

CHAPTER 4

Findings

Introduction and Purpose Statement

This chapter presents the findings of a study on the use of Quick Response (QR) codes that link to audio resources for listening comprehension practice in the first years of Spanish as a foreign language instruction. The study was conducted in four phases: (1) a needs analysis performed via an online questionnaire, (2) a personalized training for the Spanish teachers in the creation and use of audio QR codes, (3) a formative trial by the Spanish teachers of the QR code technology, after which the PI contacted the teachers to provide guidance and support, and (4) a final summative trial of the audio QR codes, followed by an interview meant to gather data on the use of the audio QR codes for listening comprehension activities. The research question that guided this study was: *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?*

The findings below are organized into three sections. In the first section there is a presentation of the quantitative and qualitative data from the online questionnaire. The second section contains the major themes and outliers that resulted from the transcription and coding of the interviews after the formative and summative trials of the audio QR code activities. Finally, the third section of data is a document content analysis in which the homework activities that the teachers created are examined and compared with the sample templates provided to them as part of the professional development training protocol. A summary of the major themes in the findings concludes the chapter.

Demographics

A full description of the participants and setting can be found in Chapter 3. The findings below were gathered from a pool of eleven participants. These participants were all middle school Spanish teachers working in public schools in a state in the northeast region of the United States. The teachers worked with students in the first and second years of foreign language study, which is the 7th and 8th grade in this region. The participants volunteered to take part in the study, expressing an interest in the use of emerging technologies and mobile devices to support instruction both in and out of the classroom. Two of the teachers worked in a team manner in the same school; otherwise the teachers all were employed at different schools, resulting in the representation of 10 educational settings. For the purposes of this study, each teacher was assigned a number (Teacher 1 – Teacher 11), which was then used for identification purposes in all written work and audio recordings in order to maintain privacy.

Needs Analysis Questionnaire Results

The needs analysis consisted of 24 questions, three of which were optional. The purpose of the needs analysis, according to the Systems Approach Model, is to (1) identify instructional goals (2) conduct instructional analysis (3) analyze learners and contexts, and (4) write performance objectives (Dick, Carey & Carey, 2008). In this study, the PI used the individual responses to design the professional development training for the participating teachers. The results are presented in summary here, in order to better illustrate the similarities and differences in the ten educational settings and of the participant group as a whole.

The survey data also serves to triangulate the responses by the participating teachers to both sets of interview questions. Instead of presenting the data for each question in order, the results of the questionnaire are grouped below based on their purpose. The table displays the

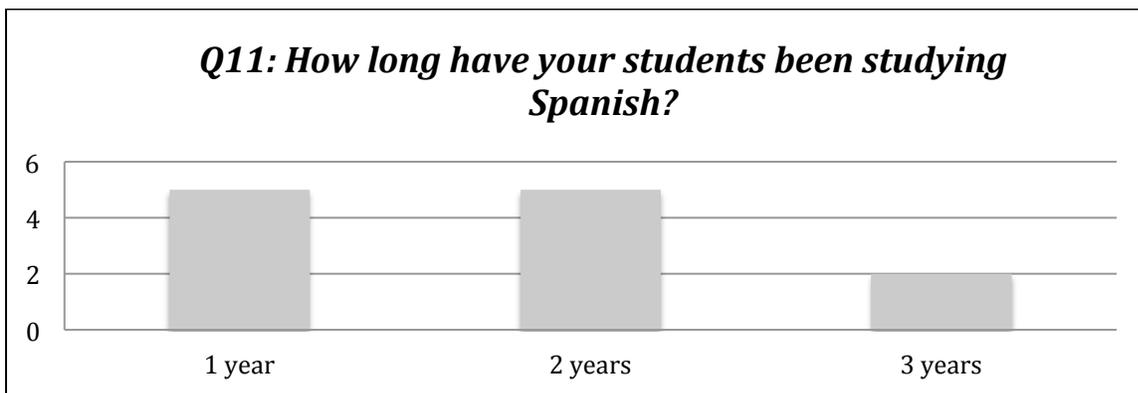
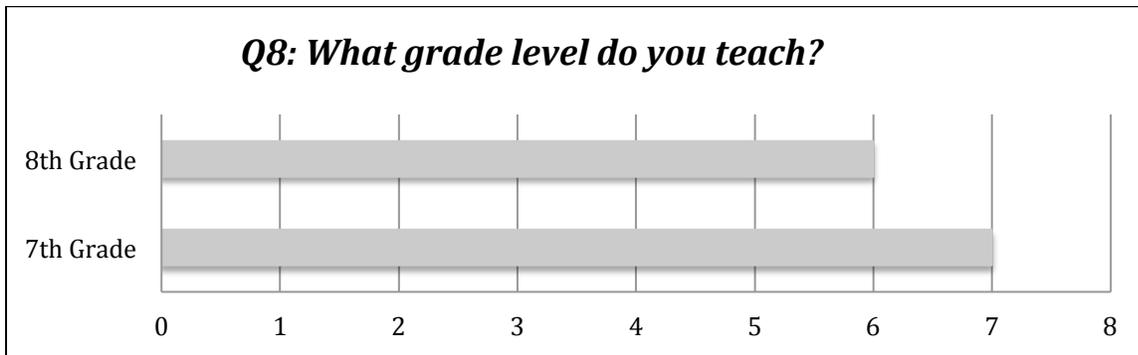
major categories and questions that fall under each. Following the table is a breakdown of the results from each of the questions, grouped by these categories. The questions and possible answers can be found in Appendix A.

Category	Question
Educational Setting	<ul style="list-style-type: none"> ▪ What grade level(s) do you teach? ▪ How long have your students been studying Spanish? ▪ How many students are in your class(es)? ▪ How often do the classes meet? ▪ Are your students considered to be working at an honors or standard level? ▪ How comfortable are your students when trying new technologies? ▪ Do you have any comments to add about this topic?
Student Use of Technology	<ul style="list-style-type: none"> ▪ Are students allowed to use personal Internet-connected mobile devices in class? ▪ What percentage of your students would you estimate have access outside of school to a personal Internet-connected mobile device such as a tablet or smartphone?
Teacher Use of Technology	<ul style="list-style-type: none"> ▪ How confident are you in your overall tech skills? ▪ Have you ever used QR codes before for instructional purposes? ▪ Do you know how to make a QR code from a given URL? ▪ Do you have access to existing audio materials (textbook or other source of multi-media materials on CD, .mp3, or online)? ▪ Do you have enough familiarity with audio technology that you would be able to create audio samples? ▪ Do you have access to technology with which you can create audio recordings? ▪ Do you have a teacher web site that can host audio resources? ▪ Do you have any comments to add about this topic?
Listening Comprehension	<ul style="list-style-type: none"> ▪ Which listening comprehension skills do you consider to be the most important for your students to acquire at this stage of their Spanish language acquisition and development? ▪ Are the students currently expected to work on listening comprehension activities during class time? If so, how many minutes on average do they actively focus on listening comprehension skills in each class period/meeting? ▪ Are the students currently expected to work on listening comprehension activities outside of class time as homework or for review/practice? If so, how many minutes on average per week are they expected to complete listening homework tasks? ▪ How do you currently provide audio examples in the foreign language for your students? ▪ How important do you think it is to provide audio examples alone – without video – to your students? ▪ Do you have any comments to add about this topic?

Table 3: Needs analysis categories and corresponding questions

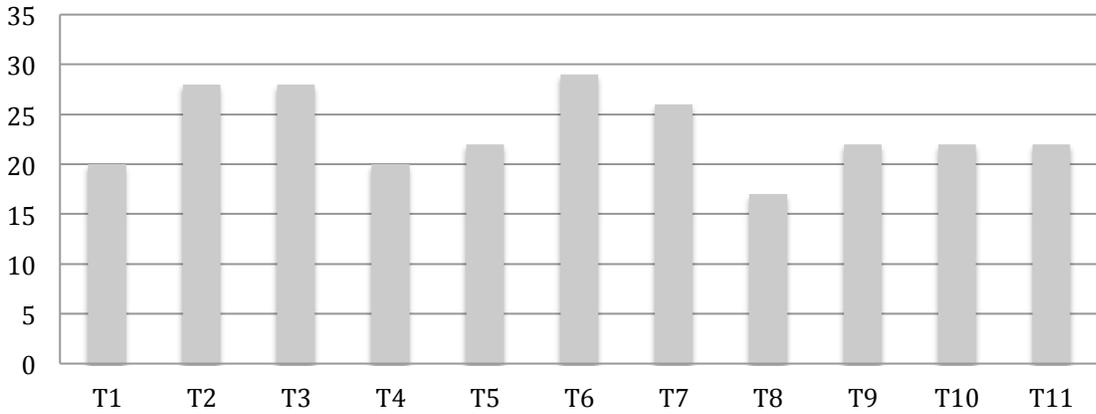
Questions Relating to the Educational Setting.

These questions were meant to inform the PI of the characteristics of the students who would be using the QR code technology for homework exercises.

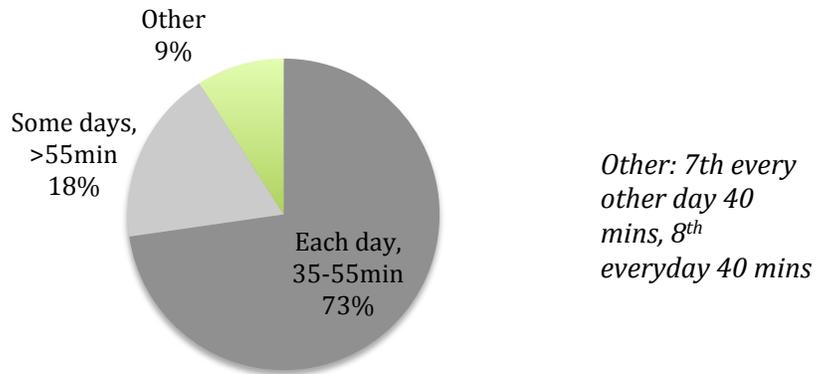


The extra responses in Questions 8 and 11 are due to the fact that one of the participants teaches students in both grades 7 and 8. Question 12 was, “Are your students considered to be working at an honors or standard level?,” to which all of the teachers responded that only the standard level was offered at the schools involved in the study. The implication is that students are not split into achievement levels until high school instruction. The responses to these three questions were meant to elicit the complexity level of the listening comprehension homework activities that the teachers would be likely to assign, in order to better advise them during the professional development training on the length and content of the audio recordings.

Q9: How many students are in the class(es) that will try the QR codes?



Q10: How often do the class(es) meet?

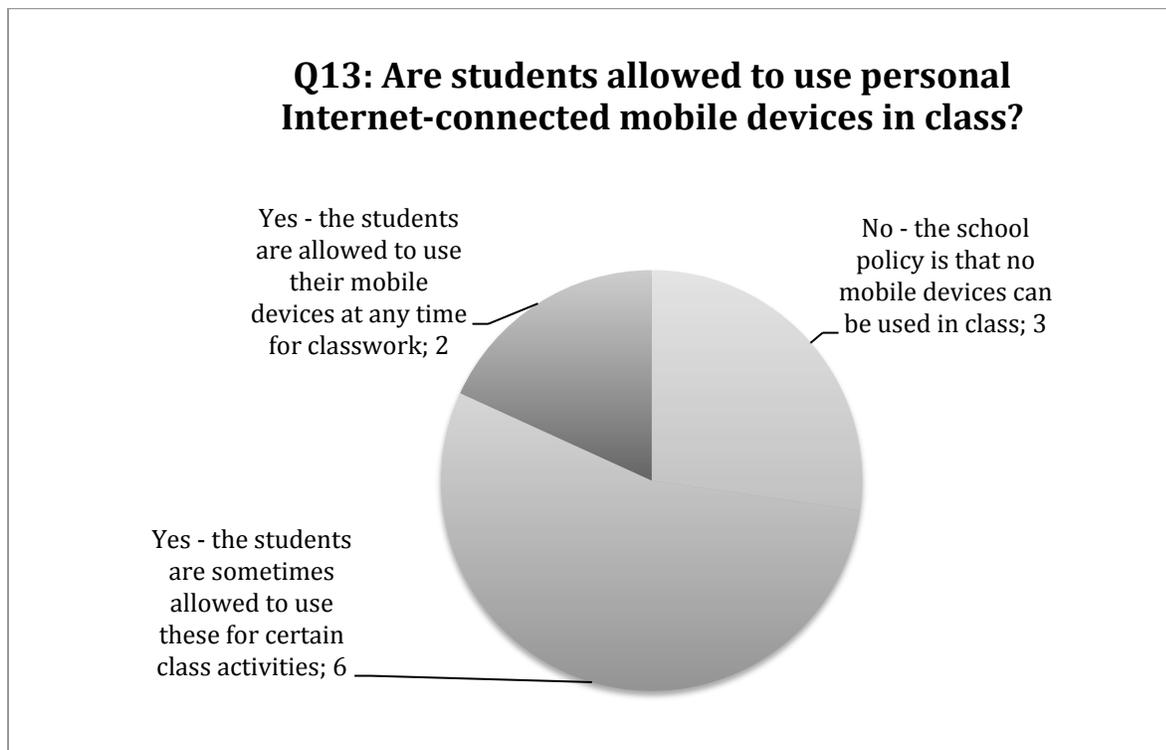


The average was 23 students per class for Spanish instruction at the middle school level. This question was asked in anticipation of the interview questions relating to how many students were able to complete the assigned homework with audio QR codes. The data from the question regarding the frequency of class meetings has a direct bearing on how much time the teachers would be able to provide for students to complete homework activities between class meetings.

Questions Relating to the Student Use of Technology

This group of questions was designed to investigate the anticipated barrier of device ownership and access. Anticipating that the teachers might want to train the students in the use of QR codes

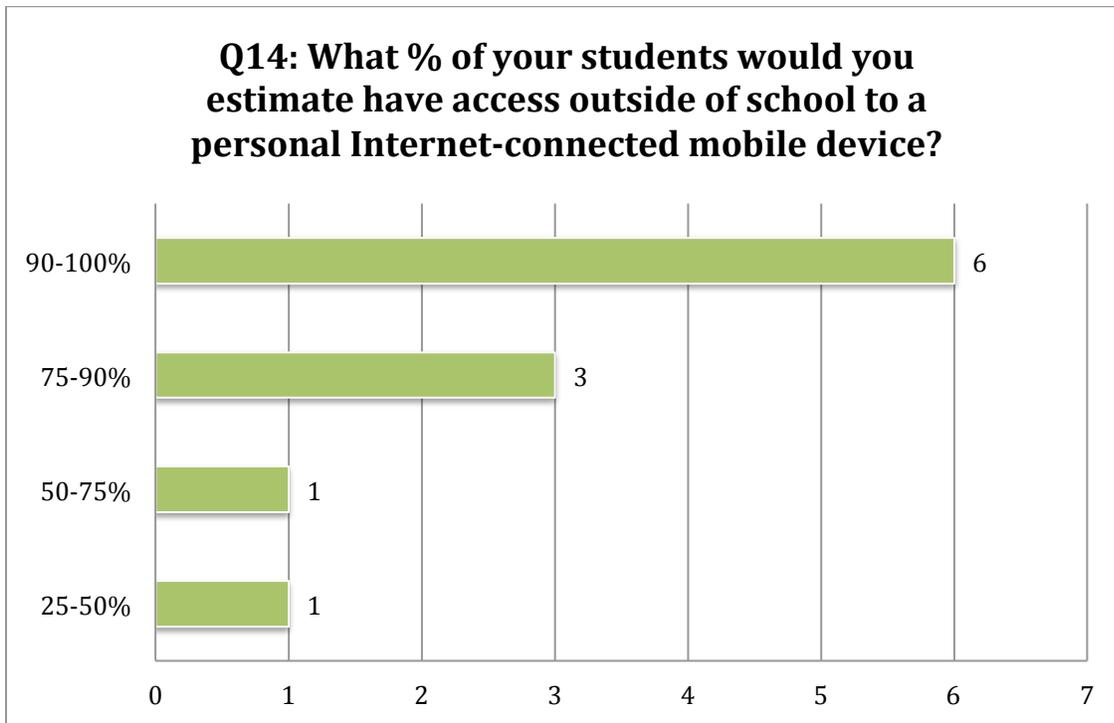
prior to assigning the homework listening comprehension activity, it was important to know whether the use of personal mobile devices was allowed in the classroom.



In Question 15, the teachers reported that their students were either “Very Comfortable” (6 responses) or “Somewhat Comfortable” (5 responses) when trying new technologies; these results suggested that asking the students to try a new technology like QR codes would not likely be prevented by a lack of technical expertise on the part of the student users. The responses to this question were to be later verified by the interview questions after the formative trial asking the teachers to report any barriers that the students encountered when first attempting to use the audio QR codes.

Question 14 was central to the use of audio QR listening comprehension activities as homework. Unless a high percentage of the participating teachers’ students owned or had easy access to an Internet-connected mobile device outside of the classroom, assigning homework involving QR codes linked to web-hosted audio files would not be practical, regardless of how

well the emerging technology worked. The responses indicated that, in alignment with the research cited in Chapter 2, device ownership among teenagers is high.



Finally, the teachers were asked to provide any “comments or thoughts about students using mobile technologies either in class or outside of class for learning Spanish.” This question was optional, with three of the eleven participants responding:

“I would like to make sure I know how to properly use the technology before I have my students use it.”

“I am currently involved in a BYOD pilot study run by the district. I am always trying new apps for my Spanish classes.”

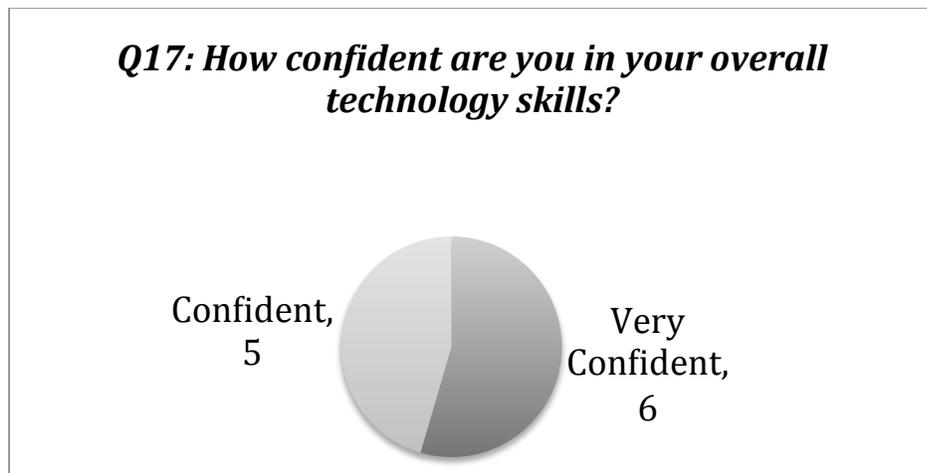
“I am, like every teacher, concerned about potential abuse – however, I think we have a responsibility to teach them how to use it responsibly.”

Although the question centered on the student use of technology, all three of these responses illustrate the perspective of the participants that the teacher is the one responsible for introducing new technologies for educational use, and ensuring that students are using them correctly.

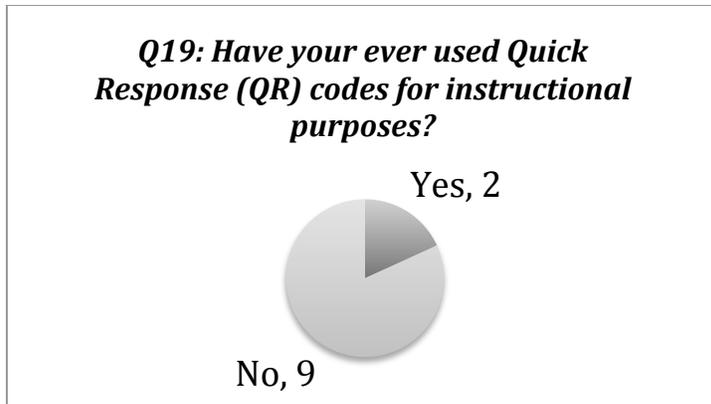
Questions Relating to the Teacher Use of Technology

The next set of questions related to the experience that the participating teachers had prior to the study with educational technologies and then specifically QR codes. The responses are presented here in total, but were taken into individual account when designing the customized professional development training sessions for each teacher (see Figure 3).

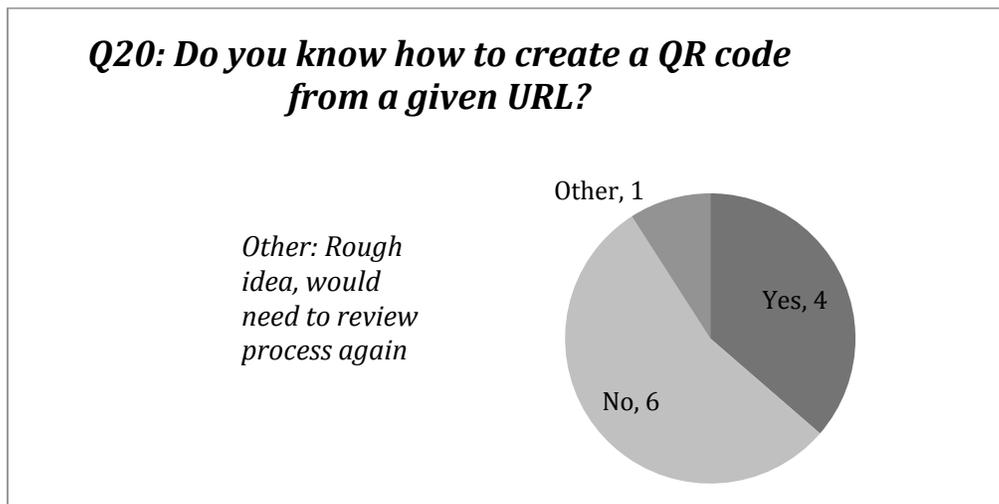
Questions 17 and 19 were used to gauge the amount of time that would be required in the training session and which materials and suggestions for creating QR codes would be the most useful to teachers, depending on their level of experience. In question 17, none of the teachers chose “not always confident” or “not at all confident,” which is not surprising given the fact that they self-selected to participate in this study with the knowledge that it would involve the use of an emerging technology and mobile devices.



Question 19 confirmed the prediction by the PI that QR codes were not being used as a regular tool in foreign language instruction at this grade level.

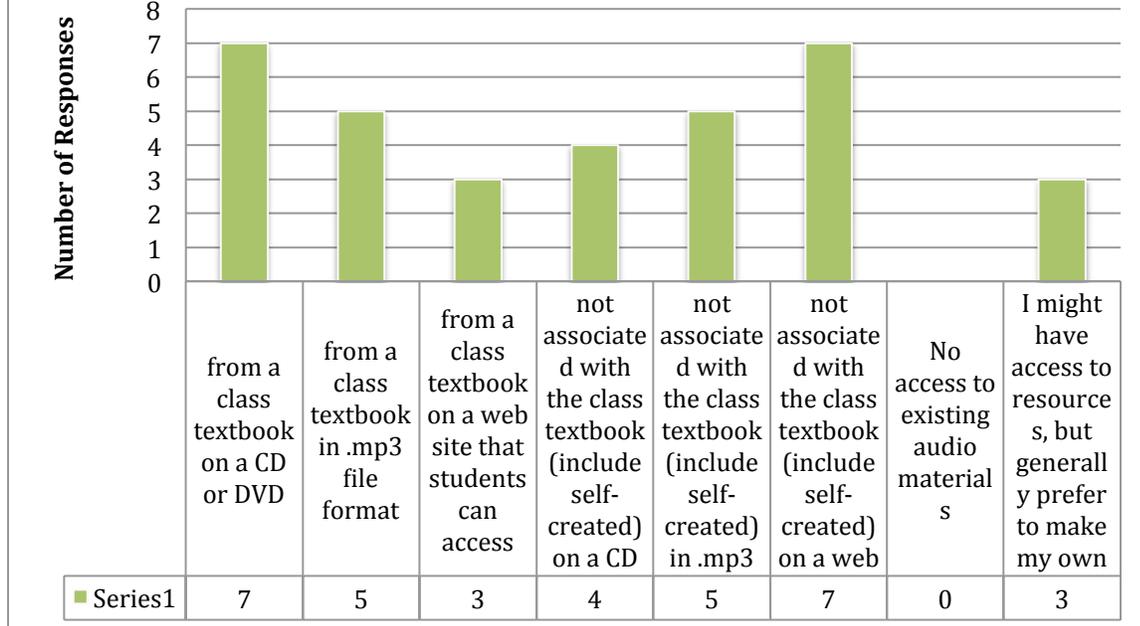


In addition to informing the design of the professional development, the results from Question 19 and Question 20 are interesting to compare. While only two respondents answered that they had used QR codes for instructional purposes in Question 19, four of the participants indicated in Question 20 that they knew how to create QR codes, and one had some previous experience trying this skill. This provided another piece of evidence that teachers might be aware of the technology, but not of its uses to support language learning, a fact that was later triangulated in the interviews.



The following three questions centered on the technology and audio resources that would be available to the teachers as they constructed the audio QR homework activities.

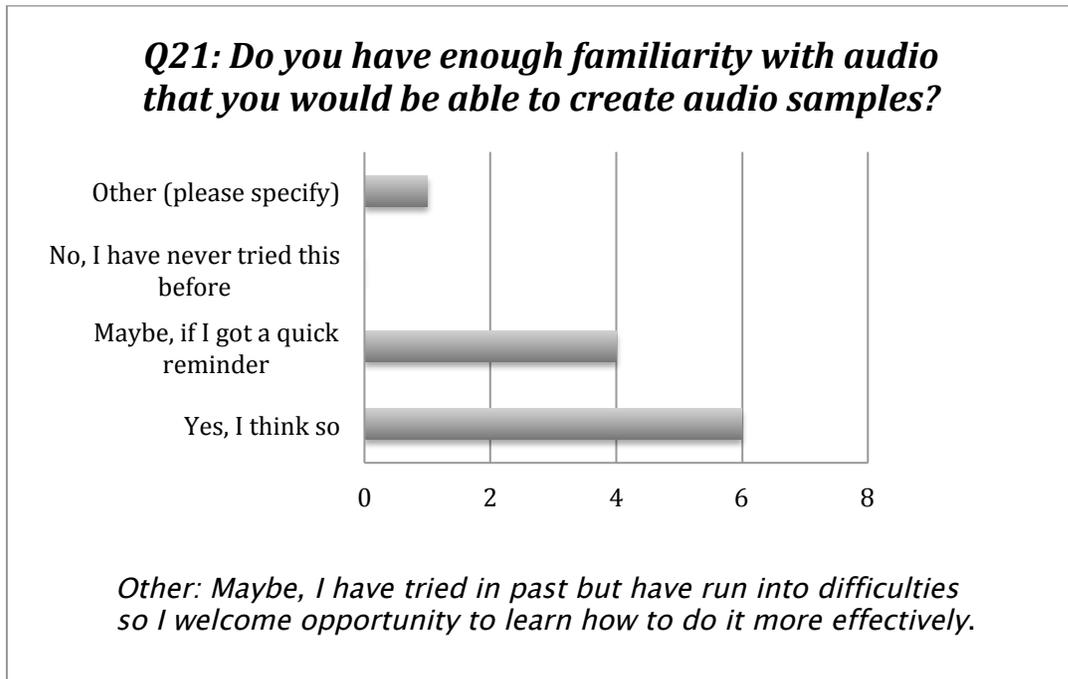
Q18 - Do you have access to any of the following existing audio materials? Check all that apply.



This question was a multiple-answer format in order to determine the range of audio resources that could be linked via QR codes. All of the respondents indicated that they either had access to existing recordings in at least one digital format or could create their own. Question 21 reinforced the result that foreign language teachers had the technology resources and skills to create their own customized audio samples for use with students. It was later mentioned by the Spanish teachers in several of the interviews that students were assessed at the end of the year by means of an in-class listening comprehension exercise, with the teacher reading the excerpts live for the students. For this reason, several of the teachers noted the importance of having the students be familiar with the teachers' manner of speaking in order to be prepared for the listening comprehension section of the final exam.

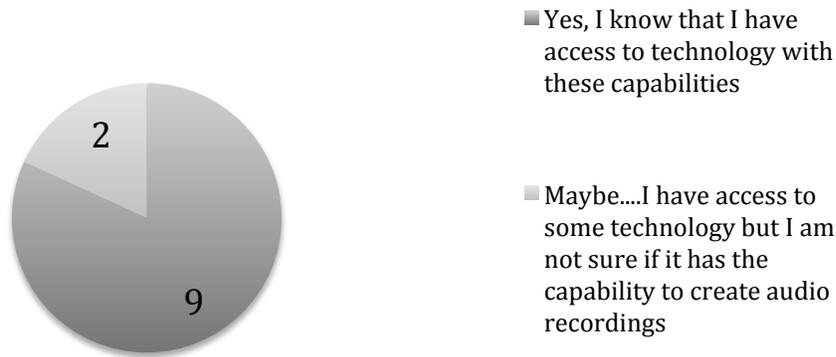
The next three questions centered on the abilities of the teachers to make and host their own web resources, as it was predicted that this would be favored by the teachers over the use of

outside resources. When speaking to other foreign language teachers informally, the PI noted their hesitation to use audio resources available on the Internet, because of both the level of complexity and the difficulty in finding audio that was a curricular match. In Question 21, all of the teachers had some experience attempting to create their own audio resources.



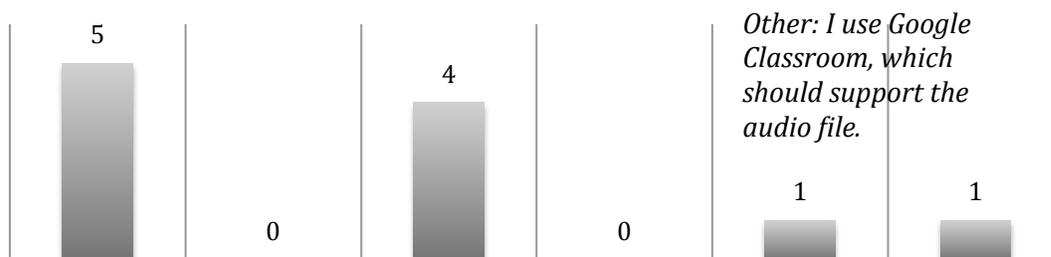
Questions 22 and 23 centered on the hardware and software required to make and host the audio files. None of the teachers answered, “No, I am sure that I do not have access to technology that can be used to create audio recordings” in Questions 22, but two were uncertain about these resources, implying that the teachers had rarely, if ever, tried to author audio resources.

Q22: Do you have access to technology with which you can create audio recordings, such as a digital voice recorder or cell phone/laptop/desktop with a voice recorder?



In Question 23, the reported lack of experience hosting audio files on a web site for retrieval by students reinforced the impression that teachers were exposing students to audio input only in the classroom, either by means of the teacher's voice or by using recorded audio or video during class time. This prediction was central to the rationale for the study.

Q23: Do you have a teacher web site than can host audio resources?



I have a teacher web site to which I can upload .mp3 files *I have a teacher web site on which I paste links to online audio resources* *I have a teacher web site but I have never tried adding a link or audio file to it* *I have a teacher web site but I know that it cannot be used to host or link to audio files* *I do not have a teacher web site that I can customize* *Other (please specify)*

The optional Question 24 at the end of this survey section allowed the participants to add comments about their experience with technology, QR codes, or the resources available to them.

Three teachers responded:

“I liked the QR codes and would like to do more with them.”

“Always willing to try something new.”

“My only concern is for my students who may not have regular access to technology in their own homes.”

The first comment showed that at least one of the participating teachers had tried QR codes in the classroom prior to the study, but it did not indicate whether the QR code linked to audio, visual, or textual information. The issue of students’ lack of access to mobile devices outside of the classroom recurs here, indicating that device ownership is not yet universal and might continue to be a barrier to assigning technology-based work outside of class time.

Questions Relating to Listening Comprehension

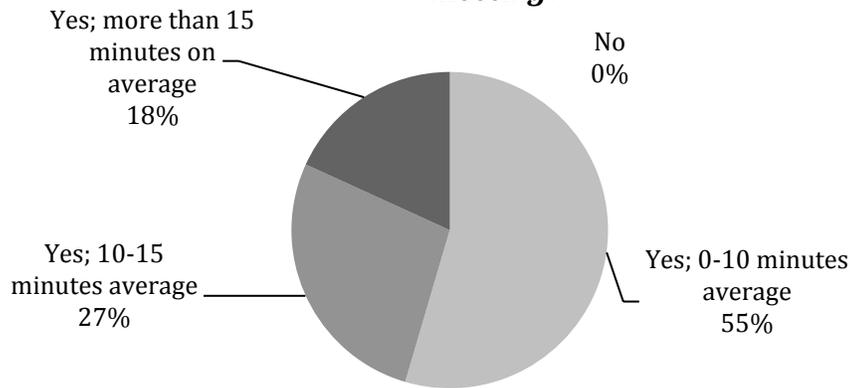
At the start of the survey the teachers were asked about their current pedagogical practice related to listening comprehension. The answers to the following questions were first used to prepare for the professional development training for each teacher. The results are also used below to triangulate data in the qualitative and document analyses. For example, according to the results for Question 2, the teachers valued the ability to follow a conversation or longer passage in Spanish, but there were few instances of these types of activities actually put into use during the formative and final attempts with the audio QR codes. This discrepancy may be due to the implementation of this particular technology, with the length of the audio recordings and number of audio QR codes created per homework sheet contributing factors to the design of the activities.

Question 2 - Which listening comprehension skills do you consider to be the most important for your students to acquire at this stage of their Spanish language acquisition and development? Pick as many as three options.	Responses
follow a conversation in Spanish and understand the meaning of the interaction	11
listen to a longer passage (not a conversation) in Spanish and understand the main idea of the text (informational or literature)	7
recognize a new vocabulary word spoken in Spanish and be able to correctly say or write what it means in English	6
listen to a sentence in Spanish and correctly translate the meaning into English (oral or written)	4
correctly spell/transcribe a word spoken in Spanish	2
listen to a sentence in Spanish and transcribe it accurately	2

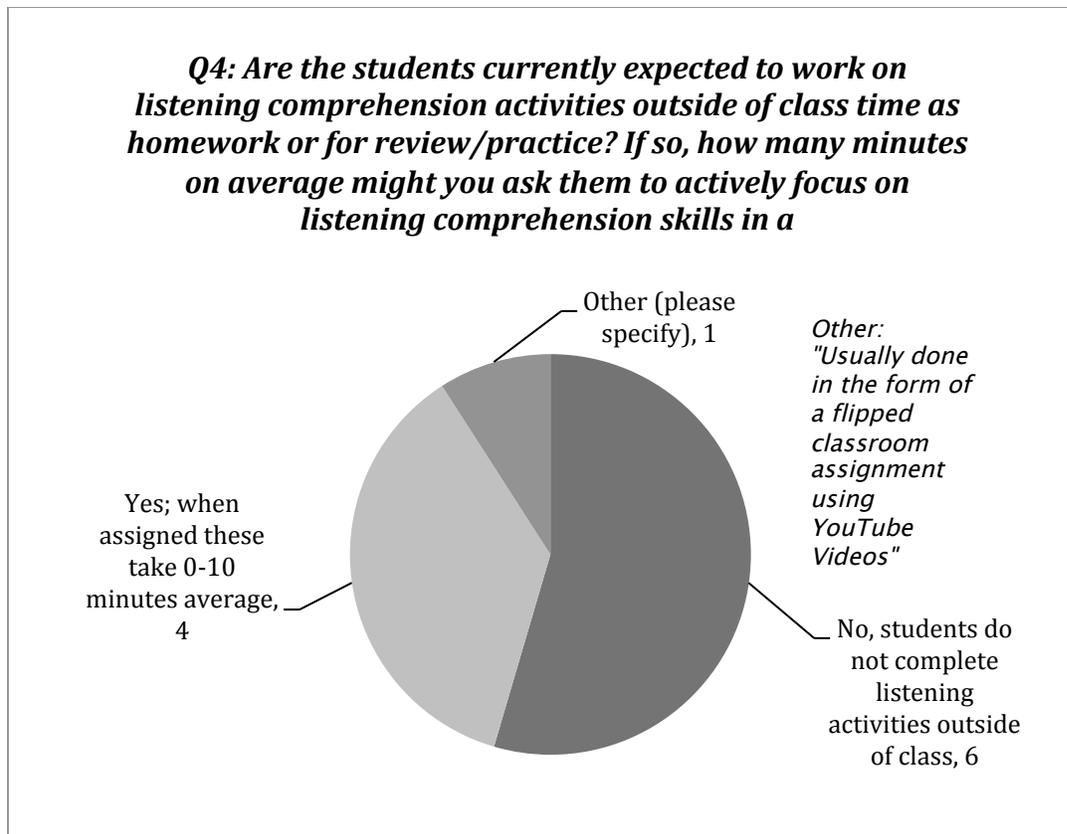
Table 4: Importance of listening comprehension skills

Questions 3 and 4 both asked for time estimates on the number of minutes students worked explicitly on listening comprehension activities both in and out of the classroom. Just over half of the responses indicated that a typical class session would involve 0–10 minutes of listening comprehension work. Whether this work involved listening to a video or audio source or the voice of the teacher is explored in question 5.

Q3: Are the students currently expected to work on listening comprehension activities during class time? If so, how many minutes on average do they actively focus on listening comprehension skills if you use one in a class period/meeting?



The next question was designed to both determine whether the teachers had any experience designing and assigning listening activities as homework tasks, and also for later comparison with the interview question asking them to compare the ways they previously assigned listening comprehension homework before trying the audio QR codes.



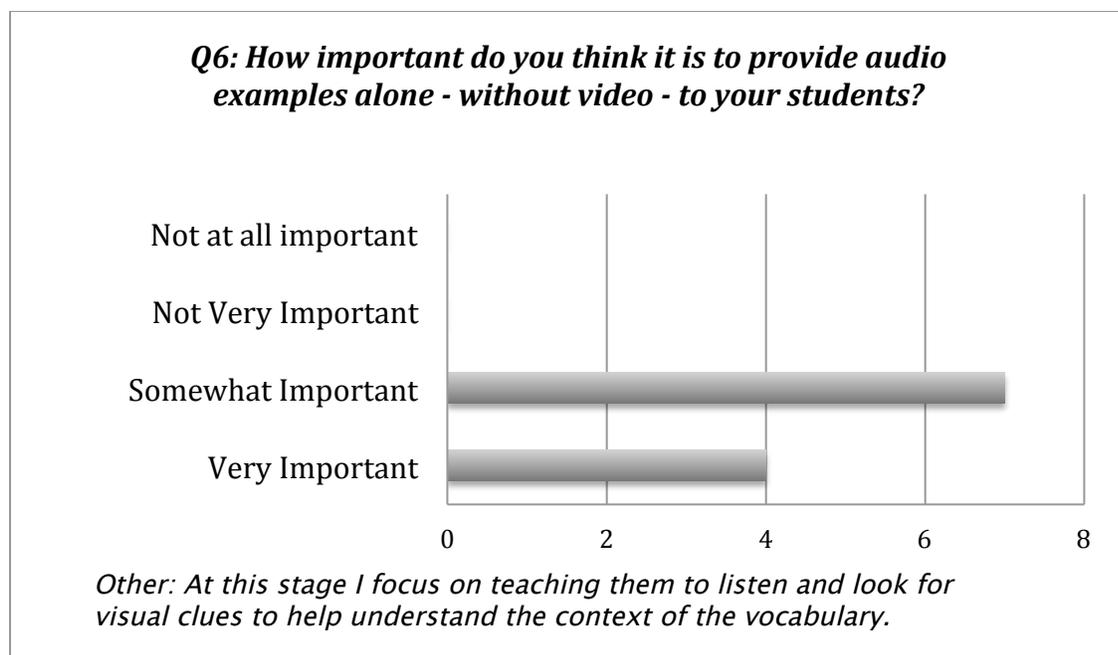
None of the teachers chose the options of “10–15” or “more than 15 minutes” of listening comprehension activities; this correlates with the research cited in Chapter 2 on the practice of keeping homework tasks short and easy for students to complete. The fact that 4 of the 11 teachers had already assigned some kind of listening comprehension activity for homework was somewhat surprising, as the expectation was that most, if not all, of the listening comprehension activities were being completed during class time.. The following table with the results of Question 5 provides a breakdown of the timing and types of audio materials that the teachers had previously used for audio input. Of the 40 total responses, 32 centered on on-class activities, 6 indicated a homework task, and the “other” responses did not specify in which context the listening activity took place.

Q5 - How do you currently provide audio examples in the foreign language for your students? Choose all that apply.	Responses
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I read texts and dialogues for them in class as a listening activity.	11
I play audio recordings in class (no visual) from a CD/DVD or online .mp3 track.	9
I play video clips in class from a CD/DVD or online web site (specific site for language learning or video site like YouTube) in which there are visuals (video or images).	9
I assign listening to video clips for homework that students listen to on a web site (including teacher web site or YouTube).	5
I play video clips in class from a CD/DVD or online web site (specific site for language learning or video site like YouTube) in which the only visual is a transcription.	3
I assign listening to audio-only clips for homework that students listen to on a web site (including teacher web site).	1
Other (please specify): Watching television programs in Spanish	1
Other (please specify): Audio recordings with visuals in books	1
I assign listening to audio-only clips for homework that students listen to on a CD/DVD.	0
I assign listening to video clips for homework that students listen to on a CD/DVD.	0

Table 5: Current ways of providing audio examples

In order to have a baseline for comparison with the later interview questions on using the audio-only samples as opposed to video that includes audio for listening comprehension, Question 6 asked the teachers to choose a level of importance for audio-only input without the visual elements. All of the teachers indicated that this was either “somewhat” or “very” important. These results would seem to indicate that the teachers found benefits to discrete listening tasks, although one added in a comment that she encouraged the students to rely on context and visual clues to aid with comprehension. This question revolved around the idea of cognitive load, although the term itself was not used in any of the survey or interview questions.



Question 7 was optional and received only one response:

Q7 - Do you have any comments or thoughts to add about listening comprehension?

"I should probably include more in my instruction."

Again, there appears to have been an awareness that dedicated listening comprehension activities – and perhaps those involving only audio input – are beneficial to beginning language learners.

Although the responses to Question 18 indicated that all of the teachers had some access to audio-only materials, some reported in the formative interviews that it was difficult to find appropriate materials to use for listening activities. This, in addition to the response that 3 of the 11 preferred to create their own resources, may suggest that the audio-only resources that accompany the class textbook or were found on the Internet did not always match well with the learners' level of proficiency or with the planned curriculum.

Formative and Summative Interview Data

The following data is derived from the two sets of interviews with the eleven participants in the study. The first interview took place shortly after the participants' initial experiences using

audio QR codes for listening comprehension homework. The second interview was conducted at the end of the study after the teachers had all completed a second QR code activity with their students. The interview transcriptions were combined and coded simultaneously, as both sets of questions were designed to elicit perceived barriers and benefits of this instructional method. After an initial review of the transcriptions that generated 30 codes, several were renamed and merged in order to better match with the responses, resulting in unique 22 codes applied to 385 quotations. These codes and a selection of corresponding quotations from the participants are presented below in four major themes of significance: (1) Teacher experience creating QR codes, (2) Issues Related to Student Access, (3) Perceived Impact on Teaching and Learning, and (4) Feedback from Affected Parties. The following table shows these themes and the related codes for each. This is followed by a detailed examination of each theme and code, including evidence from the transcriptions of the interviews.

Themes	Codes
<i>1: Teacher experience creating QR codes</i>	QR Recording Audio
	QR Distribution
	QR Time to Create
	QR Ease of Creation
	Best Practices QR Audio
<i>2: Issues Related to Student Access</i>	No Access to Device
	Restrictions on Phone Use
	Poor Access to Internet or Wi-fi
	Independent of Location
	Multiple Means to Access Content
<i>3: Perceived Impact on Teaching and Learning</i>	Audio or Listening Only Benefits
	Ability to Repeat Input
	Positive Impact on Learning
	More Practice for Listening
	Saves Instructional Minutes
	Transformative Use
<i>4: Feedback from Affected Parties</i>	Involves Others Outside of Class
	Share QR Use Professionally
	Feedback from Students
	Novelty of Activity or Tech
	Teacher Positive Attitude Toward QR
	Planned Future Use

Table 6: Major themes and codes from interview data

Theme 1: Teacher Experience Creating QR Codes

Several of the questions in the interviews after the formative and final listening comprehension activities were related to the preparation and distribution of the audio QR code materials. These questions were designed to address barriers that had been noted from previous research, including the means by which the teachers had created and hosted the audio files, the actual tools and procedure used to link the audio files to the quick response codes, and the ways in which these materials were presented to students for access by their mobile devices. These questions helped the PI to gauge the perceptions of the teachers regarding the user-friendliness of this new technology and the time needed to create learning materials. The responses were coded into five areas: (a) the recording of the audio (b) the way in which the materials were distributed (c) the time it took the teachers to create the materials (d) the perceived ease of creation, and (e) their input on the best ways to prepare the audio QR codes for student use.

QR Recording Audio

The first step in creating the materials for the listening comprehension exercises was choosing a tool with which to record the audio tracks. Two of the participating teachers had previous experience recording audio using software, such as GarageBand, or using the built-in microphone and operating system function on a laptop computer to directly record .mp3 files.

The rest of the Spanish teachers used a web site called Vocaroo to record the audio exercises for the transmedia homework sheets, upon the recommendation of the PI during the training session. This web site enables the user to record directly on the site and then hosts the recorded file, thereby eliminating the need for teachers to download the .mp3 file and then find another place to host it on the Internet. Once the recording is complete, there is a button on the site that the user clicks to instantly create a QR code linked directly to the hosted audio file.

When creating the worksheets, the participating teachers copied the QR code from the Vocaroo web site and pasted it onto the word processing file with the listening comprehension instructions and exercise. Students scanned the QR code (or multiple codes) created by Vocaroo with a mobile device, which automatically opened the default browser application and displayed a small audio player directly on the mobile version of the Vocaroo site. This audio player could be used as many times as needed to repeat the .mp3 file aligned with the learning comprehension tasks. The reaction by the teachers to this method of audio recording as opposed to others they had used in the past was very positive:

T8: I did like this one so much better. Just, well, I guess I could have done a handout for the other ones. It's just so much more involved in the settings and resetting the message, and it wasn't as easy. Like making the QR code was just so much easier than recording my voice in Google Voice and setting it as a message and giving them the phone number and, you know, making sure it was on the right message, and that kind of stuff.

T3: I used the Vocaroo; did a quick recording for each part of the conversation, then used the QR part of Vocaroo – which was actually much easier than I expected.

Other teachers commented that working with the recording tools and the .mp3 files that were produced through the tools for the listening comprehension exercises was ‘simple’ (Teacher 7) and even ‘a breeze’ (Teacher 6).

Overall, the teachers were successful in recording high-quality audio from their computers or mobile device without using specialized equipment, such as external microphones. Of the eleven participating teachers, only two reported sound quality issues after the formative trial; both of these teachers were able to fix the sound issues for the final trial materials.

T1: Um, they didn't have any issues with the app. They didn't have any issues scanning the QR code – but they had issues with my voice. And they thought that my voice was muffled – they couldn't really understand me. Um, just the quality of the audio itself.

T6: Some of them liked it, some of them didn't. A lot of them said it was too staticy, and I needed to be record in a quiet place - which I was; I was home in my house with nothing on.

Other minor sound-related issues included a feeling of self-consciousness with the online recording, and a need to retain the audio files online for later use, in case the web site did not retain the hosted audio file for as long as the teacher needed it:

T9: Because I was, just, also self-conscious of my voice, so I wanted to make sure it sounded fluid, and not, like, too screechy. So it just took a little while.

T3: What I did was I made sure that every assignment I had created I wrote the script down. That way, if in the future it deletes, I could always just really quickly redo it. But there's got to be one or two other programs that can save it for longer and that's what I need to like start looking into a little bit more.

The PI reminded the teachers that it was possible to download the .mp3 file directly from the Vocaroo site in order to save a local copy.

QR Distribution

Although there was no direct mention of the term 'transmedia' in the interviews, the teachers were asked to describe how they distributed the audio QR codes to the students. All of the participating teachers provided paper 'hard copies' to the students, and some also made the resources available online or via an e-mail link because of access issues (see Theme 2 below).

The reactions of the teachers and students to the transmedia materials were overwhelmingly positive, especially when compared to the other methods by which teachers had formally tried to distribute audio resources.

T11: So yeah, it was easy to make, and then I just, you know, photocopied and handed it out to the kids. I did spend a good amount of time kind of explaining it to them because it was the first time we did anything like that.

T4: It's a lot easier than having them type in the web sites! They'd have to go to my website click, on the link and then go through - because having them type it was a disaster. Even if it's something short - like the Google short codes, because those have to be case sensitive. Even something as simple as...I took them to the computer lab and they had to go to elcourteinglés.es. And I had the...it spelled on the - it's all Spanish, and it's places we talked about, they have it on, you know, things. They just had to type it out - and they couldn't even....some of them do that.

T5: Exactly. It was easier – you know, you just scan it and you go to the ...you avoid like all of the, ah, the steps of going to YouTube and finding the video. And, you know, that takes time.

The link to the listening comprehension activities via web-hosted QR audio resources diminished the time and more complex steps that were previously needed for students to access the online audio content on traditional web sites or in web-hosted video content.

The pair of teachers (9 and 10) working together mentioned in the formative interview that they had previously had difficulty accessing the multi-media materials that came with the Spanish textbook. Their students were able to use the online text at home, but were never able to complete exercises that called for viewing or listening. When asked if there were any such resources available to the students, they responded:

T9: There are, but we had trouble getting to the...to the videos and to the audio. So this was a good way to work around it.

This response was interesting to compare against the results of question 18 in the needs analysis, in which the Spanish teachers were asked about their access to materials related to a class textbook. Seven of the participating teachers stated in response to this question that they had a DVD or CD that came with the textbooks, five reported having access to textbook-associated audio materials in .mp3 format, and three stated that there was a web site that matched with the textbook. It appears from the interview statement by these teachers that having *access* to the materials does not necessarily mean that teachers and students are able to put them to meaningful use to support language learning.

QR Time to Create

Most of the teachers had never tried to create a QR code prior to participation in the study. Part of the rationale for completing the study was related to time; to determine whether

some audio tasks in Spanish instruction could be completed outside of the classroom to preserve instructional minutes. For these reasons, it was important to question the participating teachers explicitly about the time investment needed to build the learning materials containing QR codes. While the majority of the teachers used the functionality in Vocaroo that allowed for one-step audio to QR code creation, some of the teachers discovered alternate ways to create QR codes, including an extension to the Chrome browser and a right-click menu command in Google Classroom. Although one participant noted that teachers expect a time investment the first few times they work with new technologies, all of the responses indicated that it took very little time to actually create the audio QR codes for the listening comprehension exercises. Of the 18 instances of this code, only three (two from the same teacher) indicated that creating the materials took more time that would be expected for a traditional homework assignment.

T2: I think the level of difficulty it was actually very easy. I felt that it was a bit time consuming.

T2: Yes, the first time investment of creating the code with the reading? Fine. How much time do we invest in things the first time we create them anyway? It's just normal for teaching.

T5: It takes a little bit of time, because you are recording, and you make some mistakes, because I want it to be perfect...I would say it took about an hour?

The rest of the responses for this aspect of QR use showed that it took the teachers between 10–45 minutes to create the materials that included the audio QR code, and that only a small portion of this total time was needed to create the QR code itself.

T5: Oh, it didn't take me long at all... maybe 15 minutes?

T11: Each time...each time I did it, I just did it, um....while my daughter napped on the weekend. So it only took - I mean it only took me, like, a half hour, 45 minutes.

T1: Umm, well you provided - you gave me - like the head start, so it was just a matter of plugging in my information. So I would say just putting it together and setting up the QR code...maybe half an hour?

T3: It took me maybe, between recording and creating the sheets about 15 minutes, which wasn't too bad at all. Umm, the longest part of the process was really just getting the QR codes small enough that they all fit on one side of the sheet and that there was still space for the kids to write.

T8: The QR code was easy, the audio file was easy, typing it up...all that stuff was very easy...I'd say less than 10 minutes.

T9: Umm, I don't know...like 11 or 12 minutes?

T4: Initially maybe a half hour just like in searching and finding stuff, but I think from now on, maybe 10–15 minutes. That Google shortener was fantastic!

T6: No, time was not an issue.

QR Ease of Creation

Related to the amount of time needed to create the QR codes was the question on the level of technical expertise required to link to the audio file with the QR code. During the training, the teachers were given some options for different technologies to use for creating the QR code, such as Vocaroo, Kaywa, and Padlet. During the formative trial they found other options, as discussed in the last section, such as a browser extension or functionality in Google Classroom. As part of the formative trial interview the teachers were asked if they wanted to review any part of the professional development training before undertaking the final trial. None of the eleven teachers requested any kind of review on the actual technical skills required to create the audio QR codes. Of the 25 quotes that fell under this code, none contain statements that creating the actual QR code was technically difficult. Some teachers discussed the components of the audio and the formatting as minor problems, but still indicated that making the actual QR code was not a challenge:

T3: Umm, formatting was my biggest issue. But, yeah, the actually creating the QR codes was very simple. And then it was easy to kind of put it together and move on. And then the template helped.

T9: Um, I would say it took me about a half hour, 40 minutes to make each worksheet. Because I was, just, also self-conscious of my voice, so I wanted to make sure it sounded fluid, and not, like, too screechy. So it just took a little while. But making the QR codes – I used Vocaroo, and that was pretty easy.

Most of the teachers did not bring up any points of difficulty in the process of creating the QR codes. When asked if they had experienced any difficulties in creating the QR codes, the responses almost uniformly describe this process as ‘easy.’

T8: I did like this one so much better. Just, well, I guess I could have done a handout for the other ones. It's just so much more involved in the settings and resetting the message, and it wasn't as easy. Like making the QR code was just so much easier than recording my voice in Google Voice and setting it as a message and giving them the phone number and, you know, making sure it was on the right message, and that kind of stuff.

T7: Yeah. Because it was very easy; it is a very, very simple process.

T8: Oh my god – very, very easy.

T3: I did it with Vocaroo, yep. I used the Vocaroo, did a quick recording for each part of the conversation, then used the QR part of Vocaroo – which was actually much easier than I expected.

T5: Oh, no – that is actually the easiest part! What takes the most time for me is recording in GarageBand, and exporting, and then uploading to the web page...you know, everything takes a little bit of time. Once you have the URL, that is easy to go to the program and make the QR code.

T6: It was very easy!

T9: ...it was kind of easy once you got used to the, um, you know, method of doing it. It was...it was easy for me.

It was apparent by the end of the final interviews that, at least for this set of teachers who have a strong sense of self-efficacy in experimenting with new technologies, the actual creation of the QR codes was not a barrier to their use.

Best Practices QR Audio

The purpose of the formative trial was to allow the teachers to experiment with this new technology and then have the opportunity to make any design or instructional changes before

using the audio QR codes for the final trial. The PI reviewed the formative materials and discussed the first implementation with the Spanish teachers, and asked them about any plans they had to change the design or use of the audio QR codes. The full set of questions can be found in Appendix E, but the questions that the PI asked specifically to support the teachers in making any needed improvements for the final activity were:

- *Would you like to review any part of the training on how to create and host audio files, or create and distribute the QR codes?*
- *Were there any technical difficulties or problems with accessing or using technology that made this activity challenging to complete for the students?*
- *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?*
- *Are there any changes that you would like to make in the design of the activity for the final implementation?*

Based on the teachers' answer to these questions, the PI offered suggestions or examples of other possible uses. Many of the participating teachers spoke about lessons learned from using the QR codes, and together these comments comprise a set of advice for best practices in using audio QR codes for listening comprehension.

One set of comments centered on preparing the students to use the QR codes in order to avoid technical issues or confusion. Several teachers noted that the students needed help with choosing an application to scan the QR code, and one noted that the students needed practice scanning the QR code.

T6: Tell them that they shouldn't delete their QR readers until the end of the year.

T4: Yeah. They flat out said..I had one boy who came up to me and was like, "Look! I typed it into my phone – look, I really did try." And I said, "OK." And he said, "But there's like 15 different QR apps." I said, "Well, whichever one is free you can download...they all do the same thing." And he's like, "I just didn't know which one would work." And I said, "Well, you know, you just put it on your phone and if you don't like it you just uninstall it. But ah..I think.. I think they're just, you know, not used to being given permission to do something like that.

T4: Yeah, I think I might when I introduce it the next time I'll say, "OK if you're going to the PlayStore you're gonna use this one; if you are going to the Apple store you're gonna use this one."

T9: I liked them. One thing I noticed is that my students were holding their phones too close to the QR code...so it wasn't scanning. So I think I'd just try to instruct them on that sooner.

T2: A little bit, like the first time through. Um, I would say that also if I were to reflect on it I would do a lesson on "What Are QR Codes" an example of how to download and give them examples of which downloads to use for free, and maybe even send a notice home to parents that it is not mandatory but this is what we're going to do now.

Another set of comments was related to instructional design, including the number of QR codes used, the length of the audio track for each, and whether or not to include word banks or transcriptions.

T2: They did better with fewer questions. Because the...having the five in the row, I think it's sped it up for them. Because I also think I may have spoken quicker by doing five.

T3: I had given them the option of taking a copy where the Spanish was already transcribed and they just had to listen to it, read along with it, and then translate. Which worked out well for some of the kids, because it gave them a little less of the pressure that they were freaking out about the first time through when they had just been transcribing and translating.

T4: I put a word bank on it because of what they said the first round through. They said it was too hard to do without the word bank.

T3: Other than the...I mean I'm enjoying it so far, the QR codes. Even though, I mean I could just stick, for example a listening passage on my class web site, it kind of gives them...it's nice to have it broken down where they literally have to scan each one and then they can focus on that. For some of the kids, if you give them a list of all of the activities or all of the listening portions they somehow manage to confuse themselves and click the wrong one. So it's nice to have it very clear cut which... which passage goes with which box.

T8: The major difference with that one was I had them originally write down everything they heard, but I didn't think that that was the best way to assess their listening abilities with the language with the app. So I decided to do the questions and if they were able to answer the questions correctly.

Finally, the teachers advised that students be given extra time to complete this kind of technology-dependent homework in order to give them opportunities to overcome either technical problems, or to find a way to access a device. Some teachers paired students with others in the class as another way to share mobile technologies.

T2: Again, because they did it for a group and I gave them enough time, they really were all able to complete it.

T2: Yeah, they always, I mean that's why, um, my go to for any technology assignments always, they have to, they have to have a longer time frame. You can't make it overnight.

T9: My class had two. [nights to complete the homework]

T8: I did give them a week to do it, because I knew the issue they were going to have.

These best practices, although noted in this context of Spanish listening comprehension exercises, can be applied to the teaching of other foreign languages and even other subject areas such as math and English language arts.

Theme 2: Issues Related to Student Access

When requiring academic assignments to be completed using a certain technology, teachers are always cognizant of the current reality that not all students will have equal access outside of school to a particular type of hardware or software, or, if needed, a stable Internet connection. In the needs analysis survey responses, nine of the eleven participating Spanish teachers answered that 75% or more of their students had access to a mobile, Internet connected device outside of school hours. Even so, the teachers' responses to the interview questions revealed many concerns about student use of technology outside of school. This group of responses was coded into five areas: (a) no access to device (b) restrictions on phone use (c) poor access to Internet or wi-fi (d) independent of location and (e) multiple means to access content.

It is important to note that while the first three codes were applied to possible problems that might interfere with the completion of the listening comprehension homework tasks, the fourth explains how the audio QR code activities allowed some students *more* access because of the convenience of using an mobile, Internet-connected devices, and the last group of coded quotes presents options to help with the issue of limited access. Therefore the teachers' concerns were not uniformly related to the fact that a small percentage of students could not access a mobile device at home.

No Access to Device

The teachers' responses to the interview questions pointed to lack of student access of a mobile device as the single largest barrier in utilizing the audio QR codes as part of their regular practice. Even when teachers check to make sure that all students will be able to have such access, it may not be guaranteed; the last response below relates the story of a student who did not want to admit a lack of device ownership because of embarrassment.

T2: The kids having the availability of technology? I mean my district... I'd say, it's pretty easy to say that least one out of three has a smartphone without batting an eye in middle school. Um, and that's...I don't even have to poll them to guarantee that. I can just look around my classes and I tell you.

T4: I would say with the very miniscule group of students that maybe don't have the access to a device, then yes. Maybe out of my...I'm trying to think...I think I had 89 or so I assigned it to and out of them there's only two that don't actually have devices, but their parents have a phone so they could have used the parent's phone. Depending on like a city school - maybe they wouldn't necessarily have stuff or, you know, I think that would be the only hindrance.

T8: No. I mean just besides my students...just that some of them that don't have the access to technology, it makes it difficult for some of them.

T8: Umm, the other thing was that my biggest concern was about how many kids would have access to a smart phone, and what I did was I...there was like 11 students out of my 140ish that wouldn't – they weren't going to have access to a smartphone to do it.

T9: I mean, it's good. I think for the students who didn't have devices we would have to think of something else to give them.

T11: So what happened was, the day that I introduced the assignment and handed it out I tried to get around to everyone to make sure it was downloaded if they had their phone, or, you know, what they were going to do. And, um, this one student I think was embarrassed that he – that he didn't have, you know, everybody else had their smartphone out and so he, he didn't tell me. Umm, so I wasn't aware of it until the say the assignment was due, unfortunately. And I told him that – you know, I kind of helped him out. But, umm, I really think he was...he just didn't want his classmates to know.

The rates of ownership in this age demographic have been rising dramatically over the past few years, but unless a school is prepared to provide students with mobile devices for home use, teachers cannot rely on these as ubiquitous resources.

Restrictions on Phone Use

An interesting finding during the study was that device ownership or access itself does not always result in its use. Although there were only nine quotations marked with this code, these were gathered from five of the eleven participating teachers. Some possible obstacles to device usage included an inability to download required applications because of parent permission or storage space, or a temporary loss of access to a personal device as a punishment by parents. School policies that restrict personal smartphone or tablet usage in class also presented a barrier, as several of the teachers wanted the students to try the activity in class before completing it as a homework assignment but were not all allowed to grant this permission due to a school-wide mobile device prohibition.

T7: I think I would get...besides the 'we know it's not graded' I think I would get, you know, some of the same things I heard: my storage is full on my phone, my mom said I can't download any apps she changed the password....so I just said, you know, that's why I offered my phone.

T8: Instead of like, "oh, my phone broke, this that." Or "My phone got taken away, this that."

T9: Five students had difficulty. Two students could not download the QR readers, one student didn't have storage on their phone, and the others couldn't get into it because of password difficulties.

Excuses for non-completion of homework are certainly not a new phenomenon, but such restrictions that are beyond the control of the teacher remain, despite careful planning to ensure that all students have access to a mobile device.

Poor Access to Internet or Wi-fi

Another technology-related problem occurred due to the need for students to have a stable Internet connection first for downloading the QR reader app, and then when completing the homework. While some smartphone users could rely on cellular connections, even this option had limits due to differing data plan subscriptions. Students who connected to the Internet via wi-fi networks had to be in a place where such connection was allowed (as was not the case in some schools) and strong.

T1: Download...downloading became a problem because of the wi-fi. They can't download apps when they are in school. Um, also, if they didn't have a phone we had to find, we did have to go online and find an online reader, which took a while. So we tested a few. And then, um, sometimes when they tried to scan it didn't work.

T9: In school some of the kids had problems downloading the app, but I guess if that was out of the way and we were able to use the web site through the school Internet, then I don't think there would be too many barriers.

T3: The hardest part about it is just, um, worrying about whether or not they have good like wi-fi connection, or if they have good Internet access where they are.

T4: The only thing that was an issue was, "Well, my Internet didn't work" or "It wasn't...the page didn't load or the web site didn't work. And we found out that it was because they didn't case sensitive the web site.

T7: Um, I did have some kids tell me that they got an error code – um, and then I had some kids that when they told me that in class I gave them my phone to use, and they scanned it right in front of me and it started playing...

T8: If it was on an Apple product, the kind of like...the bottom where you would like push the play button to listen to the audio message, it like wasn't appearing fully.

T3: The only issue that I caught that some of the kids had – some of the kids did it in between like their sports games and things like that. So they didn't have access to wi-fi.

T6: Not that they said on this one. There's a lot of them on the first one who said they had wi-fi issues.

This result suggested that when planning to assign technology-dependent work, teachers must poll students about network connection in addition to device access.

Independent of Location

In contrast to the concerns about Internet-based work in the last section, a few teachers remarked upon the benefit of assigning homework that is accessed through mobile devices.

While the study was designed specifically to involve homework activities that were performed by students outside of class time, the presumption by the PI was that these would be completed in the home. As it turned out, several teachers reported that the students completed the audio QR listening activities while 'on the road' or waiting at extra-curricular activities. The students took advantage of the mobile device and the way that it allowed them to connect to Internet resources via the cellular network and wi-fi.

T3: Well to be honest, I never really gave that much listening assignments at home for homework because it seemed like such a pain to go through for them to have to use the computers and things like that. And a lot of the kids will end up doing homework on the way to practice or to another event, so for them it was it was more of a pain to have to do listening at home. We usually did most of it in class. So for me, it's a great way to give them small listening activities and kind of change the way that I assign their homework.

T1: Oh yeah. I had no issues. And most of my students had not done QR codes in that way. And they are actually on their way to Washington, D.C. . And they're using, I think they are using a QR code app up to do an activity while they are in DC.

T9: So in this case the kids were – wherever they did their homework is wherever they were able to do the listening activities, so if they were in the car, or if they were you know at home – wherever they were.

Although this code was not one of the most frequently applied, the responses indicate that students with mobile devices may appreciate the convenience of being able to complete academic tasks via such devices and transmedia materials. This convenience could, in turn, lead to an increase in homework completion rates. Additionally, if this ability to complete homework tasks allowed for teachers to assign a wider variety of homework tasks that require more use of higher order thinking skills than traditional worksheets, there could be a positive impact on overall academic achievement in foreign language learning.

Multiple Means to Access Content

As a direct result of the issues mentioned in the last three code discussions related to device usage, the teachers made various alternative arrangements to bolster the ability of all students to complete the listening comprehension activity. Some of these related to ways to make it easier for students to use the audio QR codes, but the majority of accommodations centered on providing a different route by which to access the audio. Several of the participating teachers used their own web sites to host audio files, or sent the URL of the online recording to students via e-mail. Others paired or grouped students, or encouraged them to share resources if friends could not access it one way. If none of these methods worked, they provided time and access during school hours outside of class time for students to use school devices and Internet connectivity.

PI: So it's already up there, anyway. One of the, um... one of the teachers, they had kids using Chromebooks and they found a web site where you can turn your Chromebook into a scanner and you can scan the QR code with your Chromebook.

T4: The URL, and I also put a link on my web site - so every assignment that I have is posted on my web site and they hyperlink it so they could just click it.

T4: So I'm thinking that to revise that I'm going to also put a link on my web site for them if they are having trouble with because even though it's a short code, apparently capital and lower case letters are difficult.

T7: Right. Well. Yeah I guess...right...the QR code would have to be printed for them to scan whereas I could just insert an audio link.

T6: Yeah, I think I could probably - she could probably copy and paste a QR code into the homework site, and they could scan it from the homework site. So that would be an answer instead of an .mp3.

T8: No. I mean just besides my students...just that some of them that don't have the access to technology, it makes it difficult for some of them. But it is very easy to take the QR code and just email it to them - or just email them...the thing is I could just skip right over that and send them the Vocaroo file.

T2: This was - it was actually all homework. And I posted on Google Classroom.

T11: So I actually gave them a sheet with the link. And they completed the assignment this time around. So they could have actually...they didn't necessarily have to type it in. They could have clicked.

T11: So like their friend kind of like texted them the link, or sent them a link somehow.

T8: The last time I had e-mailed a few students in order to do it...um, the ones that didn't have access to a device to do the QR code. This time I instructed them to either buddy up with a friend, they could come to me and use my cell phone to do it after school.... But no, I didn't e-mail it this time. I kind of forced them into trying to use the QR code with a buddy, or, you know...

T2: So that way they could even use something at home – they could use a phone, they could use a tablet. They could even use an app at school, a tablet at school, work with a buddy at school. So I gave them lots of options so there wasn't anybody who was not able to.

T6: I offered them the opportunity to come to me during lunch, recess, study hall to use an iPad to do it, and two of them did actually do that.

T5: Not everybody had it. I mean, they had iPads, that were able to ...some of them had cell phones, some of them had iPads, some of them had digital ones like tablets – but some of them didn't have any. I let them use my telephone if they didn't have it so they could take turns and do it.

T6: Umm...but other than that, no. And the ones that didn't have phones, I had them come use an iPad in my room.

T8: Well, I assigned it as a homework assignment for everyone for credit. The students that didn't have access to a smartphone or a QR reader, I e-mailed them the audio file so I kind of skipped over that step for them... And if they didn't have a computer at home, they were working on it in my class or in study hall.

Six of the eleven teachers brought up this idea of ensuring that students could have an alternate way of retrieving the audio content. This technique of providing multiple ways for students to connect with the web-hosted content made for nearly universal access, and could be added to the previous list of ‘best practices’ when designing homework activities that use audio QR codes.

Theme 3: Perceived Impact on Teaching and Learning

The research question driving this study did not seek to measure any change in academic achievement on the part of the students using the audio QR codes for listening comprehension activities. Instead, the study was designed to ascertain the perceptions of the participating teachers as to the possibility of using the audio QR codes to enable audio-based activities to occur outside of the regular class time and setting. In order to elicit opinions on the potential benefits and barriers to using this tool, there were several questions posed to the teachers throughout the stages of study indirectly related to the ways in which the audio QR code listening activities might enhance students’ academic skills:

Needs Analysis:

How important do you think it is to provide audio examples alone – without video – to your students?

Interview after Formative Trial:

Do you see any evidence that the audio supports delivered by QR codes had a positive impact on student learning?

Interview after Final Trial:

Do you see any evidence that the audio supports delivered by QR codes had a positive impact on student learning and/or helping students meet your stated learning objectives for listening comprehension?

The answers to these questions comprise the majority of the responses in this section, which were coded into the following schemes: (a) audio or listening-only benefits, (b) ability to repeat input, (c) more practice for listening (d) saves instructional minutes (e) positive impact on learning, and (f) transformative use.

Audio or Listening Only Benefits

The results of the needs assessment question related to the teachers' preference for supplying students with audio-only listening materials as opposed to motion media with visuals showed that seven of the eleven teachers rated this as 'somewhat important' while the remaining four chose 'very important' (see chart above). In the discussions with the teachers about this aspect of instructional design, the participants frequently stated the benefits of the audio-only format that the students accessed through the QR codes, even though this was not a scripted question for those interactions. One teacher even cited participation in the study as the catalyst for realizing the importance of these kinds of materials for building listening comprehension skills.

T2: Because when you ask someone directions on the street, you don't have that option. And that was the biggest...in my opinion that's one of the biggest obstacles. Even on the phone, even when you've been speaking it for a while, you tend to go, "Oh, can you speak a little more slowly for me?" And that's a great time where they can learn those phrases in actual conversation. So, I was skeptical at first, but I really...I really, really see the merit in it. Like, I liked the idea, and now I can see how it can up their thinking and intuition skills with it.

T2: Because in the real world we don't really, we don't get that you're on the phone with someone, and they are asking you questions in a different language. You don't get to see their body language, you don't get to...so this is a way that I could simulate those things much more, much closer to a real life situation.

T3: They were used to in the past listening to someone talking in front of them - which is much easier: you see their...their mouth and their cues that you kind of naturally make. When in listening you lose that visual part of it. So it's...it's a little bit more challenging, but it...it works in a way to align with what we're doing now, um, in our curriculum.

Other teachers noticed that students were forced to pay more attention to the audio, without the visual data that might provide clues or cause them to split attention and focus. They also took the opportunity to review with students the ways to decode spoken utterances and match them with the knowledge that the students already had of the written forms of the language.

T1: I definitely think that it forces them to just do listening – they have to really listen. They don't have any other distractions and, um, listening to somebody, you know, in the target language, I think they really have to step it up. So I definitely think it's a good tool.

T4: I think it...well it was a Spain Castellano accent, so I think it was nice that they got to hear a different accent. And they came in the next day and asked questions, you know, like, "Why did she say it that way?" or "She was speaking so fast!" And I said, "No, actually she wasn't really speaking that fast - let me play it again." And I put the words up so they could read it at the same time, and they said, "No...well I guess she's not really speaking that fast." And I said, "Well, if you play it more than once, did it seem like she was still speaking really fast?" "No, no I guess not, because now I kind of know what she's saying." And so it was kind of like a learning exercise not just on, like, the QR thing, but also the audio.

Eight of the eleven participants discussed the ways in which the audio-only materials were useful for growth in listening comprehension. In the needs analysis, the Spanish teachers rated the importance of providing audio-only materials in the following breakdown: seven chose the 'somewhat important' and four chose 'very important' It is not clear whether the perceptions of the benefits of assigning the students audio-only exercises would have been similar regardless of the technology used to link the students to the materials.

Ability to Repeat Input

Ten of the eleven teachers mentioned the ability for students to replay the audio tracks as a positive feature of the audio QR codes. The PI did not explicitly mention this possible benefit during either of the interviews, so the number of responses and similarities across participants merited its own code and analysis.

T1: And that took a little while for the students to figure out. It's like, "I couldn't go back. I had to go back and listen" and I was like, "No you just do the little bar and you go back as much as you need." So once they figured that out they were all very happy.

T8: But I do, I think that it was a great tool and now that hey know how to use it they can...they know how to re-play it and listen to it again.

T3: It was, um, it was easy for them to go back and listen – it wasn't like they hit play or recording once and they had to move on - they had the opportunity to listen as many times as they wanted to.

T5: And they were playing it and playing it until they got it!

Three of the teachers specifically brought up the fact that some students who might struggle with language learning could benefit from this ability to easily replay the audio file if needed:

T2: Well, I think...any extra practice at this point has been helpful, especially for some of the kids that are maybe farther behind. They were able to listen to it more often. They listened to it again more than once.

T7: Because then students that may need to hear a listening over and over to really get it - as opposed to you know if I usually play it twice in class and move on - they have the capability to go and listen to it as many times as they need.

T1: I have kids that will practice a lot! My special ed kids also, um, one has a tutor, and this is what he does with his tutor. And he will...because his mom really wants him to pass. He will practice each of these, and he's hearing my voice more and more. He's getting what it is...how he's supposed to answer these. And, um, it's...it's working out great!

The ability for users to repeat an audio file is not unique to this technology; in fact, the media player that most of the students were asked to use on Vocaroo is identical in features to other web-based media players with the basic commands of 'stop,' 'pause,' and 'play again.' The progress bar under the volume control allows users to see the time elapsed and click to return to any particular point in the recording.



Figure 10: Vocaroo web-based media player

It is interesting to note that despite the ease with which students could easily return to any section of the listening file, the teachers chose in practice to record fairly short utterances for the listening comprehension exercises. This is a contrast to the kinds of longer audio recordings that might typically be recorded for use on a CD or podcast. The preference for shorter passages on the part of the teacher is triangulated by the document analysis in three ways (see below); (1) none of the teachers used the template for the 'scrambled story' that would require a longer recorded passage, (2) most of the QR codes created by the teachers were composed of three sentences or fewer, and (3) several teachers specifically chose to create multiple QR codes containing shorter passages on worksheets rather than one single recording. The implication may be that the ease of recording, hosting, and creating the QR code allowed the teachers to create multiple shorter audio files instead of investing the time in creating one longer audio file to be copied to a CD or formatted into a podcast.

Another possible reason for shorter audio passages and multiple QR codes may be that the teachers were concerned about students listening to correct portion of the audio as they completed the required tasks. Teacher 3 specifically mentioned how the placement of the audio files into separate QR codes that could be aligned with matching writing tasks was an easy format for the students to follow independently.

T3: ...it's nice to have it broken down where they literally have to scan each one and then they can focus on that. For some of the kids, if you give them a list of all of the activities or all of the listening portions they somehow manage to confuse themselves and click the wrong one. So it's nice to have it very clear-cut which... which passage goes with which box.

These results are also related to the benefit of saving instructional minutes, allowing additional practice, and independence of location, as students were able to virtually recreate how a teacher might be speaking in class as many times and in any time/location that they needed.

Positive Impact on Learning

This code was purposefully broad in order to account for the variety of ways in which the teachers responded during the interviews to the question about whether they noticed any positive effects on student learning. These effects were frequently mentioned, with all of the teachers providing at least one quotation that received this code. The benefits ranged from an influence on behaviors and affect to those with an academic focus. Some teachers noted that certain students who were previously stressed by the listening and speaking required on exams found the QR audio practice helped them to feel more calm about the upcoming activities. Others stated that the students were better prepared for class discussions and assessments because of the extra practice opportunities. The teachers also mentioned behaviors that could help students become better foreign language learners, including a growth in metacognition regarding listening comprehension, and more focused attention on homework tasks.

T1: He was...he was so stressed out. So he came. We did one of these but I actually also practiced with him, and his...you know I asked him what's his stress level right now. He's like, "9 out of 10." At the end, when we had done some of this, and it was yes, me sitting in front of him, but we also did one of these, just to really break it down and, you know, what it is that I wanted. He said, "My stress level is now a 7.

T4: And I explained to them, I said, "You know what sometimes there is... you know students - native speakers - who come in here and they, you know, speak a mile a minute Spanish and it takes me a second. I have to process, process...oh that's what you said." So you kind of have to learn how to do that, and it was sort of a teachable moment that I think I would have liked to do it earlier on, now that I know that I'm doing it. And I could show them something like hyperspeed Spanish and then put the transcript underneath and then go through it a couple of times and say, "Look this is what actually is happening in your brain. This is what the process is. You're breaking it down; you're hearing it this way. So I just thought that would be kind of a cool thing to do.

T4: Because it [listening] is not something that they do in other classes. This is like...it's unique to just a foreign language, I think.

T2: But they knew what the mistake was and what it was supposed to be. So honestly that kind of showed me that one, they really paid attention to it, whereas they didn't just half

do it. Because sometimes when they don't have that extra component, they're kind of on 'autopilot' when they do stuff outside of class.

T3: So they came to class the next day already being aware of a few of the new vocab words and then when we went to go learn the vocab a little bit later they were already like, "Oh, I know what this is – I heard this on the recording!" So, umm, it was a nice kind of segue into that. And giving them the opportunity to kind of explore new vocabulary on their own before we did it in class.

T9: ..., they actually picked up on it...especially the ones that did it in front of their parents, because I think it started to make them discuss exactly what they were listening to.

T11: ...I mean I think it would certainly help prepare them for, like, the listening part of our exam, which was a similar formatting.

More Practice for Listening

According to six of the eleven participating teachers, the audio QR codes allowed students to spend more time practicing their listening comprehension skills in Spanish. This result was not surprising, given the data from the survey regarding the relatively small number of instructional minutes students participated in listening comprehension activities in class, and were assigned to practice with out of the class. As teachers must reserve time for all four skills of reading, writing, speaking, and listening, asking about the time allotted for any one of these skills individually would yield the same result.

The teachers were asked specifically to design this transmedia activity for the purposes of listening comprehension, so the additional time required for the study-mandated listening comprehension activities alone would cause at least some temporary increase in practice. The responses were very positive about this additional practice, however, with several teachers indicating that this additional practice opportunity was so valuable for language learning that it might become a regular part of their pedagogy (also see 'Planned Future Use' code below).

T1: When it comes to the listening and to the speaking, um, their stress level is so high that they kind of stop. So you're trying to come up with creative ways to have them practice not only listening, but speaking, and you know it's very difficult when you're

trying to teach. You know they've asked me, "Can you just do this with me? And it's, "Well, I have 30 other students. When will I do that with you? So it's been...it actually took a lot of stress out of my...um in my shoes, because now I have something that... I have kids that will practice a lot.

T2: Well, I think...any extra practice at this point has been helpful, especially for some of the kids that are maybe farther behind.

T3: That better honestly fits the needs of what we're doing now for our final exam and all that kind of stuff. We just changed our format of our listening and speaking sections on our test, so it kind of aligned a little bit better. So they're getting more exposure to hearing a tape.

T5: So I think this actually extends their learning time, because I don't have to be present for them to learn.

T6: Right, hearing it again, and some of them had to probably look up a word or two, so they were seeing it again and associating it with the meaning to know what they had to do.

T9: Mmmm hmm – and to practice their fluency, I guess. If they're hearing the Spanish, then they are more likely to produce those sounds.

T11: I think it gave us additional practice, where maybe, you know, we would have just done it that once or twice, where it was, like, more repetition with it...I mean I think it gave them the chance... it gave us the opportunity to practice more listening than we would have.

As Teacher 11 noted, moving some of the listening comprehension practice to homework tasks opened a new avenue to allow for more exposure and repetition.

Saves Instructional Minutes

As was noted in discussion related to the previous code, it is not often possible to find the in-class time for extra practice with listening comprehension exercises when teachers must reserve time for all four skills. Therefore, the impact of being able to utilize a new technology that can actually preserve instructional minutes by allowing for additional listening practice outside of the classroom may have significant ramifications for pedagogical practice and student achievement.

T2: So I like...I like having the option that it doesn't always have to be me up there saying it, because the amount of class time that that can use up. You know, you can use a...literally a 40 minute period on 10 of these questions. And that's a lot of class time. So this could be a really great way to flip the classroom with that.

T2: Um, you know, I do - I see how this could easily be added to what I already do to make it easier and save class time. And that alone is invaluable, in my opinion. If I can save 40 minutes of class time and the kids aren't complaining about "scanning this cool thing and it just reads to us!" Huh – okay!

T3: We usually did most of it in class. So for me, it's a great way to give them small listening activities and kind of change the way that I assign their homework.

T7: Because it's not enough; 45 minutes in a class period of hearing me speak, when half the time I'm speaking in English because I'm giving them directions, and discipline and things like that. So if they could listen to me at home more it would be definitely beneficial.

T10: Yeah. So this... this was much better because we could, um, we could create as much as we want and have them listen to as much as we want on their own without us being there. So it gave us the freedom to free up some time in class to focus on other things. Umm, you know, and have the work done, so it was just reviewing it and making sure they got the information.

The teachers explained that they could ask the students to either preview the work for an upcoming class session, gain more exposure to spoken language, or practice speaking by mimicking audio examples at home without needing a live speaker in front of them.

Transformative Use

During the interview after the final trial, the PI asked the teachers, “*How does the method of creating and providing the QR audio codes compare to your previous methods of providing content in terms of time necessary to create the codes and technical expertise required?*” When investigating the use of educational technologies, it is important to note if the technology is being used by the teacher or students to simply replace a similar process that was previously done by other means (for example, taking notes on a laptop rather than by hand) or if the new technology allows for a use that was previously not possible in the educational context. All but two of the

teachers indicated that the use of the QR codes as a means for students to access and interact with audio files outside of the classroom was a fundamental change in the way that they had previously asked students to practice listening comprehension in Spanish.

T1: In previous years what I've – it has been so stressful for me, because I know when it comes to reading and writing, I teach at a higher level. Like they're eighth grade; I always like to teach like second or third level so that they're up here when they walk in to the classroom to take the final, and they're very comfortable. When it comes to the listening and to the speaking, um, their stress level is so high that they kind of stop. So you're trying to come up with creative ways to have them practice not only listening, but speaking, and you know it's very difficult when you're trying to teach.

T2: Yes, that's usually something I usually do in person or live. But this way, what I did was I started recording it. And if students were absent the day I did it in class I gave it to them – I gave the QR codes to them – and said, "This is your homework." So they were able to not be behind, or if they couldn't stay after there was a second way to let them be independent and make up their work versus being dependent. And also I used it as just practice - as a practice for them to take home and do listening comprehension for homework, which honestly has never been possible before. So it was very exciting for me.

T3: Well to be honest, I never really gave that much listening assignments at home for homework because it seemed like such a pain to go through for them to have to use the computers and things like that. And a lot of the kids will end up doing homework on the way to practice or to another event, so for them it was it was more of a pain to have to do listening at home. We usually did most of it in class. So for me, it's a great way to give them small listening activities and kind of change the way that I assign their homework.

T7: Before I would have only been able to do this in class. They could never get anything audio from me for homework. And, like I said, the listening right before our listening quiz was perfect because that's exactly what their quiz part I was.

T9: I don't think we would have been giving out audio homework previously.

T10: I don't think we would have been giving it out at all, because, um, a lot of the audio that works with our curriculum here is, you know, textbook-based, and provided by the online textbook.

T11: It would always be in class with me reading, them listening and answering. So it's...it's never been done at home before.

T3.: One of the things that I haven't really been able to do with homework - I've never really given them listening homework before

T9: Well, listening activities are hard to get to, and I always had to do them in the classroom. I've never had the chance to do my listening activities at home.

T10: It was just one source. Um, so, um, you know, there was a native speaker from the Realidades textbook series, or Adelante textbook series; and it was just these activities that were made up for us. We just pressed play.

These quotes describe a new ability on the part of the teachers to provide students with more customized exposure to the kinds of input that they need through the use of the audio QR codes.

The Spanish teachers were able to expose the students to more language excerpts that matched with the curriculum, prepared them for upcoming assessments, and were at an appropriate level of complexity. This indicates that there is a potential for audio QR code usage to strongly impact learning in a positive way.

Theme 4: Feedback from Affected Parties

The last of the four major themes centers on the evidence presented during the interviews regarding opinions of many people directly and indirectly affected by the use of the audio QR code activities for foreign language instruction purposes. The teachers were asked in both interviews if they had received any feedback from students and parents, and were also asked about their own opinions of the QR code technology. Unanticipated feedback was also received by other members of the educational community, such as colleagues and peripheral staff members within the schools where the participating teachers work, and even other foreign language educators working in different schools. These responses were spread between the following six codes: (a) involves others outside of class (b) share QR use professionally (c) feedback from students (d) novelty of activity or tech (e) teacher positive attitude toward QR, and (f) planned future use.

Involves Others Outside of Class

When asked about the kind of feedback that parents had supplied regarding the audio QR code homework activity, one teacher gave an example of a parent who was a little confused about how to help a student use the QR code:

T11: Um, well, no. That one student, his...the student I was talking about, his mom had e-mailed me... and she was real nice about it, but she was kind of, like, she wrote something like, "Help this mom who is technology clueless!" or something, you know.

A few received or heard about positive feedback when the parents noticed that the students were completing an unusual activity; this occurred partly because of the mobile access (see code above called 'independent of location'). Others noted that it would be unusual to hear positive feedback from parents on homework assignments.

T4: Umm, one of the students that I have, her mom is actually a teacher here. She said...she came up to me and she's like, "You know what? That was really cool. I really liked the homework. We were working on that together. It was really hard - we had to play like 12 times. But it was really cool when you hear somebody saying it with an accent and speaking so fast." And you know the student, said that she was actually picking up words, and the mom said, well she actually said she understood it a little bit, which is actually really cool. So I got some positive feedback there.

T9: The parents loved it. Umm, you know, they sat there, they were curious at first, definitely curious as to what I was having them do, and when they saw, you know that it was just kind of the clear cut activity, just a listening activity - usually it would be either mine or T10's voice, and the parents liked it because actually while they were listening, they were kind of impressed with how much the students could, um, understand.

T8: One of my students did come to me this morning and said, "Teacher 8, when I was doing my assignment my mom asked me who was talking to me." And she's like, "I told her it was my teacher" and she said she had never seen anything like that before.

T9: So they said that when they had to explain to their parents what it was they were listening to, they got more out of it, because, you know they had to understand it at that point.

T4: A couple of parents when I've been calling home on the phone: "Oh by the way, that homework was really cool." Or I send out an e-mail with every unit that we do. And sometimes they'll write back and you know ask questions, and so I got some feedback with that, too.

T1: No, the only, let's see...no, actually not even the tutor. But then again, I'm not in a lot of communication with parents. I only hear from them when they're not happy.

The team teachers 9 and 10 asked other non-teaching members of the school staff, who were native Spanish speakers, to create some of the recordings, and were praised by the principal of the building for reaching out to the school community.

T10: The principal liked that because it was getting the community involved – like the school community involved in the kids' education.

T9: But this time we got people from the school to, uh, you know, who were native speakers, to read the dialogue for us, the narration for us... 'Cause we have someone here who's actually from Spain, then we have someone from Ecuador, and some are from El Salvador, so, uh, it was pretty cool.

This code also relates to the professional sharing explained in the next section.

Share QR Use Professionally

Some of the teachers who participated in the study were known within their districts or even around the larger region to be leaders in using emerging technologies for foreign language instruction. Although the participants were spread out over a large geographic area, many were members of a regional foreign language professional practice group and attended conferences and workshops related to innovative ideas in practice. There were actually occasions during the interviews when one teacher would mention the name of another participant, unaware that they were both participating in the study. Two of the teachers had already shared their use of the audio QR codes with colleagues, and another two had discussed using QR codes for other applications with educators outside of the foreign language area.

T1: But it kind of grew, and now I told one teacher in my school, and she would like me...we have professional development day on Friday; she would like me to do it for the department.

T1: Then I told my other friend teacher who teaches French in the district but in another school and she would like me to go to the school and teach all the teachers.

T4: And that's sort of the feedback that I got. Parents and people around the building that saw me copying – like, “What are you doing?” I said, “Oh I'm doing QR codes.” “Really? That's so cool! How you doing that? What are you doing with them?” And I said, “Oh well there's this this study that you know they're trying to see... “Well, why are you using the QR codes?” And I said, “Well because they're everywhere and it's kind of cool” and they're like, “That's so cool! How do you do it?”

T4: Um, the feedback was really good, and I think one of the biggest things is how the parents and community and people in the building reacted to it. Like that was...I was just, like, the coolest person because I'm doing this new thing and, “Oh, how do I do that? I wonder what else we could QR?” and things like that. Like, “Oh maybe we could do that with the grade book, or maybe we could do that with this, and...” and, you know, they liked the idea of that little shortcut thing.

This kind of professional sharing is common with educational technologies, and is an alternative way to attending workshops or conferences of spreading positive experiences with adoption of a new technology.

Feedback from Students

No students submitted work samples or took part in any kind of official poll or survey as a part of this study. The PI did ask the teachers during both interviews, though, whether they had received any kind of informal feedback from the students in regards to the audio QR code listening activities. The responses covered all possible opinions from dislike to excitement.

T1: Um, they...they didn't overall like it, I'm sorry to say. They, I think....again I can't tell whether it was because of the quality of the audio.... but I did tell them that we would be doing other activities with QR codes and the next one will be that you will be creating your own, and they – some – were excited about it and others were like, “No more technology, please! It's too complicated.

T7: Umm..not really they just kind of said, “Yeah, I did it.” And handed it in. Nobody seemed overly enthusiastic about it, or nobody was like, “This is dumb. Why do we have to do it?” Just another assignment to them. I mean they have Chromebooks in most of their other 8th grade classes, that they use every day, day in and day out.

T3: Yeah, um, the kids seemed to enjoy it. Um, the first time through it was a little more stressful – some of them were anxious about it. It was new, it was something different. But the second time through, they liked it because it was a good practice activity that they could do for homework rather than just the worksheet or review packet.

T5: They loved it! They were like, "Can we do more of this?"

T11: I've actually used it with my, um, 10th graders, too, since I learned how to do it with you. And they...they have shown even more enthusiasm about it. They really like it.

One potential benefit of using educational technologies can be to motivate students who would otherwise not always engage with the curricular material. The results from this general question on feedback seem to be inconclusive as to the students' interest in completing the listening comprehension activity with QR codes. The next code was applied to quotations that were more specific about the use of the particular technology instead of an opinion on the activity as a whole.

Novelty of Activity or Tech

The participating teachers designed the listening comprehension activity to work through a scanning application on a mobile device to access the audio content. As this is not a common way to complete homework assignments, the PI predicted that using this kind of technology might be appealing to the students in terms of convenience and novelty (Wang, 2014). Most QR codes provide no hints about what information will appear when they are scanned, so finding the 'hidden' information that is linked to them via URL can be appealing to users. Some students were interested in the new technology of QR codes:

T4: No. Once they actually had...the kids who were able to put an app on their phone and actually use it said, "Oh, that's pretty cool, you don't have to type an address. They seemed like...I have to say that honestly, when I showed them what a QR was, they hadn't..." "Oh yeah! That's what that thing is? That's what that thing does? Oh that's so cool!" And then I had my phone and I had a QR projected on the screen, on my whiteboard and I scanned it and they were like, "What are you doing?" And I said, "Oh I'm going to scan it with my phone, watch!" They were like, "You can't do that, that is on the screen!" "But, yes I can – watch!" And my phone, you know, made the noise and I went to the site...and it just took me to the site and they were baffled.

T4: I think it's a little of both [new and particular tool], because it's.. it is new and different. And you know how many worksheets to the kids take home that actually have a QR on them? I think that itself is new.

T8: No, I liked it a lot. I like using stuff like this, so it was exciting for me, and new. And, you know, my students - any time they can...you know, even some of them that don't have the technology... even though they can do something with technology, it makes it exciting to them. You know a lot of them are like, "Oh, it's so cool."

A few of the teachers noted that the students were especially interested in using the devices.

Although the study asked the teachers to assign an audio QR homework activity, several had the students bring in the smartphones to the classroom prior to the assignment so they could demonstrate how to complete the task.

T5: So what I did is I printed the squares for the QR codes and I just pasted them...or put them on their desks. So when they came to the class they were very excited that they had their cell phones with them - they got into the BYOD for school.

T5: They really liked it because they want to use their device in school, you know? I think that at this age, that is the catch. I think, you attempt, you know, make them, take advantage of the devices they have and engage them to, you know, through their use for things in our repertoire. I think that is where the key for successful engagement is.

T8: They kind of get excited when they can... because they're not allowed to use their cell phones in school. So when I tell them they can use it in class to listen to it and put their headphones in and kind of zone out and do their work, they really enjoy that.

Another factor was the novelty from the perspective of the teachers; they were interested in trying new activities. This was triangulated both by the fact that they self-selected for the study, and by some of the responses on the needs analysis in which they indicated that they were actively looking for new technology tools to use with their students:

T6: Very high [chance of using it next year]. I liked it. I think it's a...breaks up the monotony a little bit.

T2: But it was a nice break from the normal routine, and that's what some of the kids were saying they liked it - that it was different.

T3: It kind of changed it up a little bit and it gave them an activity that was more relatable to the final exam. Especially...we just finished our speaking test today - it was a

back and forth conversation, which is one of the topics that they might have gotten anyway for their speaking test. So it was kind of a nice, um, practice to kind of go through the questions and answers and see what types of questions would appear on potentially their speaking exam.

T11: Uh, just that I... that I, you know, I really enjoyed it. I found this to be sort of like a, you know, refreshing because sometimes you get in a rut. So it was something new to bring to the table.

T1: Um, I definitely think that just using technology in that way – just something different, rather than what they typically get as far as worksheets, or you know, go in and listen to this audio on, um, you know, whatever program or watch a YouTube video...it's something, just another tool that they can use.

This code was applied to responses by eight of the eleven participants, indicating that the novelty of using technology may still be a motivating factor in and out of the classroom. In order to test whether the novelty effect wears out after a certain amount of time and activity use, the PI would need to revisit the participating teachers at a later date and again ask the teachers to gauge the level of enthusiasm shown by the students when completing the QR code listening activities.

Teacher Positive Attitude Toward QR

At the end of both interviews, the teachers were invited to share their thoughts about the QR code activities and their participation in the study. They expressed very positive reactions to learning about this technology and its potential for supporting foreign language instruction.

There were many instances of positive comments related to learning about and using the audio QR codes, from 10 of the 11 teachers.

T1: So based on what I told them - because I really want to share! This is such a cool activity! It wasn't really my idea - you know, you kind of planted the seed!

T2: No I'm trying to...One, I'm so thrilled for participating because it forced me not only to learn about it but to use it and reuse it in a short amount of time. Shorter - not really short, but...and, you know, there was plenty of time, but even among the things, and by having that time frame, I think that I've achieved a level of competency with it as a new technology piece that I wouldn't normally have had. I think that kind of relates back to the whole training piece, too, about with this.

T4: As far as, for me, I liked...it felt like I was more up to date in technology. I kind of feel like I was more, you know, refreshed. I'm kind of getting out there and changing things a little bit as opposed to just the stale web site.

T6: I like it because it gave me a whole different thing to do with QR codes other than the scavenger hunts.

T3: It kind of changed it up a little bit and it gave them an activity that was more relatable to the final exam. Especially...we just finished our speaking test today - it was a back and forth conversation, which is one of the topics that they might have gotten anyway for their speaking test. So it was kind of a nice, um, practice to kind of go through the questions and answers and see what types of questions would appear on potentially their speaking exam.

T10: And also the listening comprehension tasks that we have designed for us by the textbook series, it has...it has them essentially doing, finding multiple answers at once... and they're just too confusing.

T11: Uh, just that I... that I, you know, I really enjoyed it. I found this to be sort of like a, you know, refreshing because sometimes you get in a rut. So it was something new to bring to the table.

T4: Umm, no I was really cool and I kind of enjoyed it myself and I like to incorporate it more. I want to see if it goes over better with the word box making it a little easier for them. And if it does go better I think I'm going to try to include it moving forward for next year, like sooner in the unit. Like maybe if I can, you know, start it a couple months into school - maybe not right away because that would be too much - but if it does go over well, I think it's something that I want to use because I think them getting more listening practicing is fantastic.

T6: No, I was really...my only other comment would be that I was really happy with Vocaroo and how easy it was. You get to record and generate QR codes.

T7: Umm, no – it was fun. It was interesting to see...I would have I never thought that I could have made a code! You know, to me they were just the things on boxes that I had no idea – why would I scan that? It never occurred to me that it could be brought into a lesson or an assignment.

Before giving consent to take part in the study, the teachers knew that it would involve QR codes for linking to audio content for homework activities. It is not surprising that they were motivated to learn this new technology given their choice to voluntarily participate, but the fact that all of the teachers in the study reacted positively to its potential for use in and out of the language classroom is an unexpected result. Further research might better determine if their enthusiasm

for the QR audio codes was based primarily on the fact that this technology is paired with mobile device use, or if it is actually the transmedia approach with the ease of linking to Internet-hosted media that appeals to the teachers.

Planned Future Use

After the final implementation of the audio QR activity, the teachers were asked, “How likely is it that you will use this or one of the other possible QR audio activities with your students again?” All of the 11 participating teachers indicated that they were planning audio QR code listening activities for the next school year.

Teacher 9 and 10: Very.

T10: Almost exclusively for all of our listening; in class and for homework.

T4: Um, I'm already putting it into future units that we're working on, and I'm trying to backfill for my files for next year so I can use it in the earlier units because I think it's a really cool idea. I like that they're hearing different accents, and I like that they're doing that whole listening decoding thing. Maybe if, like I see what other people did maybe it'll give me some other ideas, so it's not the same thing over and over. But I kind of like this activity at this level; I think it was a good idea, and it's not necessarily something that I would have thought to do on my own.

T2: So I see a lot of great uses for this and I'm really...I know that still in the baby stages of, of utilizing the possible potential of this, but I really think for listening comprehension and getting them not to have something to look at, that, you know, that they're reading at the same time.

T2: So there's...there's...there's a lot of great possibilities, and with us clearly pushing more into current events and different things I see a way of like using...they get a Scholastic magazine in Spanish. Have them do a QR code review about it or maybe do a verbal review that's asks some questions that's in the article.

T3: But also, I think it would be a nice activity to start with as well, because like the first night, for example, giving them a homework and with a speaking...or a listening comprehension where they can see what they can figure out from the conversation. They might not necessarily know all of the information, but cognates and context clues, and stuff like that. And maybe having the script written down in Spanish they'd be able to figure out a few more words than they would potentially just listening to me talk in class.

T7: No, I would like to try...um, it just so happened that the way the material I was teaching right now lent itself to these very singular, one by one. I would like to try a

longer comprehension where they're listening to a longer piece and responding somehow.

T8: I plan on it. Especially because I loop with these students - I'll be with them next year, so it's a very smooth kind of: "Here's a QR code - here you go." For listening. I could even, you know, give them several codes and several questions, and they could just click on each one - and I think that would be great review for them.

T11: Sure. Well, each...each chapter I teach, I do at least one or two days on a listening activity. So I think instead of just playing the CD, you know, or whatever...or me...me reading, I could do it this way in the future.

T1: Now, like I set up a worksheet. I may use...I'm going to see if I can tie it into the QR codes, where I have them "who, what, when, where, why", here's the scenario, you know, what are some questions you can come up with.

T2: I actually came up with an idea that I might do stations in my classroom as a listening activity with them using a story. And they would use the tablets at school, and they could scan it and listen to it at their station. And then the experts from each station would get together and share what they heard. And for my 7th graders I'd like to try the same idea and I may do stations with them. Because I want me 7th graders to be able to know that to use next year with the work I created this year - I want to reuse it.

T5: True, true, that is a good idea. I am already thinking that what I am going to do, because I have videos, that I have actually, um recorded myself, you know life scenarios - real life scenarios, like going into a bakery and buying stuff, ordering things. So I'm thinking I'm going to create QR codes for those videos, where they watch them at home and answer some questions, and then that would be the final activity.

These planned activities mostly relate to listening practice, but in some cases the teachers have extended the purpose to speaking and reading. The teachers were also hoping to have the students use QR code activities in a variety of planned settings, with some taking place in the classroom, others at home, and a few spanning both locations. There was discussion of what device students would use, with some teachers avoiding the issue of access by counting on students using school-owned devices to scan the QR codes.

Another way in which the activities were extended from the examples in the study is the way in which students are grouped; instead of only using the QR codes for individual work, the

teachers plan to use stations, groupwork, and pairwork, all of which should encourage communication in Spanish while completing the task.

Document Analysis

The participating Spanish teachers provided the PI with blank copies of the worksheet materials that they distributed to students for both the formative and final trials with the audio QR codes (see Appendix C). The audio QR codes that the teachers created and inserted have been replaced with a text-only placeholder QR code in order to first protect the privacy and confidentiality of the people who were involved in the recordings. The second consideration for replacing the original QR code is to ensure that intellectual property is used in accordance with copyright law. Many of the Spanish teachers wanted to save and reuse their own recordings and did not expressly give permission for other teachers or researchers to reuse them. Others read aloud or linked to recorded texts that were developed by different authors and used under Fair Use guidelines, which do not extend to the reproduction and distribution of such materials in this form.

In this analysis section, the documents are reviewed in three ways, each with a purpose described in the data analysis section of Chapter 3. First, the documents are compared to the original templates provided to the teachers in the professional development training. This section is called “Application and Adaptation of Materials,” as the materials are categorized as either an unchanged ‘application’ of the template or a modified ‘adaptation’ of the proposed materials (Van Duzor, 2011), or novel use. The second type of analysis, called “Content and Purpose,” reveals more about the actual audio and written content in the transmedia materials, in order to find patterns of use or ideas for activities that extend the repertoire of the original ideas for listening comprehension support in the early stages of foreign language learning. The last

investigation into the materials is titled “Technical Aspects.” This involves a detailed examination of the technical characteristics of only the audio material itself that was linked to by the QR codes. The audio was tested for the length of the file, audio quality, rate of speech, whether it was recorded by a native speaker, and speed of retrieval from the Internet. The results from the document analysis were triangulated throughout this chapter with the data from the needs analysis and interviews to help with the identification of the benefits and barriers of the audio QR codes for use in this foreign language learning context.

Application and Adaptation of Materials

As noted in Chapter 3, in a study on the transfer of information learned in a professional development context to classroom practice, Van Duzor (2011) coded the materials that the participating teachers used in the classroom after the training sessions, and then categorized them into one of four possible options: proposed direct application, utilized direct application, proposed adaptation, and utilized adaptation (pp. 367–368). As this study specifically required that teachers use at least one formative and one final version of audio QR listening exercises with students, the materials were labeled in Table 3 as either ‘utilized direct application’ (UDA) or ‘utilized adaptation’ (UA) of one of the three supplied templates provided to the teachers in the Phase 2 training session. In UDA, the teachers only modified the template by changing the content to match with their Spanish language curriculum; otherwise the function and layout remained exactly the same as in the original template. The materials below labeled UA have similarities to the provided templates, but also some changes beyond content in either their structure or function. An additional category of ‘novel use’ was added to describe use that was not aligned with any of the proposed three templates; in this case the teachers created a

completely different type of activity from scratch with no similarities to the three suggested during the professional development training.

Teacher # and Trial	Template 1: Dialogue	Template 2: Scrambled Story	Template 3: Cloze	Other
T1 Formative			UDA	
T1 Final				N – Transcribe heard questions and write answers in L2
T2 Formative	UA and UDA			
T2 Final				N – practice listening to passages for exam review
T3 Formative	UDA			
T3 Final	UDA			
T4 Formative			UA	
T4 Final			UDA	
T5 Formative			UA	N – Vocabulary practice
T5 Final				N – Watch video and answer questions in L2
T6 Formative				N – Listen and draw
T6 Final			UA	
T7 Formative				N – Listen and write vocab
T7 Final				N – Listen and circle picture (grammar)
T8 Formative				N – transcribe and answer questions
T8 Final				N – Listen and answer provided questions
T9/10 Formative				N – Listen and circle picture
T9/10 Final				N – Listen and write described item, indicate T/F
T11 Formative				N – Listen and answer questions
T11 Final				N – Scan and answer multiple-choice questions

Table 7: Application, adaptation, and novel use of audio QR codes in materials

Some clear patterns emerge from this visualization of the way in which the teachers chose to design the materials after the training session. First, none of the Spanish teachers chose for the students to complete the ‘scrambled story’ listening exercise based on Template 2. This

activity was the most passive of the three options, in which students were asked to listen to several sentences and then reorder them according to a logical sequence of events. It is possible that this was not chosen as an option because of the fact that students were not required to produce any language (English or Spanish) or choose answers to questions, but only reorder the existing text. This activity would also require the teachers to find or create a longer text, and some teachers expressed concern during the interviews that with longer audio clips the students tended to have more difficulty locating the pertinent information.

Of the three templates, the most frequently used was the third, with two instances of utilized direct application and two of utilized application. This template was for a Cloze activity, which is a partially transcribed text with blanks where students fill in missing words while listening to a recording. This activity called for more discrete listening that included the identification and transcription of individual words. It is somewhat surprising, after examining the results of the needs analysis, that this template was more popular than the dialogue-based Template 1, which had only one instance of utilized application and two of utilized direct application. In the needs analysis, the participating Spanish teachers were asked which listening comprehension skills they considered to be the most important for their students, and responded in the following manner:

Result	Tally
follow a conversation in Spanish and understand the meaning of the interaction	11
listen to a longer passage (not a conversation) in Spanish and understand the main idea of the text (informational or literature)	7
recognize a new vocabulary word spoken in Spanish and be able to correctly say or write what it means in English	6
listen to a sentence in Spanish and correctly translate the meaning into English (oral or written)	4
correctly spell/transcribe a word spoken in Spanish	2
listen to a sentence in Spanish and transcribe it accurately	2

Table 8: Importance of listening comprehension skills from needs analysis

Yet, the actual use of the audio QR codes for listening comprehension activities appears to be contrary to these aims; there were only three instances in which the teachers used the dialogue activity (Template 1) even though conversational skills in Spanish were at the top of the desired skills list. The transcription skills, which were not indicated in the survey to be very important at this stage of language development, were included in several of the novel use activities designed by the teachers.

The number of novel use activities is the most striking result from this categorization of the materials. Of the 22 sets of materials (Teachers 2 and 5 produced two different kinds of formative exercises), 13 of them met the criteria to be labeled novel uses of the audio QR codes when compared with the three provided templates. While some teachers mentioned in the interviews that the templates provided a good ‘jumping off point,’ it is clear that after learning about the functionality of the new technology the teachers used their knowledge of the curriculum and student abilities to design appropriate activities that would best fit with the current academic needs of the learners. This result informs the design of professional development in the use of new technologies, as providing the freedom for participating teachers to choose how best to use the new tool may lead to a more meaningful use and ultimately a better chance of long-term appropriation.

In looking at the types of uses that the teachers designed with the audio QR codes, there was a tendency toward activities that required more active learning and engagement with the audio and textual elements as students search for or produce a correct answer. Additionally, the resulting completed activities could be more quickly and easily assessed than ones where the result is not in an easily viewed and collected form. So although asking students to listen to and practice a dialogue for homework may be a valuable activity in terms of language acquisition,

the pedagogical concerns of homework completion, collecting, and grading student work may make these kinds of activities less practical for this educational context.

Content and Purpose

As noted in the previous section on the types of materials that the Spanish teachers designed after participating in the training, the audio QR code exercises were varied and not usually based on the supplied templates. During the training, the teachers were told that they were allowed to use any of the templates exactly as they were presented, make changes to them, or design a new activity – as long as the students listened to an audio-only excerpt, and it was completed as a homework activity. The ways in which the Spanish teachers, as content experts for this study, modified the templates to match with their content, learners, curriculum, and learning context help to illustrate some of the best possible ways that this tool could be used to support foreign language learners in the early stages of language acquisition.

In the following table, there are more details about the content of the activities and the overall purpose for each as a way of promoting or supporting foreign language learning.

Teacher # and Trials	Content	Purpose
T1 Formative	Cloze activity with audio recording of one paragraph related to colors and items of clothing, followed by a transcription of the paragraph (14 sentences) in Spanish with missing blanks. Area after Cloze for translating the paragraph to English.	Learn to recognize the sound of vocabulary. (Translation is not a listening comprehension skill here as it can be read from the completed Cloze sentences).
T1 Final	Listening activity with questions to transcribe, then create a written response in Spanish that is an appropriate answer with details (adjectives and prepositions). Total of 10 QR codes prepared for this activity.	In-class activity that is a review for a final exam in which the students will listen to questions in Spanish and be expected to formulate and speak the answer to the question with as much detail as possible.
T2 Formative	Activity 1: Conversation in which students first write the phrase they heard in Spanish and then answer the question in Spanish. Content related to basic personal information. 6 QR codes.	Activity 1: Follow a spoken conversation in Spanish and be able to produce an appropriate written response to a spoken question.

	Activity 2: Students listen to a conversation and choose the Spanish phrase they hear from a word bank. Then they write the correct response to the question. 6 QR codes.	Activity 2: Recognize the meaning of questions in Spanish.
T2 Final	5 audio QR codes linked to audio passages of several sentences each. Students choose the correct answer from 2–5 multiple choice questions related to the excerpt.	Practice for the listening portion of the final exam. Audio and questions based on a released exam from 2006.
T3 Formative	Students listen to a dialogue between 2 people in 5 QR codes. They transcribe the phrases they hear into Spanish and then translate the sentence to English.	Follow a conversation and reinforce vocabulary retention and use. Practice transcription and translation.
T3 Final	Listen to a dialogue between 2 people about shopping in 5 QR codes. They transcribe the phrases they hear into Spanish and then translate the sentence to English. The second activity is the same format with the Spanish translation provided.	Follow a conversation and reinforce vocabulary retention and use specific vocabulary for a setting. Practice transcription and translation.
T4 Formative	Watch a video of a woman discussing some food-related topics and complete a Cloze activity based on what the people in the video say. Then translate some sentences in Spanish taken from the audio into English.	Follow a spoken conversation by a native speaker (Spain) and discern individual words. Translate written Spanish into written English.
T4 Final	Watch two videos of different men discussing first students at the university and then transportation in a city. Complete a Cloze activity based on what the people in the video say. There is a word bank provided for the activities.	Follow a spoken conversation by a native speaker (Peru) and discern individual words from a stream of utterances.
T5 Formative	Activity 1: Listen to an audio excerpt of questions related to finding locations in a school. The questions are listed, but the answers are in Cloze form with blanks for missing words. Activity 2: A vocabulary list with the word in Spanish (including article) and then the meaning in English. Students listen to the recording to hear the sounds of the Spanish words.	Activity 1: Comprehend spoken questions and be able to formulate written answers (L2) with new vocabulary words. Activity 2: Recognize the letter-sound combinations of new vocabulary and practice the pronunciation.
T5 Final	Watch a video of a native speaker (the teacher) cooking a traditional Spanish food. Answer questions related to the events in the video (both questions and answers in Spanish).	Follow the events of a narrated video by a native speaker. Recognize spoken vocabulary words. Formulate written answers to questions in L2.
T6 Formative	Listen to a description of an extra-terrestrial and draw a picture that corresponds with the physical description.	Practice vocabulary for body parts and colors. Comprehend spoken Spanish and show understanding through drawing.

T6 Final	Cloze activity with audio recording of a short fictional story about cats and mice, followed by a transcription of the paragraph (21 short sentences) in Spanish with missing blanks.	Follow the events of a narrated story and recognize the sound of new vocabulary. Write in missing Spanish words.
T7 Formative	Listen to the first QR code and write numbers. Listen to a second QR code and write the price of the pictured item in currency format.	Recognize and understand the meaning of L2 vocabulary words previously studied and spell them correctly.
T7 Final	Listen to phrases in the QR code (just one for all) and circle the item of clothing described, paying attention to the descriptions for the words: this, these, that, those.	Recognize vocabulary in Spanish for and practice the contextual use of demonstrative adjectives.
T8 Formative	Listen to an audio file about a situation at school. Transcribe the audio in Spanish. Answer three questions about the audio in Spanish.	Practice transcription in L2 from audio. Produce answers to questions in Spanish for vocabulary and syntax work.
T8 Final	Listen to an audio file about a teacher's favorite restaurant. Transcribe the audio in Spanish. Answer three questions about the audio in Spanish.	Practice transcription from audio. Produce answers to questions in Spanish for vocabulary and syntax work.
T9/10 Formative	Scan one of 6 QR codes to hear descriptions of foods. Circle the correct food.	Recognize previously studied vocabulary and understand the meaning of full sentences.
T9 Final	Scan one of 6 QR codes and listen to the statements. Write the food or activity described and whether the audio statement was true or false.	Recognize previously studied vocabulary, write the words in L2 with correct spelling, and understand the meaning of full sentences in L2.
T11 Formative	First 5 QR codes to hear descriptions of what different people like, then for each write the type of TV show they would enjoy watching. Then scan one QR code to hear a dialogue about a trip to the movies. Answer 5 questions that follow in English on the dialogue – both questions and responses in English.	Recognizing new vocabulary and phrases in context, producing specialized new vocabulary. Listening comprehension for the meaning of the passage; answer questions in L1.
T11 Final	Scan 12 QR codes to hear a passage in Spanish and choose the correct answer to the multiple choice question that goes with each passage.	Listening comprehension practice for an identical activity that will be on the final exam. Comprehension of sentence and short paragraph length utterances in Spanish.

Table 9: Content and purpose of listening comprehension homework with audio QR codes

Many of the homework activities involved listening to a passage and then answering comprehension questions in Spanish either via selected-response (multiple choice, circle correct option) or constructed-response (write an answer). Of the 23 activities listed above (some

homework activities required more than one skill during or after listening to the audio excerpts), these kinds of tasks were required in 13 cases. Other required skills in order of frequency were: transcribe audio in Spanish (7), fill in blanks for a Cloze activity (5), translate part or all of the audio into English (2), and practice/review the sound of new vocabulary words (1). This seems to indicate that the teachers were more concerned with students' receptive understanding of spoken Spanish than in their skills with converting spoken Spanish into a written transcription or translation.

This stress on listening as a somewhat separate skill may be partly due to the design of the study, in which the PI specifically asked for the teachers to design a 'listening comprehension activity.' As communicative modern language teaching methods and standards usually stress the integration of the four skills of listening, reading, writing, and speaking, requiring the teachers to single out listening may have resulted in a somewhat artificial exercise that did not allow the kinds of integrated activities that they might normally assign.

Another possible reason for the popularity of the 'listen and choose/respond' activities may be that the teachers designed these to be straightforward and therefore easier for the students to complete outside of the classroom. One final consideration is the time of year at which the study took place; by the implementation of the final activity, most of the teachers were finished introducing new materials and were having the students focus on review and preparation for the final exam. Several Spanish teachers stated in the interviews that they had specifically designed the audio activities to help prepare students for the listening portion of the standardized Spanish exam, which contained similar or exact types of constructed- and selected response tasks.

Technical Aspects

In the Systems Approach model, Dick, Carey & Carey (2008) direct that instructional designers should make a close examination of the materials produced during the intervention. As this study sought to determine whether QR codes are a possible tool for allowing language learners easy access to audio recordings of L2, it was important to look at the characteristics of the actual QR codes and linked audio files to have a clearer picture on how the user might respond to this format. As no student data was collected as to the actual use of the QR code apart from hearsay reported by the participating teachers, it was necessary to try replicating the process that the students used to access the content.

The materials provided by the teachers were scanned by the PI, and examined for download speed, length, audio quality, rate of speech, and whether it was performed by a native or L2 speaker. The ranges for all of the QR codes that linked to audio-only materials and were still playing (not deleted from the Vocaroo hosting site) are detailed in the following table. The tests were performed on a smartphone via a strong (802.11abgn 2.4GHz) wi-fi connection to the Internet:

Download Speed	Length	Audio Quality
.1–2 seconds	12 seconds – 6 minutes	Good; only 2 ranked ‘bad’ in the scale of bad-fair-good

Table 10: Technical specifications of audio QR codes

These results indicate that the technological barriers that were present in some previous studies with QR codes do not appear to be a current barrier to the use of this method for linking to audio content. In the interview question results, the teachers did report some issues accessing the online audio if students were not in an area with strong wi-fi, but if the students have access to a network in the home the download speed was almost instantaneous. The audio recordings were not limited in size, as some lasted for several minutes and played with no loss of audio quality until the end. The voice of the Spanish teacher or other speaker was clear in all but two

of the recordings; some students reported trouble with the audio in the formative trial, but this was subsequently fixed when the teachers used a better microphone or computer for the final activity recordings. As the purpose of these audio excerpts was for language support and practice, it was very important that the audio be clear and distinct for the student audience.

Finally, the number of QR codes that the teachers produced for the homework activities illustrates that the creation of the audio and code themselves is not time-prohibitive. The number of audio QR codes on the homework activity sheets is listed below:

T1 Form	T2 Form	T3 Form	T4 Form	T5 Form	T6 Form	T7 Form	T8 Form	T9/10 Form	T11 Form
1	6	5	1	2	1	2	1	6	6
T1 Fin	T2 Fin	T3 Fin	T4 Fin	T5 Fin	T6 Fin	T7 Fin	T8 Fin	T9/10 Fin	T11 Fin
10	5	5	2	1	1	1	1	6	12

Table 11: Number of audio QR codes per worksheet in formative and final activities

While just over half (11/20) of the activities involved the use of only one or two QR audio codes, the rest (9/20) included five or more QR codes linking to audio resources on the worksheet.

Many of the teachers stated in the interviews that creating the QR codes was easy in terms of technical expertise and quick; only one mentioned that making the activity sheet with the QR codes for the formative trial was time-consuming.

Summary of Themes

The data presented in this chapter were collected in an attempt to address the following 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?* The following major themes emerged after the aggregation and analysis of the responses to a needs analysis survey, interviews of the

Spanish teachers after both the formative and final trials of the QR code activities, and a document analysis of the materials created by the participating teachers.

Mobile for Academics

The ability to complete academic tasks at home or even ‘on the go’ between other after-school activities via a mobile device was considered convenient and engaging by the participating students. Some feedback from parents and teacher colleagues confirmed this interest in using mobile to connect with multi-media content. In one case, recording on the mobile device itself resulted in the participation of native speakers working at the participating school, which was appreciated by the students and administration.

Access

Device ownership and access to a reliable Internet connection continue to be a deciding factor on whether or not teachers could assign homework with content that must be accessed via mobile technology. The needs analysis showed that the lowest percent of device ownership in the participating classes was 75%, which is in line with the national rates of ownership for this demographic. Unless the teachers could be sure that each student had a device and Internet access, however, they had to provide alternative ways and time for students to reach the online materials in order to ensure completion of the tasks.

Ease of Use

The teachers almost uniformly reported that the creation of the audio QR codes was not prohibitive in terms of technical expertise or time required. None of the teachers requested to review the training when asked after the formative trial. The great majority of the teachers did not even use the supplied templates for the study, preferring to design novel activities that better matched with the curriculum and student needs. Almost half of the transmedia worksheets

contained five or more audio QR codes for students to scan. The Spanish teachers had suggestions for ‘best practices’ including specifying exactly which QR reader application to download, and completing an in-class trial run before the first homework.

Transforming Practice

The ability for students to have additional listening comprehension practice outside of the classroom with the target language was seen by the teachers as a substantial benefit and change over existing practices. The results of the needs analysis showed that before the study students were performing very few listening comprehension activities for homework. After the teachers learned to use the audio QR codes, they remarked that being able to create worksheet activities that linked to audio excerpts provided students with more exposure to the target language and saved instructional minutes in the classroom. Several teachers noted the use of the audio-only materials as helping students focus more on discrete listening skills. All of the 11 participating Spanish teachers told the PI in the final interviews that they planned to use audio QR codes in the next school year for listening comprehension practice – some even as the exclusive way for students to access audio outside of the classroom.