence that audio alone can be useful when images/action from video can take focus away from comprehension (Rahmatian, 2011).

Mayer 1997

Mayer's Multimedia principles, including adding audio to support text, and better to have audio narration and image than audio, written text, and image (Clark & Mayer, 2008).

Mayer, 2014

*Multimedia Learning in a Second Language: A Cognitive Load Perspective
Some benefits to video with slow narration, not seen with onscreen text*

Differentiation and Universal Design for Learning (UDL)

*Looks at possible indicators to identify students who may struggle in FL classrooms.
Discusses areas of concern in FL acquisition, including auditory discrimination. Suggests presenting information with audio and teaching through more than one modality (DiFino & Lombardino, 2004).*

Results consistently showed that participants with FLLD have phonological processing and memory deficits (Palladino, 2008,.p. 620)

“The findings postulated that Chinese dyslexic children also encounter problems in learning English as a second language, and they are almost weak in phonological processing both in Chinese and English.” (p. 160) Many dyslexic learners struggle with both reading and listening comprehension. (Ghazaleh, 2011, .p. 164)

*In support of UDL for all students learning a **foreign** language. Many suggestions for including Internet resources and audio to support FL learning, including Web 2.0, collaborative docs, CD, podcasts. “The researchers at CAST (Rose & Meyer, 2002; Rose, Meyer, & Hitchcock, 2005) suggested that media such as digital text, digital images, digital audio, digital video, digital multimedia, hypertext, and hypermedia have malleability that can provide opportunities for learning that may not be possible with print text and traditional teaching methods (Rose et al., 2005).” (Castleberry & Evers, 2010).*

Possible Benefits of Utilizing QR Codes and Mobile Technology for Creating and Linking to Audio Content

Mobile Technology for Language Learning

Smartphone ownership in the United States is increasing at all age levels, with the most rapid gains in the 12-18 year old range. Surprisingly, there does not seem to be a correlation between teen ownership of smartphones and socio-economic status (Madden, et al., 2013). This trend opens opportunities for teachers to use ‘bring your own device’ (BYOD) methods to incorporate more technology into their classroom teaching and to assign homework that requires access to the Internet.

A wide variety of mobile learning (m-learning) methods have been tried with success to support the teaching and learning of foreign languages. Teachers can provide individual vocabulary words, grammatical examples, dialogues, or examples of prose in the form of audio podcasts that students can download and access on a mobile device (Dickerson, J. & Browning, 2009). They can also set up mobile devices to act as reference materials for students as an alternative to a paper dictionary or textbook (Aqib & Asim, 2012, p.9). As part of the assigned class- or homework, the foreign language teacher may encourage the use of mobile devices as a

way to check translations or even to record oral practice with the foreign language for reflection or assessment (Kolb, 2008, p. 715). Smartphones can be used for ‘mobile blogging’ when out of the classroom in authentic contexts (Comas-Quinn, Mardomingo, Valentine, 2009). There are many applications (apps) now designed for use on mobile devices such as tablets and smartphones that can help people learn or refine a foreign or second language, and some studies show ‘significant gains in vocabulary knowledge’ among students who utilize them regularly (Wu, 2015).

Unfortunately, many teachers and students are unaware of the benefits of using mobile technology to support foreign language learning (Woodcock, Middleton, Nortcliffe, 2012, p. 1), or reluctant to allow it in a learning context for fear of distraction and misuse (Kolb, 2008).

Quick Response (QR) Codes

A Quick Response (QR) code is a two-dimensional barcode in the form of an image comprised of small black and white squares. Unlike UPC codes, QR codes store information in both vertical and horizontal directions, thereby having the ability to display more than 1000 “characters” that can store up to several pages of information (Lai, et. al, 2013, p. E58). These codes were originally developed in the mid-1990’s for use in automotive factories in Japan (Shin, 2012), but their use spread rapidly to the advertising industry.

There are several free web tools and mobile applications that allow users to create and track QR codes, including Kaywa (<http://qrcode.kaywa.com/>) and Myqr (<http://myqr.co/>). Creating the code takes a matter of seconds; once the web link or content is entered into the web site interface, the QR code is automatically generated. It can then be saved as an image (.jpg or .png) and printed or embedded into word processing software or Internet pages.

In order to interpret the QR code, the user must install a QR code reader on a mobile

device, such as a smartphone, that also contains a camera. After opening the application, the camera on the mobile device acts as scanner that ‘reads’ the QR code and interprets the binary patterns. QR codes can link to a URL leading to any type of web-hosted content, such as a web site, online video or image, or audio track. When a user scans the QR code with a smartphone, the application will decode the information and route the user to a web address using the default browser. Additionally, QR codes can be linked to textual content that does not pull from the Internet, making it operable even when the user’s device is not connected to a cellular or Wi-Fi network.

Transmedia with QR Codes

Transmedia materials are those that allow the user to ‘cross media’ from a physical object, such as a piece of paper, to a digital resource (Cohen, Smolkin, & Bull, 2011, p. 238). While it has always been possible to refer readers of a paper or book to a digital reference through the listing of a web address (URL), the length and complexity of typing in long URLs made this technique impractical to use, especially with younger learners. Including a QR code instead allows users to instantly access the digital material linked to the code with any mobile device that includes a camera and QR scanning application without needing to type in long strings of characters.

Teachers in several contexts have experimented with using QR codes as a way to enhance learning activities that have traditionally relied on other formats as the single source. For example, one use of QR in a physical education class allowed students to view short video clips of people performing physical activities at three skill levels, thereby helping the teachers differentiate instruction to the current needs of the students (Adkins, Wajciechowski, & Scantling, 2013).

Another use of QR codes in an educational setting centered on how teachers used them to provide “additional activities that scaffold, focus, extend or support students to get started” in an elementary math classroom. The results were promising for the use of QR codes as a means of differentiating instruction and to encourage students to work more autonomously “by identifying which route is most appropriate for them” (Leahy, 2013, p. 28).

QR codes have shown promise in keeping students engaged in learning tasks when used in ‘treasure hunt’ activities outside of the classroom, either in outdoor natural settings or on field trips at museums and indoor places of interest (Rikala & Kankaanranta, 2012). In one such study, elementary students successfully used QR codes with an application specifically designed for gathering information related to science content in the field (Kamarainen, et al., 2013).

QR Codes for Language Support

Research that examines the use of QR codes in language-learning contexts has yielded mixed results in regards to how this method of quick access to resources may affect language acquisition. In one study, students were provided with scaffolded questions that they accessed via QR codes while reading. It was determined that using the scaffolded questions did cause significant gains in understanding the texts, but that “direct access to digital resources using QR codes” did not in itself impact reading comprehension. In a follow-up survey to the intervention, however, the students favored the combination of print and digital resources, even though there were some technical glitches that sometimes made the access inefficient (Chen., Teng, Lee, & Kinshuk, 2011).

Much of the research involving QR codes has focused on their use in English as a Second/Foreign Language contexts. One study involved college freshman using a specially-designed augmented reality system by which they could access web pages including audio

materials by scanning QR codes. The students reacted favorably to the way that they could easily access the material via mobile devices anywhere on campus and indicated that they would like professors to use similar instructional methods in other courses (Tsung, Tan, & Chu, 2010, p. 48). Another study looked at combining paper-based and technology-enhanced learning in EFL contexts in an effort to see how personalization and flexibility of learning were affected (Leone, & Leo, 2011, p. 328). The results again demonstrated that the learners reacted very favorably to the way that they were able to easily access the materials via the QR codes.

QR Codes for Audio Support

Attempts at using QR codes to link learners to audio supports in the target language show early promise. Suggested classroom applications include audio recordings and podcasts to accompany lessons, a QR Code “word wall” for vocabulary development, and a link via QR code to a dialogue in the foreign language (Hopkins, 2013, pp. 38-43).

One rationale for creating custom audio recordings that students can access via QR codes is that traditional prepared materials on CDs or DVDs “may not be flexible enough to cater for the diverse needs of the teachers” and “must be pitched at the right level of difficulty” (Law, & So, 2010, p. 94). Creating several different levels of audio recordings that students can scan via a QR code is a low-cost solution to differentiating instruction. If teachers know that students all have access to Internet-connected mobile devices outside of the classroom, including QR codes on homework papers can allow them to easily access and study supplementary materials such as audio recordings (Crompton, LaFrance, van ‘t Hooft, 2012).

When first implementing new methods involving technology, teachers must be aware that the novelty effect of experimenting with a device or application may diminish after repeated use, therefore negating any perceived benefits of increased student engagement or motivation. This

'wear-out' effect (Wang, 2014, p. 217) may also occur with the use of QR codes, but as this technology is new to most educational settings, there are presently no studies that investigate any long-term trends in student use of QR codes.

CHAPTER 3 - METHODOLOGY

Introduction

This mixed-methods study is designed to first examine current instructional practices for creating and distributing audio supports to students in foreign language classrooms. It then investigates the practicality and perceived usefulness of providing such supports through the use of audio QR codes and mobile technology. Analyzing the feedback on the effectiveness and practicality of this new method may inform the pedagogical practice of middle and high school foreign language teachers.

Research Questions

The following proposed research questions will be addressed in the study and analysis:

1. How do foreign language teachers currently provide auditory input in the target language to their learners?
2. What are the barriers that foreign language teachers face when creating and distributing customized audio examples in the target language via technology?
3. Are QR codes an efficient and practical way (in terms of technical know-how, time needed to create materials, and student access) to deliver and access audio support in face-to-face foreign language learning contexts?

Research Design

Overview of the Design

This is a mixed-methods study consisting of three parts: (1) an online survey, (2) a pre-training interview followed immediately by a short professional development training, and (3) a second follow-up interview.

The first data collection method is an online survey of a wide group ($N > 30$) of practicing middle and high school foreign language teachers on the current methods that they use to provide auditory foreign language input to students, both in and out of the classroom. This anonymous survey will be distributed via Twitter using the *#langchat* hashtag. Colleagues will also be asked to distribute the link to the survey by e-mail to other educators in their professional learning network.

Concurrently the researcher will invite five to ten practicing foreign language teachers to participate as subjects of a case study. The teachers will take part in an initial interview that includes some questions similar to those distributed in the survey, and others that require a more in-depth discussion about the current methods they use (if any) to provide audio input to students. Other questions will be used to elicit a response regarding the barriers that might be present to creating and distributing custom audio materials to match the curriculum.

At the conclusion of the interview, the researcher will provide a short professional development training session to each of the focus teachers on the possible uses of QR codes as a way to provide customized audio support in the target language. Three options for using QR codes in the classroom will be presented: in the first the QR code leads to audio clips of a dialogue in the target language, in the second the QR codes link to audio clips of fragments of a scrambled story in the target language, and the final option is a Cloze activity in which the QR code is scanned to hear audio clips in the target language which the students must listen to as they identify missing words in a transcript. The teachers will be provided with a full set of

instructions, word processing templates, and an example activity for each of the three methods. At the conclusion of the short training, the teachers will be asked to choose which activity they think will work best with their pedagogical styles, curriculum, students, and settings. They will then agree to implement the QR audio activity in the classroom or as a student homework assignment within the next month. The researcher will provide options for modifying the activities based on the number and type of mobile device that are available to the teacher and students, and will be available to assist the teacher in creating the materials, if needed.

After the teachers have constructed and implemented their preferred QR audio activity, they will each participate in a follow-up interview in which they will provide samples of the materials that they created for the students, explain any difficulties they had in creating the materials, discuss the general reactions of students to the QR codes, and give their overall impressions of the practicality of using QR codes to provide auditory input. No student work is viewed or collected during the follow-up interview.

Participants

Foreign Language Teachers

Two groups of foreign language teachers will participate in the study. One larger group (N>30) will be contacted via Twitter or e-mail and asked to take an anonymous online survey with questions centered on current practices and opinions on providing audio input in the target language to their students. The second group of 6-10 teachers will be recruited from at least two different middle or high schools. These participants will be the subjects of short case studies; they will be asked to meet twice with the researcher for 45-60 minute interviews. The first interview ends with a short professional development training session. The teachers who

participate in the interviews will receive a gift certificate to a local or online vendor of his or her choice at the conclusion of the study.

Researcher

The primary investigator will be responsible for the development of the survey questions and the construction of the online survey tool. She will also distribute the survey via Twitter and colleagues in the educational community.

The researcher will also recruit teachers for the case study and conduct the interviews and professional training with the volunteers who agree to participate. The researcher will be available to answer questions and provide technical support to the case study teachers at any time during the study.

The primary researcher will be solely responsible for the data collection and analysis including downloading and interpreting the survey results, recording/transcribing/coding the interviews, and collecting any examples of instructional materials that the teachers distribute to the students as part of the QR audio activity.

Legal and Ethical Protections in Place

Institutional Review Board (IRB)

The researcher, who has completed all required CITI training modules for working with human subjects, will first obtain permission to conduct the study from the Institutional Research Boards of both institutions of higher learning to which she is affiliated (degree-granting and current employer).

Survey

The first page of the online survey contains a detailed consent form (see Appendix B) which describes the purpose of the study, reiterates that participation is anonymous and

completely voluntary, and provides details as to how confidentiality of the data results will be maintained.

Case Study Participants

The researcher will send a letter to the principals of the target schools explaining the nature of the study and asking for permission to invite foreign language teachers in the building to participate. If they agree to allow the researcher to contact the teachers, the principals will sign and return the form to the researcher (see Appendix C). Once the teachers have been contacted and agree to participate, they will also be provided with an informed consent form explaining the nature of the study, the way that identities will be anonymized, that participation is voluntary and that they can withdraw from the study at any time, and how the data from the study will be stored securely (see Appendix D).

Privacy and Confidentiality

The online survey will be shared via social media, with the settings such that the respondents do not see the compiled results at the conclusion of the survey. Only the researcher and faculty advisor will have access to the results of the online survey. The survey is completely voluntary and anonymous. No identifying information, such as IP or e-mail addresses, will be collected. There will be no way for the researcher to identify respondents or match responses to the person who entered them. Once the results have been downloaded, the survey instrument will be deleted from the online site. According to the web site's privacy policies, deletion of the survey instrument will lead to instant inaccessibility of the results and the permanent deletion of the collected responses within 90 days. The results will be stored on a computer that is not connected to the Internet in a private home for 7 years and then permanently deleted.

Teachers who participate in the interviews/professional development will print and sign their names on the consent form. The teachers will be identified in the audio recordings and transcriptions of the interviews by number only (e.g. “Teacher 1”). The interviews will be transcribed with no identifying information, including that of the state, city/town, school district, or school. Any mention of identifying information during the interviews will be struck from the transcription. The recordings will be stored on a computer that is not connected to the Internet in a private home for one year and then permanently deleted. The transcriptions will be stored for 7 years on the same computer. The paper consent forms and paper key linking the teachers’ names with their assigned number will be only accessed by the researcher and available for viewing by the faculty advisor. These papers will be kept in a locked safe in a residence and shredded after seven years.

Data Collection

Survey

The first instrument for data collection is a survey of middle and high school foreign language teachers ($N > 30$) on the current methods that they use to provide auditory input to students. This anonymous survey will be distributed via Twitter using the #langchat hashtag. The researcher will also distribute the link to the online survey to colleagues in the educational community and request that they forward it to any practicing foreign language teachers that they have in their professional learning network. See Appendix E for the proposed questions on the survey.

Initial Teacher Interview and Training

Five to ten practicing foreign language teachers will be recruited to participate in case studies involving two meetings outside of school hours. The first meeting will consist of an

interview that includes similar questions to the online survey; some will require a more in-depth discussion about the teacher's current methods of providing audio input to students, including the barriers that might be present to creating and distributing custom materials to match the curriculum (Appendix F).

Immediately following the first interview, the researcher will provide a short professional development training session to each of the focus teachers on the possible uses of QR codes as a way to provide customized audio support in the target language. The teacher will be asked to implement one method that works best with his or her pedagogical style, curriculum, students, and setting within the next month. Options for teachers who do not want to request that students use their personal devices to scan the QR codes will be discussed and include using a class set of mobile devices, working in teams or at centers with a limited number of devices, or even using one teacher-supplied (or researcher-supplied) device in turn. The teachers will also have the choice to make student participation in the activities optional, with no penalty for non-participation.

Final Teacher Interview

After the teachers have tried the QR audio method with their students, they will participate in a follow-up interview in which they will provide samples of the materials that they created and provided to the students. The teachers will be asked to discuss their overall impressions of the practicality of using QR codes to provide auditory input, and the general reactions of students to the QR codes (Appendix G). No student work is viewed or collected during the follow-up interview.

Data Analysis

This is a mixed-methods study. The quantitative data will be collected through the online survey. Qualitative data includes additional data from the interview answers provided by the classroom teacher and the instructional materials that they create.

Quantitative Analysis

The survey data will be downloaded from the online survey tool site and exported in a spreadsheet for tabulation and statistical analysis. The data will be graphed and inspected for trends and outliers, and important results will be prepared in table format for display in the research document. Depending on the question format, analyses of the results will be performed that include determining measures of central tendency and variability.

Qualitative Analysis

The recordings of both interviews with the classroom teachers will be carefully transcribed, with any identifying information being eliminated from the transcription. After each set of interviews is transcribed, the resulting data will be transferred to a spreadsheet and examined for themes. The transcriptions will then be coded and organized to help see the connections between the research questions, topics, theory, and previous research in this area.

After both sets of interviews are transcribed and coded, I will perform additional analyses that include triangulation of the ideas and themes that emerge from the coding process with the evidence from the instructional materials and the quantitative data from the online survey.

Limitations

A discussion on the limitations of the study will be included in the full description of the methodology. These include, but are not limited to, the sample size and selection of the participants completing the online survey and taking part in the case studies, teachers' time

constraints and access to technology, unanticipated problems with the data collection instruments including the survey and interview questions, etc. This disclosure will also include the limitations and influences on my own choices as a researcher, such as the population to be studied, the inclusion and exclusion of certain literature, and the types of data and analysis that I chose for the study.

Timeline for Data Collection and Analysis

Month 1

- Recruit teachers for case studies
- Collect all consent forms from school principals and participating teachers and set dates for initial interviews
- Distribute and collect responses to the online survey of foreign language teachers

Month 2

- Start face-to-face interviews/trainings with case study teachers
- Start transcriptions of teacher interviews

Month 3

- End data collection via survey; compile survey results and start quantitative and qualitative analysis of survey data
- Complete all initial face-to-face interviews/trainings with case study teachers
- Complete transcriptions of all initial teacher interviews
- Code all initial teacher interviews
- Start qualitative analysis of initial teacher interviews
- Participating teachers start to implement QR activities in their classrooms

Month 4

- Complete quantitative and qualitative analysis of survey results
- Finish qualitative analysis of initial teacher interviews
- All participating teachers finish the implementation of QR activities in their classrooms
- Start final interviews with case study teachers
- Start transcriptions of final teacher interviews

Month 5

- Complete all final interviews with case study teachers
- Code all final teacher interviews
- Start qualitative analysis of final teacher interviews
- Examine instructional materials and summarize pertinent observations in qualitative form

Month 6

- Complete all transcriptions and coding of final teacher interviews

- Complete qualitative analysis of final teacher interviews
- Triangulate results of teacher interviews with results from survey and instructional materials analysis
- Summarize important findings of study

Summary Data Table

Research Question	Collection Method	Analysis
<i>How do foreign language teachers currently provide auditory input in the target language to their learners?</i>	online survey	Tabulation and statistical analysis of survey results including measures of central tendency and variability
	teacher initial interviews	Transcription and coding of interview data to examine common themes within and across subjects
<i>What are the barriers that foreign language teachers face when creating and distributing customized audio examples in the target language via technology?</i>	online survey	Tabulation and statistical analysis of survey results including measures of central tendency and variability
	teacher initial interviews	Transcription and coding of interview data to examine common themes within and across subjects
<i>Are QR codes an efficient and practical way (in terms of technical know-how, time needed to create materials, and student access) to deliver and access audio support in face-to-face foreign language learning contexts?</i>	teacher final interviews	Transcription and coding of interview data to examine common themes within and across subjects
	instructional materials	Examination of instructional materials and triangulation with the qualitative data from the teacher interviews and survey data

APPENDICES

Appendix A: New York State Standard for Teaching Languages Other than English (LOTE)

Standard 1—Communication Skills

Checkpoint A

Modern Languages

1. Listening and speaking are primary communicative goals in modern language learning. These skills are used for the purposes of socializing, providing and acquiring information, expressing personal feelings and opinions, and getting others to adopt a course of action.

Students can:

- comprehend language consisting of simple vocabulary and structures in face-to-face conversation with peers and familiar adults
- comprehend the main idea of more extended conversations with some unfamiliar vocabulary and structures as well as cognates of English words
- call upon repetition, rephrasing, and nonverbal cues to derive or convey meaning from a language other than English
- use appropriate strategies to initiate and engage in simple conversations with more fluent or native speakers of the same age group, familiar adults, and providers of common public services.

This is evident, for example, when students:

- ▲ exchange simple greetings and answer questions about self and family
- ▲ listen to radio broadcasts and answer questions about main ideas
- ▲ speak in complete sentences, using present tense and, occasionally, markers for past and future tenses
- ▲ ask for information or directions
- ▲ discuss classroom activities with a peer
- ▲ use appropriate body language and gestures to supplement the spoken word.

2. Reading and writing are used in languages other than English for the purposes of socializing, providing and acquiring information, expressing personal feelings and opinions, and getting others to adopt a course of action.

Students can:

- understand the main idea and some details of simple informative materials written for native speakers
- compose short, informal notes and messages to exchange information with members of the target culture.

This is evident, for example, when students:

- ▲ obtain information from materials written in the target language including short notes, brief messages, posters, printed advertisements, illustrated simple texts from newspapers and magazines
- ▲ guess the meaning of more complex written material, using context, recognition of cognates, accompanying illustrations, and prior knowledge of situations and issues
- ▲ write a brief message about an everyday activity, using simple sentence structure, not necessarily limited to the present tense.

Appendix B: Informed Consent for Online Survey

Informed Consent

A study of technology to support the delivery of audio content in the foreign language classroom is being conducted at Boston University. The purpose of the study is to better understand the current methods that foreign language teachers use to create and deliver audio content, and what some of the barriers to using audio content in the target language with learners might be.

Plans for Participation

You must be at least 18 years old or older to participate in the study. Your participation will involve the completion of one questionnaire, which contains questions about your current practices with audio content as a foreign language teacher. Completion of the survey will require approximately fifteen minutes of your time.

Voluntary Participation

Your participation in this study is voluntary and you may withdraw at any time. You do not have to answer any question you do not wish to answer. There are no foreseen risks or discomforts to you by involving yourself in this study. There is no direct benefit to you for participating in this study.

Confidentiality

Your responses will not be matched with your identity and will be anonymous, and your responses to the questionnaire will be used for research purposes only. No additional identifying information will be gathered from the online survey instrument (such as IP addresses). At the conclusion of the research-gathering phase, the data will be downloaded from the online survey site and stored on a computer with no Internet connection for seven years. The survey instrument will then be deleted from the online survey site, which will cause the associated data to be immediately inaccessible and completely purged from the company data storage within 90 days.

Should you choose to participate, please indicate your consent. You may withdraw your consent at any time without penalty.

Authorization: I have read the procedure described above. I voluntarily agree to participate in the procedure and I have read a copy of this description. I am aware that my responses will remain confidential and that I may decline to participate at any time.

By clicking next, you are consenting to participate in this study.

Any questions or concerns about your rights as a participant in this study, or other information, may be obtained by contacting:

Kathleen Vigil, T: 781-333-8310, kvigil@bu.edu

Faculty Advisor Dr. Bruce Fraser, T: 617-353-3234, bfraser@bu.edu

Any questions regarding your rights as a research participant can be directed to the **Boston University** IRB Office at:

25 Buick Street, Room 157

Boston, MA 02215

T: 617-358-6115

www.bu.edu/IRB

irb@bu.edu

Appendix C: Letter and Permission for School Principals

Kathleen Vigil, M.A.
Address information

October 1, 2015

Principal _____
_____ School
_____ Street
City, ST 00000

RE: Permission to Conduct Research Study

Dear Principal _____:

I am writing to request permission to conduct a research study at your school. I am currently enrolled in the Educational Media and Technology doctoral program at Boston University and am in the process of writing my dissertation. The study is entitled, "QR Codes for Audio Support in Foreign Language Learning."

I hope that the school administration will allow me to recruit three foreign language teachers from the school to take part in the study, which includes the following:

- An interview (30-45 minutes) focusing on how the teacher provides audio support in the foreign language to students
- A short training (15-30 minutes) at the end of the interview on three possible ways to use QR codes in activities that provide audio content for students
- A follow-up interview (30-45 minutes) after the teacher has implemented one of the QR audio code activities with students

At no time would I enter the classroom during instruction or when students are present. I am also not collecting any samples of student work or interacting with students in any way. In the final paper there will be no identifying information, so the names of the teacher, school, city, and state would remain private.

Interested teachers who volunteer to participate will be asked to sign a consent form (copy enclosed), and copies of the first page of the form would be left with the teacher and administration.

Your approval to conduct this study will be greatly appreciated. I will gladly send a copy of the finished paper to the school for review, and I would be happy to provide some professional development in educational technology for your teachers in gratitude for your cooperation.

I will follow up with a telephone call next week and can answer any questions or concerns that you may have at that time. You may also contact me at my email address or phone listed above.

If you agree, kindly sign below and return the signed form in the enclosed self-addressed envelope. Alternatively, kindly submit a signed letter of permission on your institution's letterhead acknowledging your consent and permission for me to conduct this survey/study at your institution.

Sincerely,
Kathleen Vigil

Permission to Conduct Research Study

I, _____, grant permission to Ms. Kathleen Vigil, a doctoral student at Boston University, to recruit teachers to participate in the research study entitled “QR Codes for Audio Support in Foreign Language Learning” at _____ School.

I understand that the research includes two interviews with the teachers outside of instructional time, and a short professional development training session. Participating teachers are asked to try one activity involving the use of QR codes to provide audio support to their foreign language students.

Copies of the consent forms that the teachers sign will be confidential, and no identifying information about the teachers, school, town, or state will be present in the finished research paper.

Participation in the study is completely voluntary, and the teachers may withdraw from the study at any time. Any questions about the study procedures can be answered by the researcher, faculty advisor, or Institutional Review Board at Boston University using the contact information listed below.

Printed Name

Signed Name

Date

Primary Researcher: Kathleen Vigil, kvigil@bu.edu or 781-570-9465
Faculty Advisor at Boston University: Dr. Bruce Fraser, bfraser@bu.edu or 617-353-3234
Boston University Institutional Review Board Office: irb@bu.edu or T: 617-358-6115

Appendix D: Informed Consent for Case Study Teachers

Informed Consent Form for Interviews and Professional Development (Page 1 of 2) Research Title: QR Codes for Audio Support in Foreign Language Learning

I am a doctoral student in the School of Education at Boston University, and my major is Educational Media and Technology. This research will take place from October 2015 to March 2016. This form details the purpose of the study, a description of the involvement required and your rights as a participant.

The purpose of this study is:

- To examine the practicality of providing students learning a foreign language access to audio support in the target language through QR codes and mobile technology

The potential benefits of this study are as follows:

- Foreign language teachers may be able to add a new instructional tool to their repertoire after learning about and utilizing QR audio codes in their classrooms
- Students will indirectly benefit by gaining access to more audio material if teachers employ these methods after participating in the study

The methods that will be used to meet this purpose include:

- One-on-one interviews
- A short training on some possible uses of QR codes to provide audio content

You are encouraged to ask questions or raise concerns at any time about the nature of the study or the methods I am using. Please contact me at kvigil@bu.edu or 781-570-9465 and/or my advisor, Bruce Fraser, at bfraser@bu.edu or 617-353-3234.

The interviews will be digitally recorded (audio only) to help me later accurately transcribe your insights. The recordings will only be used by the researcher to aid in transcription of the interview for the purpose of this study. If you feel uncomfortable with the recording of the interview, you may ask that it be halted at any time. These recordings will be stored on a computer not connected to the Internet and destroyed one year after I finish my dissertation. The transcriptions of the recordings will be stored on the same computer and destroyed after seven years. This paper consent form with your name and signature will be stored in a locked safe in a residence for seven years and then shredded.

There is no inherent risk in this study, and the interview will be anonymous and confidential. You have the right to withdraw from the study at anytime. In the event you choose to withdraw from the study, all information you provide (including audio recordings) will be destroyed and omitted from the final paper. You will receive a gift certificate for your time at the conclusion of the data collection, regardless of whether you withdraw from the study.

Data provided by you and other participants will be used in writing a dissertation, which will be read by my three committee members. Though direct quotes from you may be used in the paper, your name and other identifying information will be kept anonymous.

Informed Consent Form for Interviews and Professional Development (Page 2 of 2)
Research Title: QR Codes for Audio Support in Foreign Language Learning

Thank you for your interest in this study. You will receive a copy of this document for your records.

By signing here, you give your consent to participate in this study

Name of person giving consent (please print)

Signature of person giving consent

Date

Research staff signature

Kathleen M. Vigil

Name of person obtaining consent (please print)

Signature of person obtaining consent

Date

Appendix E: Anonymous Online Survey Questions

1. Informed Consent
2. How do you currently provide audio examples in the foreign language for your students? Check all that apply:
 - a. My own voice in class only
 - b. My own voice as an audio recording
 - c. An audio recording of a native speaker's voice
 - d. A video including audio of native speakers' voices
 - e. A video including audio of my voice
 - f. A software program for a desktop or laptop
 - g. An application program for a mobile phone or tablet
 - h. A web site with audio recordings or video with audio
 - i. CDs, DVDs, VHS or cassette tapes
 - j. Other: _____
3. Do you use a textbook that comes with multimedia materials? If yes, is the multimedia provided..
 - a. On a web site, and does that have audio and/or video examples of the foreign language?
 - b. On a CD or DVD with audio and/or video materials?
4. If you answered "yes" to Question 3, do you currently use the multimedia supports that come with the textbook?
 - a. No
 - b. Yes
5. If you answered 'no' to Question 4, why don't you use the multimedia materials that come with the textbook? (check all that apply)
 - a. Poor quality
 - b. No technology available in the classroom that can play the multimedia
 - c. No student access to technology at home to access material
 - d. Not a good match with my curriculum
 - e. Not a match with my own pedagogical style
 - f. Not enough class time
 - g. Other: _____
6. Do you ever create your own audio materials?
 - a. Always
 - b. Sometimes
 - c. Rarely
 - d. Never
7. How often do you require that your students access audio content in the foreign language outside of class as part of their homework or review/studying?
 - a. Daily
 - b. At least once per week
 - c. Not more than once per month
 - d. Never
 - e. Other: _____
8. Do you have technology in the classroom that can play audio recordings? If so, what kind of technology is it?
 - a. Yes: _____
 - b. No

9. Do you have access to technology with which you can create audio recordings? If so, what kind of technology is it?
- Yes: _____
 - No
10. Do you have enough familiarity with audio technology that you would be able to create audio samples?
- Yes, I am confident in my skills with audio technology tools
 - No, I do not feel confident enough in my skills with audio technology to attempt creating custom audio samples
 - Maybe, depending on the available software and hardware
 - Other: _____
11. Do your students have access to the Internet while using school-supplied devices in the classroom?
- Yes, every day, with a reliable and fast Internet connection
 - Yes, every day, but the Internet connection is unstable or slow
 - Sometimes, with a reliable and fast Internet connection
 - Sometimes, but the Internet connection is unstable or slow
 - Never
 - Other: _____
12. What percentage of your students would you estimate have access to the Internet at home using desktop/laptop/tablet/mobile phone?
- 0-25%
 - 26-50%
 - 51-75%
 - 76-100%
 - I do not know
 - Other: _____
13. Do you allow your students to use their Internet-connected mobile devices in class?
- Yes, daily
 - Yes, occasionally for certain activities
 - No, because not enough students own personal devices
 - No, because I have concerns about the use of the devices in an educational setting
 - Other: _____
14. How important do you feel providing audio samples in the target language apart from your own use of the language in the classroom is to student learning?
- Very Important
 - Important
 - Not Very Important
 - Not Important
 - Other: _____
15. How important do you feel it is to provide audio input alone instead of video as multi-media support?
- Very Important
 - Important
 - Not Very Important
 - Other: _____
16. Optional: If you have any comments to add about this topic, please add them here: _____

Appendix F: Questions for Interview #1 (*Pre-Training*)

1. How do you currently provide audio examples in the foreign language for your students?
2. Are the audio examples you provide ever audio only, without visuals (as in a video)?
3. Do you create your own audio materials?
4. Does the textbook that you use come with multi-media materials? If so, what kind? Do you use them in class? Do students use them in or out of class?
5. How often do you require that your students access audio content in the foreign language outside of class as part of their homework or review/studying?
6. Do you have technology in the classroom that can play audio recordings?
7. Do you have access to technology with which you can create audio recordings?
8. Do you have enough familiarity with audio technology that you would be able to create audio samples?
9. Do your students have access to the Internet while using school-supplied devices in the classroom?
10. What percentage of your students would you estimate have access to the Internet at home using desktop/laptop/tablet/mobile phone?
11. Do you allow your students to use their Internet-connected mobile devices in class? If not, why not?
12. How important do you feel providing audio samples in the target language apart from your own use of the language in the classroom is to student learning?
13. How important do you feel providing audio apart from your own speaking is to your students' proficiency in speaking? Listening comprehension?
14. How important (or unimportant) do you think it is to provide audio examples alone – without video – to your students?
15. Do you have any comments to add about this topic?

Appendix G: Questions for Interview #2 (Post-Training and Use of QR Codes)

1. Can you explain exactly how you used the QR codes for instruction/support? (Researcher will review the materials with the teacher and ask any clarifying questions needed).
2. Can you provide samples of the materials, directions/instructions, etc. that you provided to the students during your trial of the QR codes?
3. How does the method of creating and providing the QR audio codes with qrvoice.net compare to your previous methods of providing content in terms of time necessary to create the codes and technical expertise required?
4. How satisfied were you with the accuracy of the pronunciation provided by the combination of qrvoice.net and Google translate?
5. Did you receive any feedback from students about the QR homework assignments? Did you receive any feedback from parents?
6. Were there students who were not able to complete the QR audio activity? If yes, how did you make accommodations for them to learn the same material?
7. Do you see any evidence that the audio supports delivered by QR codes had a positive impact on student learning?
8. Are there any barriers that would make this method of providing audio support to your students not feasible to use as a regular part of your teaching?
9. How likely is it that you will use this or one of the other possible QR audio activities with your students again?
10. Do you have any additional comments to add or ideas for improvements on the activities?

Appendix H: Script for Professional Development (Outline)

Approximate time required for training: 15-30 minutes

Materials required: laptop computer with Internet access, mobile phone or tablet with QR reader installed and Internet connectivity, paper examples with instructions and word processing templates for each of the three activities

- Introduce the web site <http://qrvoice.net>
- Explain that the site automatically generates a QR code for any text entered (up to 140 characters) when the foreign language is chosen from the list
- Explain how to download an application that can scan the QR codes from a mobile device
- Scan a sample QR code with an Internet-connected device and show the teacher how the device automatically links to Google Translate and plays the audio
- Have the teacher follow the same steps to create and scan an audio QR code
- Introduce three possible QR activities that can be implemented with the audio QR codes:
 - Dialogues in the foreign language to study for homework
 - Scrambled stories for classroom use or as a homework activity
 - Third example
- Explain the options for ways to use the activities as homework (if enough students own and can use mobile devices) or as class activities with a full class set of mobile devices, a partial set, or a single mobile device (which the researcher can provide, if needed)
- Provide the teacher with some templates for each of the activities, so that only the language examples and QR codes need to be added.
- Ask the teacher if there are any questions about how to implement the audio QR code activity, or if the researcher should help the teacher start to create one of the options
- Provide contact information and offer to provide technical support either via distance or an in-person visit to finish creating the materials for the QR code activity
- Remind the teacher to please complete the activity within the next month and to save a copy of any materials provided to the students.
- Ask the teacher if it is acceptable to initiate contact after two weeks and (if needed) four weeks to set up the follow-up interview.
- Thank the teacher for participating in the study

Appendix I: Homework Sheet with Audio QR Codes

Procedure: Turn each part of a dialog into a QR audio code and supply a worksheet as below:

Basic Conversation in Spanish: Greetings			
<p>Use your mobile phone and the Kaywa app to scan and listen to all parts of the following conversation each night as part of your homework. Practice speaking the conversation in the same way as you hear through the QR code app.</p> <p>At the end of the unit you will record yourself performing this conversation. You will also listen to a similar conversation in Spanish in class and be expected to translate it into English. See the rubrics on the back of this sheet for the levels of performance.</p>			
Scan and Listen	Person	Spanish	English
	<i>Sara</i>	'Buenas noches. Me llamo Sara. ¿Cómo te llamas?'	Good evening. My name is Sara. What is your name?
	<i>Carolina</i>	'Hola Sara. Me llamo Carolina. ¿Cómo estás?'	Hi Sara. My name is Carolina. How are you?
	<i>Sara</i>	'¡Muy bien! ¿Cómo estás tú?'	Very well. How are you?
	<i>Carolina</i>	'Muy mal. Sara, yo soy de México. ¿De dónde eres tú?'	Very bad. Sara, I am from Mexico. Where are you from?
	<i>Sara</i>	'Soy de Colombia.'	I'm from Colombia.

Appendix J: QR Audio Codes with Scrambled Stories

Procedure

Take a simple story, news article, or dialogue in the target language and split it into shorter sections. Put each section into QR Voice.net and copy the QR code to a master sheet. Some possible options to work with the created QR codes:

1. Give each student a QR code to transcribe and translate either in class (with headphones) or for homework. Later in the class or the next day, have the students put the story in order, check the language use, and perform it.
2. Scatter the QR codes around the classroom and have students in teams scan each code and try to either transcribe it (more advanced students) or match it to a provided transcription either in the target language or an English translation.
3. Give each student a selected section of the story - such as a paragraph – in audio QR code form to listen to for homework or in class with headphones. The student must complete a worksheet in which he puts the selection in logical order and then writes a translated summary of the selection.

Example

This is a simple version of Aesop’s “The Lion and the Mouse.” Following the story are the first three sentences converted into audio QR codes using QRvoice.net.

Der Löwe und die Maus - nach Äsop

Unter einem Baum liegt ein Löwe. Er schläft. Da läuft eine kleine Maus über sein Gesicht. Der Löwe wacht auf und fängt die Maus. Die Maus hat Angst. Sie bittelt: “Bitte, bitte, lass mich frei! Dann helfe ich dir später auch einmal.” Der Löwe lacht: “Hahaha! Die kleine Maus will einem Löwen helfen! Hahaha!” Aber er lässt die Maus laufen.

Es ist ein paar Tage später. Fünf Jäger fangen den großen Löwen. Sie binden ihn mit einem Strick am Baum fest. Der Löwe ist wütend. Er brüllt laut um Hilfe. Das hört die kleine Maus.

Husch, schon ist sie da! Sie beißt den Strick mit ihren scharfen Zähnen durch. Der Löwe ist befreit. Da sagt die Maus: “Siehst du, auch eine kleine Maus kann einem großen Löwen helfen.”

<p>Unter einem Baum liegt ein Löwe. Er schläft.</p>		<p>Da läuft eine kleine Maus über sein Gesicht.</p>	
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Appendix K: QR Code Cloze Activity

Procedure: Provide students with a set of audio QR codes and a passage (as in the example below) with blank lines in the place of certain words. Students listen to the QR codes in class with headphones or at home and fill in the words. Teachers may differentiate the activity by choosing to provide a word bank containing some or all of the missing vocabulary.

Instructions: Scan each QR code to listen to the sentence or part of a sentence. You may scan and listen to the code as many times as you want. Fill in the blanks with the words that you hear. (Optional: Use the words from Word Bank below).

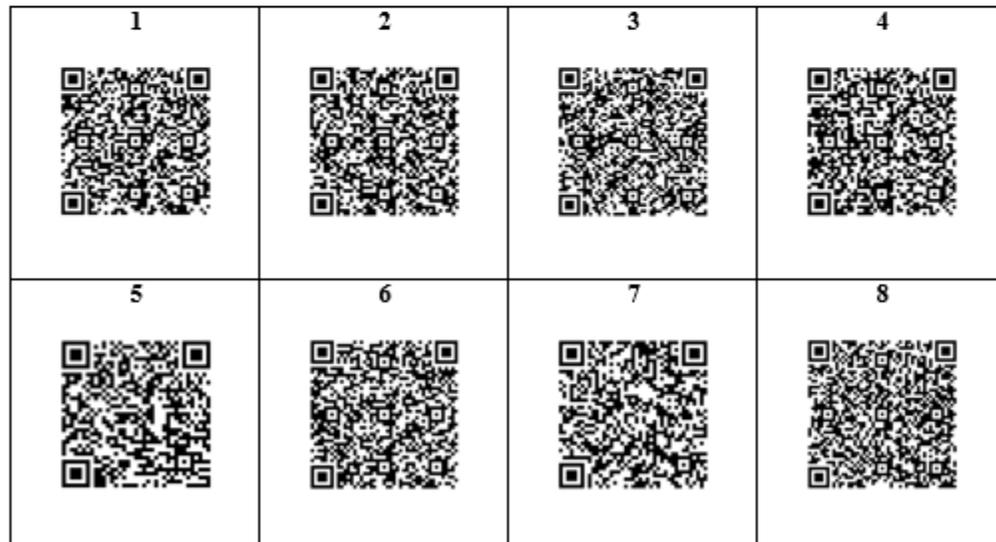
Les Fromages Français

(1) La première _____ à faire, c'est le _____. (2) Vous avez des fromages de _____, comme le Brie et le Cantal ; (3) de chèvre, comme le Crottin de Chavignol ; et plus _____, de brebis: (4) le _____ est le plus connu, mais pas le seul... (5) Puis vous avez l'âge. (6) Il y a des fromages _____, qui se mangent tout de suite, (7) et se _____ souvent au frigidaire, (8) et puis des fromages _____, qui ont _____ dans des caves pendant des années.

Word Bank (optional):

affinés – distinction -- frais – gardent – lait – rarement – Roquefort – vieilli -- vache

Audio clips:



French text sample from "Une Semaine à Paris"

<http://www.frenchtoday.com/learn-french/french-audio-books/une-semaine-a-paris-audiobook>

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