

## **CHAPTER 3**

### **Methodology**

#### **Introduction**

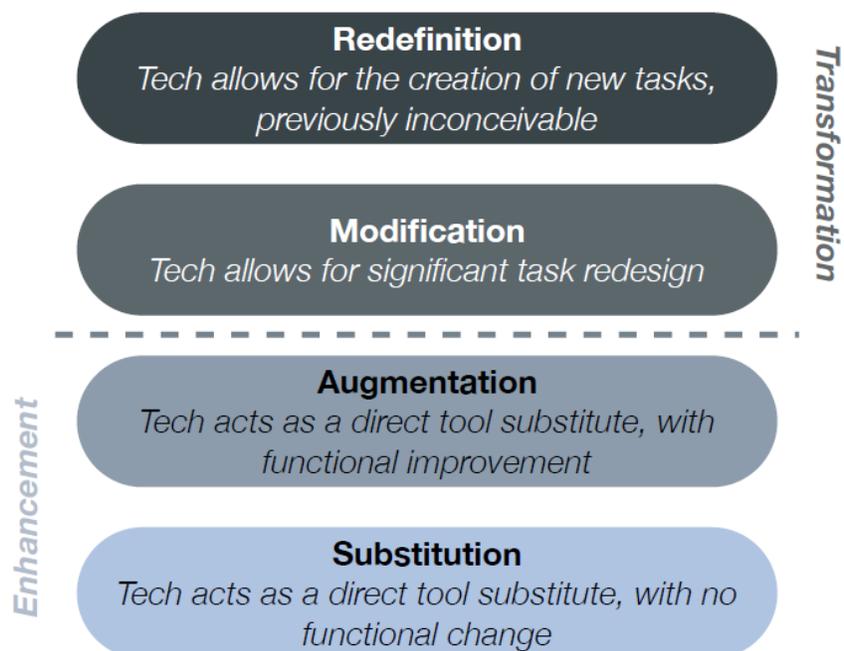
This chapter will present the design and methodology of the study on teachers' experiences using QR codes that link to audio resources as a possible way to support listening comprehension in foreign language instruction. The first section contains a short review of some theoretical and practical considerations that influenced the format of the professional development training. Next there is a recapitulation of the research question, followed by the full plan of inquiry, which consists of (1) information about the setting and participants (2) the stages of the study, including the instrumentation and procedures for data collection, and (3) the steps for the analysis of the collected data. Ethical considerations for the protection of the privacy and confidentiality of the informed participants are incorporated into the explanation of the plan of inquiry.

#### **Professional Development with Emerging Technologies**

##### *Transformative Use of Technology and SAMR*

In a recent case study of a small number of teachers using emerging technologies (including QR codes) to support language learning, the researcher warns that only professional development that takes “into account teachers’ personal experiences with technologies and provide opportunities to reflect critically on their digital mindsets, and examine and challenge their dominant assumptions” will lead to more creative use of new technologies and the potential to expand approaches to language teaching (Tour, 2015, p. 136). This kind of transformational use of technologies is identified as ‘redefinition’ in Puentadura’s (2010) Substitution,

Augmentation, Modification, and Redefinition (SAMR) model of technology adoption, in which the use of technology in educational settings is categorized into four levels:



**Figure 7: Puentedura's SAMR Model of Technology Adoption**

This model is recommended for use by instructional designers to evaluate how mobile technologies are implemented in language learning contexts to enable learners to undertake such 'previously inconceivable' tasks (Romrell, et al., 2014). Before the use of emerging mobile technologies and applications, such as smartphones and audio QR codes can be studied, however, teachers must first be convinced of their potential to enhance learning and trained in their use.

### *Systems Approach Model*

Research into teachers' classroom use of technology by Cuban (1986; 2001) explores the role that training plays in changing teachers' practices. Cuban (1986) notes that teachers will "alter classroom behavior selectively to the degree that certain technologies help them solve problems they define as important" (p.70), and that the lack of success in training teachers to use new technologies in the classroom may be because teachers ask "very different questions of new technologies than do administrators" (p. 67). Cuban (2001) expands upon this claim in a later study, noting that teachers are more likely to ask "practical questions about the details, logistics, and worth of new technologies in their classrooms" (p. 183).

In order to design a professional development training protocol that would address these issues of identifying individual teachers' problems and possible solutions within their unique learning contexts, the Systems Approach Model (SAM) by Dick, Carey, & Carey (2008) was chosen as a framework for this study. It is a systematic, outcomes-based approach in which the instructional designer performs a series of steps with the learner (in this case, the foreign language teacher) that eventually lead to the desired objectives. Although the original SAM model was developed in 1978, the authors note that it has an "inherent ability to remain current by accommodating emerging technologies, theories, discoveries, or procedures," and that it has been updated it to include ideas for application in constructivist environments (pp. xxi–xxii). Other researchers continue to adapt and build upon the SAM framework, particularly in the realms of distance education and e-learning (Akbulut, 2007; Persico, et al., 2014).

One aspect of this approach that works particularly well in educational contexts is the way in which the learners are asked to evaluate the new skills, knowledge, or tools in a cycle of formative and summative trials. A formative evaluation "is conducted while the program is still

being developed” and provides data that can be applied to improve instruction (p. 381). The summative evaluation is performed at the conclusion of an intervention, and involves judgment on “content, design, and feasibility” (p. 384). In this study, the Spanish teachers assigned a trial version of the audio QR code homework and then reflected on the results of this first formative attempt before assigning a revised final summative audio QR code activity to the students. Not only did this repeated attempt permit the teachers to gain more expertise at designing the audio QR code transmedia materials, but it also allowed for a better understanding of how well this emerging technology fit into their pedagogical practices.

The table below lists the required SAM components in the left-hand column; the right-hand column explains how they were modified and implemented for the purposes of this study:

<b>Systems Approach Model</b>	<b>Study with Audio QR Codes</b>
<i>Identify instructional goals</i>	<b>Phase 1:</b> The PI conducted a survey in which teachers provided information about their students, institutional setting, background in technology use, and learning objectives.
<i>Conduct instructional analysis</i>	
<i>Analyze learners and contexts</i>	
<i>Write performance objectives</i>	
<i>Develop assessment instruments</i>	<b>Phase 2:</b> Based on the results of the survey, the PI designed and delivered a customized professional development training protocol for each of the Spanish teachers.
<i>Develop instructional strategy</i>	
<i>Develop and select instructional materials</i>	
<i>Design and conduct formative evaluation of instruction</i>	<b>Phase 3:</b> The participating teachers assigned an audio QR code homework activity to the students. They discussed the implementation and results with the instructional designer (PI), who then offered suggestions for the final activity.
<i>Revise instruction</i>	
<i>Design and conduct summative evaluation</i>	<b>Phase 4:</b> The participating teachers assigned one more audio QR code homework activity, and then met with the PI to reflect on the barriers and benefits to audio QR codes as a means by which to support listening comprehension.

**Table 1: *Systems Approach Model* (Dick, Carey, & Carey, 2008) and modification**

Each of the four phases planned for this study is explained in greater detail below, and is accompanied by the data collection instruments.

### **Recapitulation of the of the Research Question**

The following major research question the drove the 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?*

### **Participants and Setting**

#### *Participants*

In order to eliminate as many variables as possible that could influence the results of the data collection and analysis, the technique of purposeful criterion sampling was employed to recruit eleven study participants with similar characteristics working in typical educational settings (Patton, 2002, p. 238). The proposed study involved the cooperation of middle school teachers of Spanish as a foreign language. The other selection criterion for taking part in the study was a pre-existing interest on the part of the Spanish teachers in the use of emerging applications and mobile devices as learning tools. No prior use of such technologies by the teachers was required, nor was any pre-determined level of technical expertise.

The sample size of eleven participants to take part in the study was determined to be sufficient to reach saturation in the data for two reasons. The first consideration was that the population to be sampled in this study was relatively homogenous. The teachers were all recruited from middle school settings within a 100-mile radius, and were teaching the same target language to students within a limited age range. The second factor affecting the size of the sample population was the relatively 'modest claims' explored in this study (Mason, 2010). While the results may be generalizable to other areas of Spanish instruction and possibly to the teaching and learning of other modern foreign languages, this study focused on one specific type of emerging technology (the QR code) and its possible use only for listening comprehension activities in the same target language.

The study participants were selected from publicly-available faculty lists of regional public and private middle schools. Colleagues at the institution where the PI currently teaches also provided access to contact information of former students and other educational professionals in the region who were actively teaching Spanish at the middle school level. An introductory contact by e-mail was sent to teachers of Spanish who instruct students in the first

and/or second year of study; in the region of the proposed study, this level of instruction generally occurs in the 7<sup>th</sup> and 8<sup>th</sup> grade at a middle school. Any teacher who showed an interest in participating was then sent a more detailed explanation of the study procedure, including the full consent form and the condition that the most senior building-level administrator provide authorization for the teacher to take part in the research. The teachers learned through the information provided in the e-mail and consent form that no student work was to be collected, and that the PI would not be visiting the classroom when students were present, thereby eliminating the need for assent or consent to be collected from their students.

### *Setting*

Spanish was chosen as the target language in this study because it is the most widely studied foreign language in United States; enrollment in the state in which the research took place was approximately 60,000 students in 2013, with the next closest studied language of French at only one third of this total at approximately 20,000 learners (Modern Language Association, 2013). The researcher had no contact with students; no classroom observation, interviews, surveys, or focus groups were conducted, and no student work was collected. Some teachers chose to meet at the middle schools for the training and final interview during a non-instructional time, and others chose an off-campus location as a meeting place. Only general information about the middle school in which the teacher worked, including the number of students in the class and available instructional and technological resources, was required to answer questions for the needs analysis. Additional demographic information about the schools and student population was obtained by the researcher from publicly-available 'school report cards' web sites sponsored by the state department of education. Entry to the setting was secured

by obtaining permission from the highest-ranking building administrator before any data collection took place.

### **Ethical Considerations**

The researcher, who completed all required training for working with human subjects, first obtained permission to conduct the study from the Institutional Research Board at the degree-granting institution to which she is affiliated. The participants were asked to sign an informed consent document that explained the nature of the study, the procedure for ensuring anonymity, that participation was voluntary, that they could withdraw from the study at any time, and how the data from the study will be stored securely (see Appendix F). The informed consent form also explained that there was no inherent risk in the study other than the potential for loss of privacy, and that there were no guaranteed benefits to participation. The principal or highest-ranking administrator of the building in which each teacher works was asked to provide oral consent allowing the teachers to take part in the study. The teachers who participated in the study received a gift certificate to an online vendor at the conclusion of the study, which would have been available regardless of whether or not they were able to participate fully in all aspects of the research.

### **Plan of Inquiry**

#### *Overview*

As introduced in Chapter 1, the study was conducted in four phases. Each of the phases involves contact between the PI/instructional designer and the Spanish teacher, as illustrated in the following figure:



**Figure 8: Phases of the study**

*Phase 1: Needs Analysis.*

Professional development that is closely matched with the needs of the participants in a particular context is not only more appealing and relevant, but is also more likely to lead to changes in teachers' beliefs and behaviors (Van Duzor, 2011). Kopcha (2010) describes the needs analysis phase of a SAM professional development process for technology integration as a time during which the instructional designer can start to take on a mentoring role, while gathering information on the teacher's current use of educational technologies to support learning, general skill level with technology, and "goals and vision for technology use" (p. 179).

In this study, the researcher asked each participating Spanish teacher to complete an online questionnaire designed to elicit information that was used in a needs analysis, as described in the Systems Approach Model (Dick, Carey & Carey, 2008). In a needs analysis, the instructional designer must first identify and analyze the learning goals, then gather as much information as possible about the “learners’ current skills, preferences, and attitudes,...the characteristics of the instructional setting, and the setting in which the skills will eventually be used” (p. 6). In this study, the learners included both the foreign language teachers and their students, so the teachers provided some brief demographics of the student population, including the number of students in their Spanish classes, and the presumed student access to mobile technology outside of school. Some of the questions on the learning context were adapted from the Looking for Technology Integration (LoFTI) survey developed by the SERVE Center at UNC Greensboro as means by which to gather data that can “be helpful to building-level staff members as they plan and/or provide professional development in instructional technology” (SERVE, 2005). The teachers were asked to describe how they currently used audio resources in the classroom to support language learning. Although at this phase of the study the teachers were not asked to indicate their current level of satisfaction with the methods that they used to support listening comprehension exercises, questions in later phases invited teachers to compare the use of audio QR codes with previously employed methods and activities.

The questionnaire was delivered by means of an online survey site; this data collection format was chosen as the most time-efficient way for teachers to access and answer the questions. Teachers were assigned an identifying code (e.g. Teacher 1) under which to submit their answers to the survey. The PI sent out the link to the survey site, informing the teacher that as soon as the survey was complete, the training could be scheduled. The PI sent a weekly

reminder via e-mail asking participating teachers to complete the survey until all results were collected.

The teacher's responses to these questions allowed the researcher to construct the script for the professional development training, in which the classroom teacher gained the technical knowledge to implement the audio QR code activities. Additional analysis on the survey results is discussed in the section following the plan of inquiry on the treatment of the data. The full set of questions and response options for the needs analysis can be found in Appendix A.

## *Phase 2: Professional Development Training*

Once the results of the needs analysis questionnaire were examined, the information was used to design a customized professional development training on how to create and distribute audio materials that are accessed by QR codes and mobile technology. The technical training steps followed a planned protocol, but the delivery and depth of the training was adjusted to suit each teacher's existing knowledge about QR codes and audio materials hosted on the Internet.

The presence of existing resources, such as a school-hosted or Google web site or curriculum examples on an instructional CD/DVD, also affected the content of the training. The flow chart on the next page illustrates how the results of the needs analysis were used in the design of the training modules, and is followed by a sample script. It was assumed that these in-service teachers had the pedagogical content knowledge on listening comprehension strategies in foreign language learning. As the teachers self-selected to take part in the study on an emerging technology for use in FL listening comprehension, there was also a presumption on the part of the researcher that they had a genuine interest in using technology to enhance listening comprehension, and may have had prior experience designing technology-enhanced listening activities.

The manner in which the responses to the needs analysis were used in the preparation of the training is illustrated in the flowchart on the following page. The planned training script that was used during the face-to-face training with the Spanish teacher can be found in Appendix B.

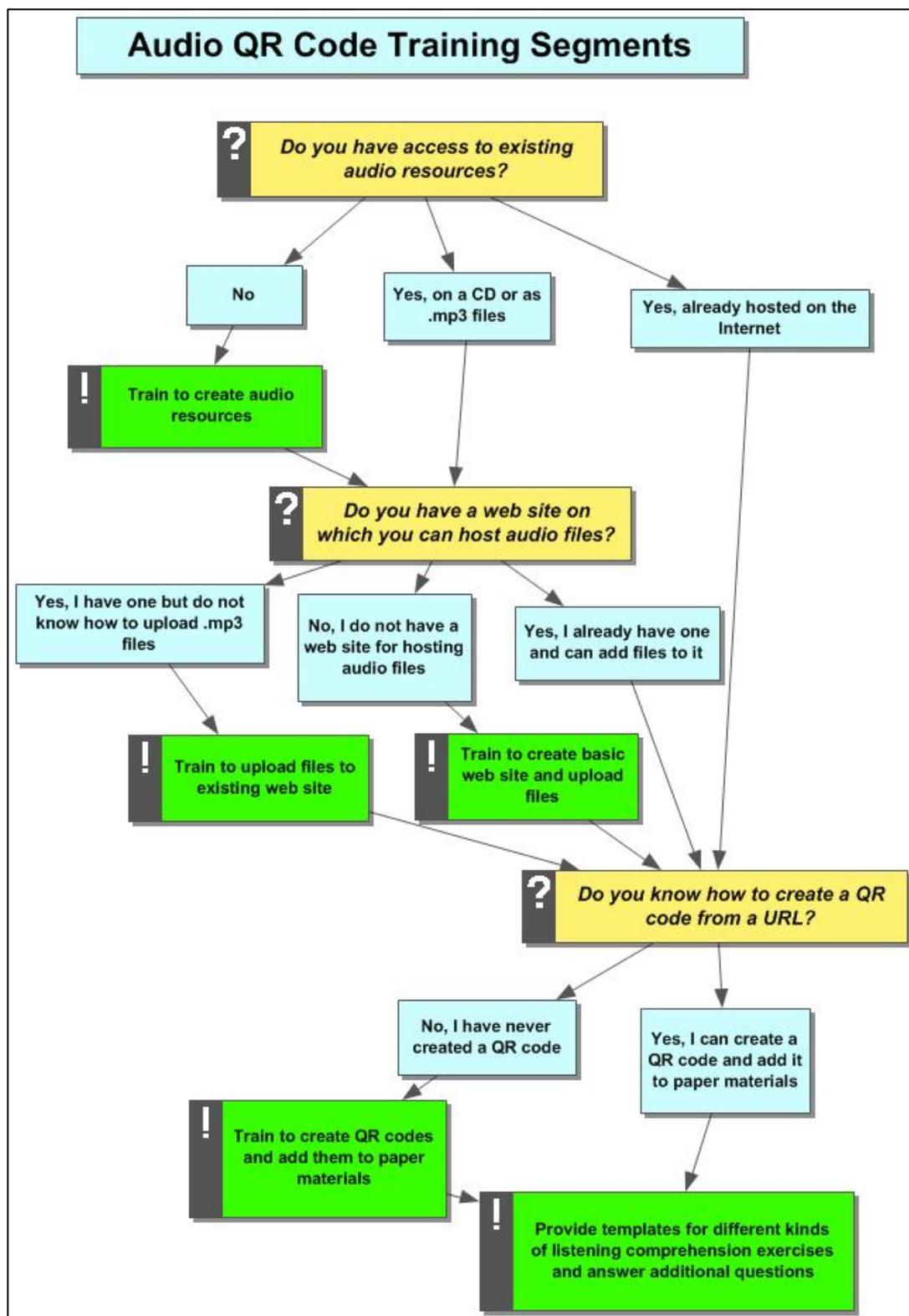


Figure 9: Flowchart for professional development training

Part of the training included providing the Spanish teacher with templates for three possible options for audio QR code listening comprehension activities. Each of the activities involved students scanning QR codes linking to online audio recordings: (a) a dialogue with two speakers that students follow and imitate, (b) a scrambled story that students listen to and reorganize, and (c) a Cloze activity with blanks for missing words that the students listen for and fill in.

In a discussion of the effectiveness of professional development, Guskey (2002) emphasizes that teachers are pragmatic and need “specific, concrete, and practical ideas” presented to them so that they can better conceive of how the new technique, tool, or skill can immediately be used as part of their instruction (p. 382). The templates were meant to act as springboards that could help the teachers plan activities with the audio QR codes, not as mandatory worksheets that they were required to fit into their existing pedagogy and curriculum. Forcing teachers to implement a particular activity in order to demonstrate transfer of the skills in the professional development intervention is not likely to be successful; in fact, such attempts are often “modified or disregarded” in favor of a use that teachers develop in alignment with their own “understanding of innovations, their classrooms, and their personal goals” (Van Duzor, 2011, p. 364). Therefore, the templates were offered to the teachers as a starting point and a way to save time in formatting worksheets for the transmedia materials, not as a mandated layout that had to be strictly used without modification. The teachers were encouraged to use any or all of the presented templates, modify them to suit the needs of the content and learners, or develop a different audio QR code activity that better matched with their students’ needs and learning targets for listening comprehension in Spanish.

This freedom in the structure of the activity presented a challenge, however, in the planned document review and analysis of the activities that the teachers designed with the audio QR codes. While this study sought to gather teachers' opinions on the benefits and barriers to using audio QR codes for listening comprehension homework activities and not data about the success or failure of any one particular activity or method, the materials that the teachers designed were collected and examined as an important component of the Systems Approach Model.

In a study on the transfer of information learned in a professional development context to classroom practice, Van Duzor (2011) coded materials that teachers used in the classroom after attending the professional development session, and categorized them into one of four possible transfer options: proposed direct application, utilized direct application, proposed adaptation, and utilized adaptation (pp. 367–368). As this study specifically required that teachers assign at least two audio QR listening exercises to students (one formative, and one summative), the materials that the teachers created were expected to fall under either the utilized direct application, in which they made no or only minor modifications to the provided template, or utilized adaptation, in which case the teacher either made major changes to the template or designed a new activity using the audio QR codes. The procedures for data analysis of the collected materials are detailed following the plan of inquiry.

The blank templates for each of these activities as presented to the participating Spanish teachers can be found in Appendix C, followed by an additional QR resource sheet provided to the teachers to help them identify tools for creating and scanning audio QR codes in Appendix D.

During the training session, the researcher provided the templates to the Spanish teachers in Microsoft Word form, and demonstrated how to build the transmedia worksheet, including the creation of the audio recordings and QR codes. The teachers chose one of these activities, or modified or adapted one of these into a different type of audio QR code activity, and assigned it to the students. The PI checked in with the Spanish teacher every 1–2 weeks until notified that the students had tried the audio QR code activity.

### *Phase 3: Formative Trial*

The first time that the teachers used the audio QR code activity with the students was considered the ‘formative trial’ (Dick, Carey & Carey, 2008). The researcher contacted the classroom teacher via telephone after the implementation of the audio QR code activity to discuss the formative trial. The PI continued to act in a mentoring role (Kopcha, 2010), making clear to the Spanish teacher that this contact was not about evaluating either the teacher’s implementation of the activity or the students’ success in accessing or completing the audio QR codes as homework, but rather as a way to understand how the audio QR codes were used, and to offer support and guidance to the teacher for the next attempt. The PI used a digital voice recorder and speakerphone in a private area to record this interaction for later transcription. The teachers were asked to initial the original consent form to grant permission for interviews to be recorded, but were reminded they were about to be recorded and would therefore only be addressed as their assigned teacher number for the rest of the conversation in order to safeguard their privacy.

During the telephone interview the teachers answered a series of questions about the QR activity, including exactly how they used this technique, how easy or difficult it was to produce the materials, whether they had any problems with the technical aspects of using QR codes, and

whether they saw any benefits to using the QR codes for listening comprehension. The teachers were asked to send via e-mail blank copies of the exact materials they distributed to the students. Even if they used one of the exact templates provided in the training, the transmedia worksheets would contain the teacher-created QR audio codes in Spanish and directions to the students, so they were needed for the content analysis. At the conclusion of the conversation, the researcher asked the Spanish teachers if they had plans for the final audio QR code activity, and made suggestions for improvements to the revised or new activity based on the results of the formative trial.

The full set of questions for the interview after the formative trial are listed in Appendix E. The PI asked all of the questions listed, but was also prepared to keep the conversation casual and open-ended, as the purpose of this phase was not yet to determine the barriers and benefits to audio QR codes, but rather to help the teachers with any technical or design issues and reflect on the process of creating and implementing the activity. Dick, Cary & Carey (2008) note that the formative evaluation allows the learners (in this case, the Spanish teachers) to try the new skills transferred from the professional development as a first draft. Then, with guidance from the instructional designer, the teachers can make any needed revisions to the materials before the summative trial. Thus, it was hoped that the intermediary step of having the Spanish teachers perform the formative trial and then reflect on possible improvements would lead to a summative trial of the audio QR codes with fewer technical issues and a better understanding of the needs and behaviors of the student learners as they attempted to access the audio content outside of the classroom.

#### *Phase 4: Summative Trial.*

In the last stage of the study, the Spanish teachers implemented the revised audio QR Code activity with their students. This attempt occurred within a few weeks after the formative trial has been discussed with the PI; weekly reminders were sent after the telephone interview to determine if the teacher had completed the summative trial.

The researcher contacted the classroom teacher to set up the interview once the final version of the activity was complete. During the face-to-face interview, the researcher asked the teacher a series of questions to elicit the following information: exactly how the teacher used the activity (e.g. in-class or as a homework assignment), how this method compared to previous methods used to supply audio samples in the foreign language to the students, if the students or parents provided any feedback that the teacher could explain anecdotally, whether all students were able to access and complete the QR code activity with mobile technology, and if the teacher noted any impact on student learning as a result of this approach.

The teacher was asked to provide a blank set of the revised audio QR code activity materials that were distributed to the students. Additionally, the researcher asked the teacher to reflect in general on using QR code activities as a regular part of their classroom instruction by asking the teachers to identify any benefits and barriers to this tool. At the conclusion of the interview, the researcher also discussed with the classroom teacher the process of the individualized professional development training for this new technology, and asked for feedback on how effective this method was as compared to self-directed learning or larger group professional development training experiences. The complete set of questions for the final interview is listed in Appendix F.

## **Procedures for Treating, Coding, and Analyzing Data**

This section will describe the procedures by which the data collected through the processes and instrumentation described above was analyzed. For any of the recorded interview data described below, the transcription was transferred to the software program ATLAS, which is specifically designed to help with inductive analysis, as described in Patton (2002) to be “discovering patterns, themes, and categories in one’s data, through the analyst’s interactions with the data” (p. 453). In cases where no existing framework was determined prior to the analysis, organizing the transcribed data in ATLAS assisted in allowing the themes and codes to emerge organically from the data. The resulting codes and themes were used in conjunction with other data gathered for each setting, and compared across settings for notable trends and outliers.

### *Phase 1: Online Survey Responses*

After using the responses to the online questionnaire to inform the customization of the professional development training protocol, the responses were entered into ATLAS, coded, and then analyzed both by individual participant and across participants to discover commonalities and differences between the teachers in the different classrooms and schools. This analysis was particularly pertinent to the identification of existing barriers in the learning context (both classroom and in the home) to using audio QR codes accessed through mobile devices.

### *Phase 2: Professional Development Training*

No data was collected during this phase, other than what was taken during the study from the results of the needs analysis survey responses in order to help plan the customized training session.

### *Phase 3: Phone Correspondence after Formative Trial*

The results of the interview were first immediately used by the researcher, acting as an instructional designer, to suggest revisions to the activity for the final implementation during the conversation with the classroom teacher. At a later time, the transcription of the telephone interview after the formative trial was entered into the ATLAS software as described above. The resulting codes and important quotes were examined in a content analysis for each individual teacher, and then compared across subjects for common themes and differences in the first experience of using this emerging technology.

*Phase 4: Final Interview after the Summative Trial.*

The final interviews were transcribed and entered in the ATLAS software program in the same manner as the interview after the formative trial. Data analysis for the information gathered via the interview after the summative trial focused on determining the Spanish teachers' perceptions about the feasibility of this method of using audio QR codes to deliver audio content for use in language listening comprehension exercises.

Dick, Carey, & Carey (2008) advise that four types of analyses be performed after the summative trial: (1) a congruence analysis in which the needs of the participants are compared against the method of instruction (2) a content analysis in which the actual materials are examined for completeness, ease of use, and accuracy (3) a design analysis in which the materials are examined for evidence of alignment with learning principles and (4) a feasibility analysis, which investigates the practical aspects of applying the new skill, and producing and using the resulting materials (p. 321). The transcriptions of the final interviews, and summative trial transmedia materials containing the audio QR code activities (see Document Review below), were coded and analyzed according to those four constructs.

*Phases 3 and 4: The Document Review*

In a study on the transfer of information learned in a professional development context to classroom practice, Van Duzor (2011) coded the actual materials that teachers used in the classroom after attending the professional development session, 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 assign (not just propose) at least two audio QR listening exercises to students, the materials that the teachers created fell under either the utilized direct application category, in which the teachers made no or only minor modifications to the provided template, or utilized adaptation, in which case the teacher either made major changes to the template or designed a new activity using the audio QR codes.

In addition to organizing the QR transmedia worksheets by the degree of similarity that they bore to the original templates using Van Duzor's (2011) two categories for utilized materials, the activities were examined for content and purpose. As noted above in the discussion of the professional development training design, the Spanish teachers in the study were assumed to be pedagogical content experts, so the way in which they modified the templates to match with their content, learners, curriculum, and learning context brought to light some unexpected benefits and uses for audio QR codes that could merit further study.

As part of the content analysis of the materials suggested by Dick, Carey & Carey (2008), the PI listened to the actual QR audio codes to check the length and quality of the audio clips and triangulated these results with the self-reporting by the teachers in the interview regarding the process of creating the audio QR clips and if there were any complaints by students as to the audio quality. These features of the audio were noted for informational, not evaluative purposes. Finally, the PI scanned the QR codes on the printed transmedia worksheet materials with a

smartphone in an area with a reliable wi-fi connection to check for the speed and successful retrieval of the connection to the web-hosted content.

### **Summary Data Analysis Table and Timeline**

After the recording, coding and qualitative analysis of all of the collected data was complete (needs analysis responses, interview after the formative trial, design of the QR code student materials for both trials, responses to the interview questions after the summative trial), the researcher wrote a summary of the qualitative findings (see Chapter 4). This discussion centered on the teachers' opinions of the benefits and barriers of using audio QR codes to support listening comprehension exercises in foreign language study, based on their recent experience with designing the transmedia materials and implementing the activities with their students.

#### *Data Analysis Table*

The table below illustrates how the information gathered through the data collection instruments was analyzed to help answer the research question, and is followed by the study timeline.

<b>Collection Method</b>	<b>Data Analyses</b>
<p><i>Phase 1:</i></p> <p><b>Online Survey</b></p>	<ul style="list-style-type: none"> <li>• For each study participant, individual teacher/student needs, context, curriculum, and resources were analyzed in order to develop an appropriate customized training</li> <li>• The results of the questionnaire were transcribed, coded, and analyzed for each setting and across settings for commonalities and deviant cases</li> </ul>
<p><i>Phase 3:</i></p> <p><b>Interview after formative trial of audio QR activity</b></p>	<ul style="list-style-type: none"> <li>• The answers to questions and additional teacher comments were used to inform recommendations for revisions to the final implementation of the activity</li> <li>• The responses were transcribed and coded to examine factors within each setting and common or deviant themes across settings</li> </ul>
<p><i>Phase 4:</i></p> <p><b>Interview after summative trial of the audio QR code activity</b></p>	<ul style="list-style-type: none"> <li>• Answers to questions were transcribed and coded in congruence, content, design, and feasibility analyses within and across settings</li> <li>• The results of analyses were triangulated with all previous data collected through other instruments</li> </ul>
<p><i>Phase 3 and 4:</i></p> <p><b>Document Collection for Formative and Final Activity</b></p>	<ul style="list-style-type: none"> <li>• The transmedia instructional materials were examined for each setting and compared across settings.</li> <li>• Data from the document review was triangulated with the qualitative data from the analyses in Phases 3 and 4</li> </ul>

**Table 2: Data analysis for study**

### *Data Collection Timeline*

The following timeline illustrates the implementation of all four phases included in the plan of inquiry. Some flexibility in the schedule was required to account for non-instructional days due to weather, holidays, vacation breaks, and required state testing; this push the final data collection into the start of June, 2016 for two of the participants.

#### *Month 1: February 2016*

- Recruited teachers to act as study participants
- Collected all consent forms from teachers and have teachers clear study with administrators
- Conducted online survey with foreign language teachers

#### *Month 2: March 2016*

- Developed customized professional development to participating teachers based on the analysis of the needs analysis questionnaires
- Met with teachers to deliver professional development
- Teachers implemented the formative trial of QR activities in their classrooms

#### *Month 3: April 2016*

- Checked in with teachers regarding formative trial of QR activities via telephone; collected original materials and made suggestions for the final version
- Teachers revised QR activity (based on their initial results and suggestions from the researcher) and implemented the final summative form of the activity with the students

#### *Month 4: May 2016*

- Teachers implemented the final versions of the QR activity
- Conducted final interviews with participating teachers; collected revised materials

## **Privacy and Confidentiality**

The online questionnaire was distributed to the eleven participating teachers via e-mail, with the settings such that the respondents did not see the compiled results at the conclusion. The teachers were assigned a code name to use on the survey for research identification purposes. Only the researcher and faculty advisor had access to the results of the online questionnaire. Once the results were downloaded, the survey instrument was deleted from the online site. According to the web site's privacy policies, deletion of the survey instrument will lead to instant inaccessibility of the results and the permanent deletion of the collected responses within 90 days.

The teachers were identified in the audio recordings and transcriptions of the interviews by the same code name only (e.g. "Teacher 1"). The interviews were transcribed with no identifying information, including that of the state, city/town, school district, or school. Any mention of identifying information during the interviews was struck from the transcription. The recordings are being stored on a computer that is not connected to the Internet in a private home for one year and then will be permanently deleted. The transcriptions and questionnaire results are being stored for seven years on the same computer. The paper consent forms and paper key linking the teachers' names with their assigned code name can only be accessed by the researcher and the faculty advisor. These papers are being kept in a locked safe in a residence and will be shredded after seven years.

## **Delimitations and Limitations**

Limitations to the study included the small sample size and selection criteria of the participants for the study, teachers' time and curricular constraints, and access to technology resources by both students and teachers. The trustworthiness of the informants and any unknown

outside influence on them to answer questions or act in a certain way during the course of the study may have influenced the reliability and validity of the information collected. The generalizability of the conclusions from this study may be limited due to the homogeneity and small size of the population that was studied, and because of the variability in teacher and learner characteristics and their access to the emerging technology.

Additional limitations may have arisen due to the role and actions of the researcher, including possible bias or lack of objectivity in the choices made regarding the format and content of questionnaire and interview topics, the selection of participants, the inclusion and exclusion of certain literature, and the types of data and analysis that were chosen for the study. There may also have been unanticipated problems with the data collection instruments, including the design of the questionnaire and interview questions.

All efforts were made to ensure the trustworthiness and authenticity of experiences of the participants during the study in order to increase the reliability and validity of the findings. The PI strove to be “balanced, fair, and conscientious in taking account of multiple perspectives” when interacting with the participants during the study (Patton, 2002, p. 575).

### **Conclusion**

This qualitative study involved eleven teachers of middle school Spanish, and was conducted in four phases: a pre-visit needs analysis to establish the parameters of the educational context and expertise of the teacher with technology, an individual professional development training on creating audio resources and the QR codes, a follow-up to the formative trial of the QR activity by telephone, and finally an in-person interview with the classroom teacher after the summative QR activity that was assigned to the students. The methodology outlined in this chapter was designed to first ensure the collection of detailed and appropriate information from

multiple sources and at several key points during the professional development intervention. The researcher performed a comprehensive and thorough analysis of the resulting data, triangulating results whenever possible and relating the emerging themes to the previous research in the area of emerging technologies for use in classroom settings. Throughout the process of data collection and analysis, the researcher was certain to follow all ethical guidelines and maintained the privacy of the participants.

It is hoped that the resulting conclusions and recommendations will add to the literature in the field of educational technology and have a positive impact on the practice of in-service and pre-service teachers of foreign languages seeking technology supports to enhance their students' listening comprehension skills in the target language by answering the research question, *“What are the benefits and barriers to using Quick Response (QR) codes that link to audio resources as a means by which to support students' listening comprehension skills in the beginning stages of foreign language acquisition?”*