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Sophia Minnillo April 14, 2020

Digital Shifts in Language Learning:

Analysis of CALL in Beginner, College-Level French SLA

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An abstract of
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The rapid technological innovations of the past century have engendered significant changes in language use, societal habits, and educational practices. These changes have resulted in *digital shifts* in language education—shifts in the resources used to teach and learn languages and shifts in sentiment and discourse regarding educational technology. The present study addressed a need for a diversification of approaches to analyzing technology in the field of Computer Assisted Language Learning (CALL). Two studies—a case study and an experimental study—were conducted to fill this gap in the literature. Through the combination of classroom observations, student questionnaires, instructor interviews, and syllabus analysis, a case study described the current state of sentiment toward CALL and implementation of CALL in a beginner, college-level French program. Examining the same learner population, an experimental study measured the efficacy of a CALL resource offering audio-visual feedback for prosody learning through Praat. Case study results indicated that educational technology guided daily class practices, contributing to at least 40% of students' course grade and facilitating the realization of many pedagogical objectives, such as the prioritization of flipped classrooms, learner-centeredness, authentic materials, and cultural competence. While students and instructors expressed substantial frustrations with some technological resources used in the course, they conveyed positive sentiments regarding CALL use generally. In the experimental study, the Praat-based CALL intervention was effective in facilitating students' acquisition of French-specific patterns of final syllable lengthening. Students' and instructors' optimistic attitudes toward CALL, coupled with the proven effectiveness of the Praat-based CALL resource, illustrated a rich potential for CALL development and implementation in beginner, college-level language programs.

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I. Introduction

1.1 What are Digital Shifts?

In a rapidly digitalizing world, the ways in which people learn, teach, use, and think about language are shifting. These shifts constitute only one aspect of the greater dynamic between technology and education; technological innovations have served and altered learning throughout time. However, the pace of the past century's digital revolution has resulted in the current,

augmented interest in the relationship between technology and education. This augmented interest gave rise to the founding of a field of study, *Computer Assisted Language Learning* (CALL), which studies the role of computers and other technology in language learning (Chapelle, 2001). This discipline falls within the domain of *Second Language Acquisition* (SLA), "the scholarly field of inquiry that investigates the human capacity to learn languages other than the first, during late childhood, adolescence or adulthood, and once the first language or languages have been acquired" (Ortega, 2009, p.10).

CALL evolved from the field of *Computer Assisted Language Instruction* (CALI; Blake, 2008). CALI emerged in the 1960s as *audiolingual* language pedagogy came into popularity. Audiolingualism, which stemmed from B.F. Skinner's behaviorist psychological theory, advocates for learning languages by memorizing common phrases and the environments in which they occur through stimulus-response conditioning (Paesani et al., 2016). Technological resources, such as language laboratories, offered the possibility for language instructors to play recordings of common phrases in dialogues and drill students on the linguistic structures found in those phrases. CALI facilitated the audiolingual method's emphasis on presenting material through the audio modality and on developing language skills through stimulus-response drilling.

The transition from audiolingualism to *communicative language teaching* (CLT) in the 1970s ushered in a change in the conceptualization of the role of technology in language teaching (Blake, 2008). In reaction to audiolingualism, CLT prioritizes the learner's role in learning and minimizes the role of the language teacher as the sole source of knowledge. As such, CLT promotes a *learner-centered pedagogy*, or teaching in which the focus is on the learners—their unique learning styles, their ability to construct knowledge themselves instead of learning through conditioning or through the unquestioned expertise of the instructor (Paesani et al., 2016). CALI

evolved into CALL to mark a shift from behaviorist concepts of 'instruction' to communicative concepts of 'learning' and learner-centeredness.

Since the debut of CALL in 1981, rapid technological innovations have occurred. These changes have rendered the name 'CALL' perhaps too narrow, as the study of technological resources for language learning spans well beyond computers (Kern, 2006). In 2013, Thomas, Reinders, and Warschauer advanced that Levy's (1997, p.1) seminal definition of CALL, "the search for and the study of applications of the computer in language teaching and learning," ought to be altered. Thomas et al. (2013) emphasized the importance of applications of the web, mobile devices, and digital technology generally for language teaching and learning. Seven years later, technology has expanded even further. Innovations in virtual reality, automatic voice recognition and translation, social media and online sharing platforms, and other technology have presented new frontiers in the study of CALL.

The importance of investigating these innovations lies not only in their potential effectiveness for language learning, but also in the fact that technological innovations are contributing to transformations in communication, learning, and culture (Blake, 2008; Chun et al., 2016; McCulloch, 2019; Paesani et al., 2016). New textual genres and digital literacies[1] are developing through the novel means of communication that technology offers (Gonglewski & DuBravac, 2006; Kern, 2006). Students' habits, social identities, relationships, and patterns of thought, as well as their expectations regarding education, have changed (Chun et al., 2016). Given the prevalence of digital devices, teaching methods that do not incorporate digital technology sometimes lose the competition for students' attention to those devices (Devauchelle, 2012). Educational institutions have recognized the potential of technology for learning. They have

[1] I understand digital literacies to refer to the ability to comprehend, navigate, and produce digital texts in order to retrieve, critically analyze, and share information.

responded by creating specialized resource centers for educational technology and instituting guidelines and requirements for technology use in instruction (Blake, 2008; Devauchelle, 2012). Therefore, understanding recent digital shifts holds great value for tailoring language instruction to evolving expectations, practices, and needs among stakeholders in education.

1.2 Theoretical Framework

In the past 40 years since the advent of CALL, language pedagogy has shifted in theory and in practice. Current theoretical approaches still embrace many aspects of communicative language teaching, including learner-centeredness, the importance of linguistic form, meaning, and function, and the value of collaboration and interaction (Paesani et al., 2016). CLT fell in popularity because of its primary emphasis on speaking, especially for transactional purposes, and its lacking approach to cultural studies and critical, textual analysis (Kern, 2000; Paesani et al., 2016).

In response, pedagogical approaches, including the *multiliteracies framework* (Paesani et al., 2016), have developed and taken hold in many college language programs. The multiliteracies framework conceptualizes language learning from a *sociocultural constructivist* theoretical perspective (Vygotsky, 1978), in which the learner creates meaning and knowledge with a focus on the social and cultural context of communication. This framework emphasizes learning through critical textual interpretation and production. As the studied language program adopted the multiliteracies framework as its primary pedagogical approach, this theory of language pedagogy formed the basis for the case study analysis.

1.3 CALL in Language Pedagogy

CALL offers considerable advantages to support theory and practice-driven approaches to language teaching and learning. First, technology can increase students' exposure to the target language. With access to the internet, students can find many free online dictionaries, conjugators, videos, podcasts, books, and other resources. Students can take entire courses online through video conferencing tools such as Zoom and through Massive Online Open Courses (MOOC; Daïd & Nguyên, 2015; Mangenot, 2017; Zoom Video Communications, 2020). Students' *time-on-task*, or time spent learning the language, increases in some cases because of heightened access to the target language through digital means (Blake, 2008). Additionally, students might spend more time learning the language because digital resources allow them to study the language while engaging in other hobbies, such as watching TV shows or reading online news sources.

Technology can also broaden students' access to *authentic* target language materials (Dubreil, 2006; Kramsch, 1993). I understand *authentic* materials to mean materials that are not created expressly for language classes and that reflect the language use of speakers of the target language. For example, the current website of a restaurant in Dakar might provide a more authentic source for learning about Senegalese cuisine and digital genres of writing than an invented website pasted into a course textbook. The internet also allows language learners to keep up with the pace of synchronous changes in language and culture, which the speed of print language textbook publications cannot always match.

CALL can provide access to authentic materials from various time periods, locations, and cultures, which can facilitate the development of *cultural competence* beyond the limitations of traditional classrooms (Dubreil, 2006). I understand cultural competence to mean knowledge about different cultures that facilitates communication and understanding between people of diverse cultures. For example, email, video calling, and direct messaging allow cultural and linguistic

changes to occur more quickly and in a greater variety of modalities than traditional 'pen-pal' exchanges (Leakey, 2011). Video calling might allow for a student to learn about the French traditions for the Bastille Day holiday by accompanying a virtual 'pen-pal' to a parade; the student would be able to see and hear the parade in addition to learning about the pen-pal's interpretation of the parade through one-on-one communication. The additional information provided by video might assist the student in understanding the tradition, the cultural practices linked to the tradition, and its significance. It is true that non-digital language learning resources certainly offer important advantages that are not always replicated in digital forms. However, the opportunities for augmented access to language learning materials, especially authentic, multimodal materials, in the service of cultural learning renders CALL worthy of pedagogical exploration and implementation.

Secondly, CALL caters well to the approaches to teaching and learning that the multiliteracies framework encourages. CALL can facilitate learner-centeredness in that it can allow instructors to differentiate instruction based upon individual differences and can allow learners to have greater agency in their learning. When using technological resources, instructors can allocate different levels of scaffolding based on differences in student needs through options offered by CALL **(**Hendricks, 1998; Kramsch, 1993). For example, students who need augmented support might watch a video with subtitles, at a slower speed, and with greater opportunities to pause than students who need the extra challenge of watching the video without subtitles, at a faster speed, and with fewer opportunities to pause. Greater levels of differentiation may increase students' confidence and lower anxiety levels, as students are less likely to feel overwhelmed or isolated by a discrepancy between the class's pace and their own pace of learning (Barrière et al., 2014).

According to sociocultural constructivist theory (Vygotsky, 1978), learners should have the agency to construct meaning and knowledge through engagement with social and cultural contexts of language use. CALL not only allows learners to connect with these contexts through augmented access to authentic materials, but also provides learners with significant opportunities for individual and collaborative meaning and knowledge construction (Hirschsprung, 2005).

Incorporating aspects of social constructivist theory, the multiliteracies framework advocates for meaning and knowledge construction through the critical analysis and creation of texts (Paesani et al., 2016). Texts include, but are not limited to, literature, film, music, blog posts, websites, and virtual reality worlds (Kern, 2000; Kern, 2006). Therefore, digital technology provides access to textual genres that learners benefit from interpreting and producing within a multiliteracies framework.

Additionally, digital technology offers substantial opportunities for collaborative and interactional learning and textual production (Barrière et al., 2014). Scholars discuss a change from *Web 1.0* to *Web 2.0*, which represents a shift from the internet in an information-driven state to one focused on collaboration and sharing (Paesani et al., 2016). This change resulted in the creation of many CALL resources to meet collaboration and interaction-based learning objectives, including collaborative writing resources such as Google Docs and interactional discussion platforms such as VoiceThread (Google, 2020; VoiceThread, 2019). CALL can facilitate the accomplishment of sociocultural constructivist and multiliteracies-based objectives related to learner-centeredness, differentiation, collaboration, interaction, critical textual analysis, and meaning and knowledge creation.

CALL's structure and provision of automatic feedback can also provide advantages relative to traditional language learning resources. Kramsch (1993, p.200) highlighted the non-sequential

structure of CALL resources as a major benefit for learning; students can expand beyond the linearity often imposed by language textbooks to consider material in "relational" and "hierarchical" manners. Similarly, the structure of CALL resources invites students to engage in recursive learning, revisiting and reanalyzing aspects of digital texts instead of learning in a discrete-point manner (Kramsch, 1993). Additionally, the possibility for automatic feedback in CALL can provide substantial benefits for heightening learners' *noticing* of errors and of patterns of language use (Holland & Fischer, 2008). The speed and consistency of this feedback, as well as the corrections that students often must complete in response to the feedback, can increase students' learning from feedback. Finally, automatic feedback provides pragmatic advantages for instructors who have limitations to the time and resources that they can dedicate to providing individualized feedback. The possibilities for non-sequential and recursive learning and for rapid, consistent, and individualized feedback through CALL appeal to both theoretical and practical concerns in language pedagogy.

It is certainly true that not all CALL resources offer the aforementioned advantages. Moreover, the advantages of CALL differ based upon the curricular goals, context, and students of each language program. Scholars maintain that language instructors must critically select CALL media and associated learning tasks that align best with their classes (Dubreil, 2006; Hendricks, 1998). The field of CALL has contended that the ways in which language programs employ resources to fit their curricular needs is more important than the integration of CALL in order to accomplish department-mandated technology requirements (Blake, 2008). The field has insisted that researchers and instructors consider new CALL resources in terms of the pedagogical advances that the resources provide, not solely in terms of the technological innovations present (Blake, 2008; Hendricks, 1998).

1.4 Objectives and Research Questions

With these guidelines from the discipline, I sought to describe the integration of CALL in the studied language program with a focus on how CALL use aligned with the departmental and curricular objectives and the program's theoretical pedagogical approach. I examined the alignment with theory through the lens of the multiliteracies framework, with a focus on the previously mentioned advantages that CALL offers to this pedagogical approach.

A second objective of this study responded to a need for greater diversification of methodology in CALL studies. Kern (2006) echoed a call for research that expands the breath of methods typically employed in CALL studies in order to ensure validity:

> To maximize validity in CALL studies, Ortega (1997) urges researchers to diversify data sources, combining classroom and school observation, interviews, self-report data from questionnaires or think-aloud protocols, and computer-collected data to seek relationships across self-reports, observed behavior, and linguistic performance (p.202).

Following the recommendations of Kern (2006) and Ortega (1997), the present study maximized possible sources of data. I completed classroom observations and interviews with the program coordinator and instructors, and I gathered self-report data from a student questionnaire and computer-collected, linguistic performance data from the experimental study.[2] Through the variety of methods employed, this study offered a multidimensional account of the current state and the potential of the implementation of CALL and sentiment toward CALL in a beginner, college-level French program.

The study also maximized both qualitative and quantitative approaches by including a case study and an experimental study. In order to accomplish the aforementioned objectives, the case study addressed the following research questions:

[2] See subsequent chapters for further methodological explanation.

1) How do language departments and instructors implement digital technology in the curriculum and in the classroom?
2) How do students interact with and appraise their digital technology use for French language learning?

The experimental study addressed the final research question:

3) How effective are pronunciation interventions that use technology to provide audio-visual feedback at contributing to generalizable phonetic development?

The following chapters provide greater detail about how these questions were answered in the studied context.

1.5 Context of Study

This study analyzed a beginner-level French program at a mid-sized, private university in the Southeast region of the United States. The study took place in the fall semester of 2019. The studied French course, which I will refer to as *French 101*, was the first course of the beginner sequence in this university's undergraduate French program. In 2019, undergraduate students at the university were required to complete at least two semesters of modern languages study in order to graduate. Students took a placement test in order to qualify for courses in this department. Students qualified for French 101 if they scored at or below *A1* in the Common European Framework of Reference for Languages scale (CEFR, 2020). Thus, the students were typically first-time French learners or had some limited exposure to French.

The studied French program described itself as a total immersion approach program, signifying that the department expected students and instructors to speak entirely in the *L2*, or second language, of French. The department also emphasized the rigor and fast pace of the program, as students complete the beginner sequence in one year. In Fall 2019, French 101 classes met four times per week. Three of the sessions lasted 50 minutes, and one lasted 1 hour and 15

minutes. The course syllabus indicated that the instructors scheduled 55 class sessions in the 15 week semester. French 101 at the studied university constituted the learning context of this study, on which the following chapters elaborate.

II. Case Study

2.1 Case Study Introduction

While technological innovations have occurred at a rapid pace, those innovations have not always transferred as rapidly into the language classroom. In 2013, Thomas, Reinders, and Warschauer (p.5) reported, "While many language educators make use of digital technologies, the reality remains that the vast majority use little more than a computer attached to a projector to display presentation slides." Six years later, I asked whether this reality that Thomas et al. (2013) had described still held true. The present case study examined the digital technologies that an introductory French course employed in order to shed light upon the current state of CALL implementation and sentiment toward CALL in the studied learning context.

The case study approach, using a variety of methods, has proven to be a valid and effective means of describing the state of CALL in educational contexts. Hellmich (2019) employed case study interviews and self-report questionnaires to measure high school students' beliefs regarding CALL. Hellmich (2019, p.15) found that students typically reported "utilitarian" beliefs about CALL, describing its potential to augment the efficiency of learning linguistic structures. Similarly, Levy (1997) described language instructors' sentiments about CALL, especially regarding the alignment of CALL resources with the instructors' teaching philosophies. In examining questionnaire responses from instructors of adult language classes, Levy (1997) observed that instructors framed the relationship between their teaching philosophies and CALL in considerably different manners. Commonalities between instructors related to the preference for conceptualizing CALL as a tool, rather than a tutor, for language learning. This distinction concerns the difference between technology serving as a "complement to classroom instruction," which is the *tool* conceptualization, and technology serving a "primary role" in which instructors

"project [themselves] as teacher[s] into the machines," which is the *tutor* conceptualization (Levy, 1997, p.126). The framing of CALL as a tool vis-à-vis a tutor has functioned as an important theoretical distinction in CALL research, and it is therefore included in the present study (Blake, 2008; González-Lloret & Ortega, 2014; Hellmich, 2019; Levy, 1997).

Many scholars have also conducted studies in which they have reported CALL use in language classrooms. Adair-Hauck, Willingham-McLain, and Youngs (2000) studied the integration of multimedia in a second semester, college-level French course. The researchers described the use and evaluation of a textbook-aligned video series, a computerized reading plan, and online exercises in this program. They demonstrated that students using multimedia resources exhibited sustained interest in using the resources and showed greater improvement in writing skills than students who did not use the studied multimedia resources. Likewise, Marenzi (2014) conducted a case study analysis on the use of CALL resources within the *multiliteracies framework*[3] implemented in the English for Special Purposes program at an Italian university. Marenzi (2014) noted that the instructors focused CALL use in the course around digital literacy development, the analysis of a digital genre, and the completion and presentation of a project through a digital collaborative annotation tool. The aforementioned studies established the utility of using case study methodology, including questionnaires, interviews, and classroom observations, to illustrate the state of CALL in language programs.

The present study adopted similar research questions to those proposed by Adair-Hauck, Willingham-McLain, and Youngs (2000) for research on CALL implementation. The researchers focused their investigation on the following three areas: 1) students' and instructors' perceptions regarding CALL, 2) the roles of the instructor and the students while using CALL, and 3) the

[3] See section *1.2* for a definition of the multiliteracies framework.

relationship between CALL, the curriculum, and student learning. The present study addressed each of the three areas in the following research questions:

1) How do language departments and instructors implement digital technology in the curriculum and in the classroom?
2) How do students interact with and appraise their digital technology use for French language learning?

In responding to these questions while employing a varied methodological approach, the present study aimed to provide a valid evaluation of CALL use in the studied program.

2.2 Methods

2.2.1 Participants

I studied the four sections of French 101 offered in the fall semester of 2019. The coordinator of the French 100-level course sequence, a Senior Lecturer in the French department, taught two sections of the course, and two graduate students each taught a section. Fall 2019 was the first time that these graduate students were teaching this course. I use the term *instructor* to refer to the coordinator and the graduate students. Each section included approximately 20 students. Due to scheduling conflicts, I only observed one instructor's classes. In order to characterize the French 101 course as fully as possible, I interviewed all three instructors and included students from all three instructors' courses in the experimental study.

As I could not collect demographic information from all of the students, I used the demographic information from the experimental group as a sample to represent the larger French 101 student population. The experimental study sample, which included 10 students (*N=10*), had an average age of 19 years. Participant ages ranged from 18-20 years. Within this sample, 70% of participants were female, and 30% were male. The students reported majoring or minoring neither

in French nor in any other language. None of the students were heritage learners of French. Some reported having studied French, both informally and formally, for a short duration. Within the sample, 90% of participants reported proficiency in English and one or more languages other than French. These languages included Spanish, Mandarin, Arabic, and Korean. Although the university required students to complete two semesters of language study in order to graduate, the requirement was not the only reason students cited for taking French 101. Other reasons included a desire to learn French (2), to work in francophone countries (1), to communicate with family members (1), to study abroad (1), and to study international law (1), in addition to admiration for the language (2), France (1), and French musicals (1).

2.2.2 Classroom Observations

I observed five sessions of French 101 over the course of the fall semester, all of which were taught by one graduate student. I practiced semi-participant observation, as I sat to the side of the class and did not participate in the class. During the observations, I focused on the instructor's and the students' use of technological resources in the classroom and their reference to technology use for French learning outside of the classroom. Six research questions structured my observations (see Table 1). In answering these questions, I charted how instructors and students integrated CALL tools into daily learning practices. In conjunction with the other elements of the case study—the instructor interview, syllabus analysis, and student questionnaire—the classroom observations illuminated how CALL-related curricular objectives, departmental decisions, and student attitudes manifested in the classroom learning experience. The observations also demonstrated students' and instructors' sentiments and conceptualization of CALL, including the extent to which CALL use fit within the department's espoused theoretical framework.

Table 1: *Research Questions for Classroom Observations*

Questions
1. What are the objectives and the themes of the lesson?
2. Which CALL resources do the instructor and the students use?
3. How do the instructor and the students use the resources?
4. How much time do the instructor and the students spend using each resource?
5. How do the students and the instructor interact with and respond to the resources?
6. Which objectives does the instructor meet using the resource?

2.2.3 Instructor Interviews

Over the course of the semester, I interviewed the coordinator of the 100-level course sequence twice and the graduate student instructors once. In the interviews, I collected information about the instructors', the French department's, and the university's aims regarding technology use for language education. The interviews also enriched the contextual background of the classroom observations, as I gained an understanding of the role of technology use in the broader French 101 curriculum. I asked specifically about how and why the instructors incorporated digital tools into the curriculum. The coordinator provided a detailed explanation of MindTap,[4] the online learning platform that the class used for daily homework (Cengage, 2020). The instructors also described their future objectives concerning technology use in the 100-level course sequence. The instructor interviews brought to light both curricular and departmental factors that determined CALL incorporation in French 101, as well as instructors' reflections on their experiences and goals relative to CALL.

2.2.4 Syllabus Analysis

[4] MindTap is a digital learning platform produced by Cengage Learning that corresponds with this course's textbook, *Atelier* (Jansma, 2018). The website, which students access via personalized accounts, offers a series of learning modules and exercises customized by the class instructor. For more information, consult section *2.3.2.1*.

In conjunction with the instructor interviews, I analyzed the implementation of technological resources at the curricular level through the course syllabus. While examining the syllabus, I recorded the technological resources that the document referenced. I also compared the syllabus' presentation of the technological resources to its presentation of course objectives within a multiliteracies theoretical framework. Thirdly, I noted the amount of weight that the syllabus attributed to the use of each resource. I defined weight in terms of the portion of the course grade designated to tasks utilizing technological resources and the amount of time expected to be spent using each source.

2.2.5 Student CALL Questionnaire

The student sample that completed the experimental study (*N=10*) completed a questionnaire at the beginning of the study. Students completed the 7 question questionnaire on Google Forms, an online surveying platform (Google, 2020). The questionnaire assessed students' evaluation of CALL use in class, their evaluation of the use of MindTap for homework, and their evaluation of CALL generally (Cengage, 2020). Each question included both quantitative and qualitative sections. In the quantitative section, students provided answers on a Likert scale from 1-7 for the majority of questions. For two questions, students entered numerical quantities (see Appendix A, Table 2). In the qualitative section, students had the option to elaborate on answers to the quantitative questions. Each question in the optional qualitative section had a minimum response rate of 40%.

I analyzed the qualitative and quantitative sections in tandem in order to develop a more complex image of students' perspectives. I illustrated and interpreted the distribution of the quantitative data through the calculation of descriptive statistics (see Appendix B, Table 3). I

examined the qualitative data by identifying and summarizing themes in student responses. The qualitative data added depth of explanation to the phenomena that the quantitative data distribution revealed, especially given the small number of participants (*N=10*).

2.3 Results & Discussion

2.3.1 Classroom Observations

During the five classroom observations, the instructor used or made reference to an average of three technological resources per lesson. Those resources included PowerPoint, YouTube, Vimeo, MindTap, Canvas Studio, and Podcast Français Facile. The syllabus and instructor interviews revealed that these resources did not comprise the entirety of those used throughout the French 101 course. However, within the sample of class sessions that I observed, I only noted the use of the aforementioned resources. I will now explore several focal technological resources in order to provide further detail on the role that these resources played in daily classroom practices.

2.3.1.1 PowerPoint

PowerPoint was the most frequently used technological resource (Microsoft, 2020). The resource is fairly ubiquitous in American university contexts, and, in this case study, students and instructors received a subscription to the software through the university. In all of the class sessions observed, the instructor projected a PowerPoint to the front of the classroom as a primary step in preparing for class. The instructor used a PowerPoint for the majority, if not all, of class time in all of the observations.

I emphasize that the PowerPoint was situated at the front of the class. While this fact may seem banal to those for whom a similar classroom arrangement has been the norm for the majority of their educational experience, the deconstruction of this norm provides interesting insight into

the valorization of CALL. The rectangular classroom featured four lines of desks arranged as an incomplete rectangle. Two parallel lines of desks faced the right wall of the room, and the other two lines of desks faced in toward each other. One long whiteboard spanned the entire right wall. In the center of the whiteboard, the instructor typically descended a retractable projector backdrop on which she projected the PowerPoint and other digital media. This classroom orientation compelled students to direct their attention to the center of the right wall. Thus, the projector backdrop, and therefore the PowerPoint, served as the natural focal point of the class's attention.

The instructor reinforced the focus on the PowerPoint by primarily positioning herself directly to the right or left of the right wall's center. Her frequent interaction with the PowerPoint also augmented its significance in the class. The instructor typically read or referenced elements from the slides, splitting the positionality of her body between the slides and the students. While interacting with the slides, she typically used a marker to point to or tap on specific areas of the PowerPoint. This action conveyed to students that they should participate in a joint attentional activity with the instructor, using PowerPoint as a method for shared engagement.[5] The instructor also asked students to read or reference elements from the slides on numerous occasions, which further amplified their engagement with the resource. I noted that students frequently directed their attention to the PowerPoint, even when the instructor was not standing next to it. The attentional focus on the PowerPoint showed that this technological resource received a great amount of value and authority from the instructors and students in the course.

The instructor's and students' interactions with the PowerPoint demonstrated that the resource served as a representation of the instructor and, by extension, a representation of the curriculum, department, and institution. In this manner, PowerPoint took on aspects of the *tutor*

[5] I understand engagement to indicate a state in which students dedicate their attention fully to the intended lesson or activity.

conceptualization of CALL; the resource embodied the instructor and served a primary role in the class. As the instructor created the presentation, it represented her knowledge and intentions for the course. One function of the PowerPoint included to display vocabulary and grammar points in a visual form to the entire class. The instructor orally presented this information and directed class discussion that developed beyond the information displayed on the PowerPoint. The instructor also extended instruction beyond the PowerPoint by writing relevant vocabulary from class discussion on the whiteboard adjacent to the presentation. In this case, the PowerPoint functioned as a basis and reference point for more sophisticated classroom interaction.

PowerPoints also typically included directions and information for class activities. For example, in the first observation, students completed an exercise in which they transformed the grammatical gender of adjectives from masculine to feminine. The instructor listed the activity's directions and the adjectives in question on the PowerPoint. While she did present the directions orally, she did not present the adjectives, leaving the students to read the adjectives from the PowerPoint. In this scenario, the instructor allocated some of her instructional responsibilities to the PowerPoint, which in turn required students to exert more effort in understanding the activity. Students also engaged more with written text, which diversified the modalities present in the lesson. In other scenarios, the instructor displayed media of a variety of modalities through the PowerPoint, including videos, cartoons, and other images. The PowerPoint served as a resource for multimodality in the classroom, and its written representation of the instructor's intentions alleviated some of the instructor's responsibilities.

2.3.1.2 Video: YouTube and Vimeo

The instructor used the projector to display videos on two occasions. The videos came from two online video sharing platforms, YouTube and Vimeo (Vimeo, 2020; YouTube, 2020). Given

the similarities between the lessons that incorporated each video sharing platform, the present study only described the first lesson in detail; the second lesson was incorporated in analysis. The instructor dedicated between 10 and 30 minutes in each class period to the videos and related activities. Through the use of the videos, the instructor addressed curricular objectives cited in the syllabus, including the following:

> You can expect to gain cultural insight and acquire the skills necessary to analyze and interpret…short videos. Through the study of French and francophone cultures, you will increase your awareness of cultural differences while also gaining new perspectives on our global connectedness (*Français 101, Automne 2019*, 2019, p.1).

The stated objectives described the development of cultural competence, analytical and interpretative skills, and digital literacies.

The first video noted during an observation came from YouTube. This video described the French perfume industry through narration that was relatively fast-paced for an introductory French class. The class spent approximately 10 minutes watching and discussing the video, and the instructor assigned another viewing of the video for homework. The video lesson began with the instructor presenting background information on the video. Then, she directed the students' attention to a few video comprehension questions that she had listed on the PowerPoint. She instructed the students to take notes in response to these questions while watching the video. The class proceeded to watch the video for a first time, after which the instructor prompted students to ask questions about vocabulary that they did not understand. The instructor also asked general comprehension questions and wrote new vocabulary on the whiteboard as a visual aid. The vocabulary eventually surrounded the video, as the instructor listed such a large quantity of words that the list extended onto both sides of the whiteboard.

The lesson continued with two more viewings of the video. After the second viewing, the instructor asked students to respond to the comprehension questions, and the students met her with

silence. She played the video a third time and urged students to focus on answering the questions. During the third viewing, the instructor stopped the video twice to check for comprehension of vocabulary. After the third and final viewing, the class answered the questions briefly and then continued to work on vocabulary. Instructors and students demonstrated considerable engagement during the use of videos in the classroom.

This approximately 10-minute-long lesson revealed much about how the instructor leveraged videos as instructional resources. First, analyzing and interpreting the video facilitated the students' development of digital literacies, as the students gained familiarity with the structure, delivery, and language found in the genre of informational videos. Additionally, the video existed as a CALL *tool* as it functioned as one resource in interaction with many others, including the PowerPoint and the whiteboard. The combination of the audio and visual information provided by the video with the textual and visual information provided by the PowerPoint produced a strongly multimodal learning situation. Video offered a dynamic and malleable medium for learning, as the instructor was able to pause and replay the video to fit her students' needs (Kramsch, 1993; Paesani et al., 2016).

The instructor challenged students to practice listening comprehension using authentic materials.[6] As such, the fast pace and advanced vocabulary of the video also challenged learners. The instructor scaffolded for difficulties in understanding through extensive vocabulary explanation. However, the scaffolding proved ineffective in facilitating full comprehension, as the students demonstrated difficulty in answering the comprehension questions. The students referenced the fast speed of narration and their unfamiliarity with vocabulary as obstacles to comprehension. This example illuminated the value of video for meeting the learning objectives

[6] Consult section *1.3* for the definition of authentic materials.

of enlarging students' vocabulary, improving listening comprehension, honing analytical and interpretive abilities, developing digital literacies, and expanding cultural competence. This example also showed that the unique features of video, such as speed adjustment and rewinding, can serve as assets for facilitating the accomplishment of the aforementioned objectives.

2.3.1.3 Audio: Podcast Français Facile

In the fourth observation, the instructor incorporated a podcast from the website Podcast Français Facile (Durrenburger & Chopin, 2020). The website described itself as a platform for learning French as a foreign language through free resources that are tailored to learners' proficiency levels. The podcast, which included an interview on the subject of the interviewee's childhood, fit within a larger lesson focused on the difference between the preterit (*le passé composé*) and the imperfect (*l'imparfait*) verb forms in French. This lesson met the following course goals as enumerated on the course syllabus: "French 101 will develop the four skills necessary to learn a language. You will increase your confidence and ability to read, write, speak, and understand French. Vocabulary and grammatical structures will be introduced in coherent cultural contexts" (*Français 101, Automne 2019,* 2019, p.1). According to the syllabus, Podcast Français Facile served as a *tool* for reaching the course goals of teaching the imperfect, as well as teaching listening, speaking, reading, and writing.

The activity lasted 20 minutes, in which the students listened to the podcast three times. During the first listen, the students prepared to answer comprehension questions by taking notes on the content of the podcast. Following the first listen, the class responded to the comprehension questions together and discussed challenging vocabulary. The instructor transcribed the new vocabulary words on the whiteboard, mirroring her activity while using other CALL resources, such as YouTube and PowerPoint. During a second listen, the students filled in the blanks in a

transcript of the interview. They subsequently discussed the answers as a class while taking turns reading the sentences out loud. The instructor projected the dialogue at the front of the class through the PowerPoint. During the third listen, the students underlined the verbs in the imperfect on the transcript. Finally, the students identified the infinitive form of the verbs in the imperfect. The activity concluded with the entire class verifying the answers to the final exercise, during which the instructor transcribed the answers on the white board.

The podcast helped to meet the instructor's learning objectives, although the resource's lack of authenticity presented some disadvantages. The activity in which students underlined verbs in the imperfect heightened students' noticing of the form, function, and meaning of the imperfect. Additionally, the students developed listening abilities through listening to the podcast once without a transcript and twice with the aid of the transcript. Reading the transcript, both independently and out loud, allowed students to develop literacy related to the interview genre, as well as speaking and reading abilities. Filling the blanks in the transcript contributed to students' writing abilities and vocabulary acquisition. I noted that students demonstrated motivation[7] to answer the instructor's questions, although the class generally did not show great energy or enthusiasm during the activity.

Though the podcast catered well to the instructor's learning objectives, it did so at the potential detriment of the authenticity of the source. The podcast had a deliberately slow pace, short duration, deliberate enunciation, and limited contextual information in order to accommodate A1-level L2 French learners. While these features assisted the students in focusing on the imperfect, students might benefit from greater access to resources with greater contextual information that offer more robust opportunities for cultural learning. The instructor that was

[7] I understand motivation to refer to goal-directed, persistent, effortful behavior.

observed in the case study identified the same advantages and disadvantages of Podcast Français Facile during the graduate instructor interview.[8] The instructor's note provided evidence of the manner in which the instructors had reflected upon the alignment between their theoretical pedagogical framework and their teaching practice.

2.3.2 Instructor Interviews & Syllabus Discussion

2.3.2.1 MindTap

MindTap is an online learning platform offered by Cengage Learning (Cengage, 2020). The platform corresponds with French 101's textbook *Atelier* (Jansma, 2018). While I never observed students or instructors using MindTap in class, I studied MindTap through interviews with instructors, analysis of the syllabus, and student responses to the questionnaire. The instructors' inclusion and structuring of MindTap in the French 101 curriculum provided one of the most robust examples of CALL implementation in this study.

The coordinator structured French 101 as a *flipped classroom* through MindTap. In a flipped classroom, students study vocabulary, grammar, and other *available designs*, or communicative resources, for homework (Kern, 2000). They then come to class with sufficient mastery of this foundational knowledge so that the class can engage more fully in *meaning design*, or active, meaningful language use (Paesani et al., 2016). The syllabus stated, "The homework [on MindTap] will introduce students to vocabulary and grammar that will then be practiced in class the next day" (*Français 101, Automne 2019*, 2019, p.2). According to the syllabus' interpretation of the platform, MindTap was conceptualized in the role of a *tutor*; the platform embodied the instructor in the role of assisting students in acquiring available designs. The instructor's use of

[8] Consult section *2.3.2* for further detail on the instructor interviews.

the platform corresponded with the multiliteracies framework's support of reducing teacher-centered pedagogical practices and spending classroom time with a focus on meaning design.

The coordinator intended for MindTap to provide a regular schedule for consistent French learning, which many students reported appreciating in their responses to the student questionnaire.[9] In an interview, the coordinator stated that she expected students to spend 40-50 minutes per day, 4 days per week, studying French and completing exercises on the platform. The syllabus specified that students ought to spend "3-4 hours per week" on MindTap (*Français 101, Automne 2019*, 2019, p.2). In the student questionnaire, the student sample reported spending on average approximately 3 hours per week on the platform. The data indicated that student and curricular objectives aligned to result in about 45 minutes of online preparation for each upcoming class.

MindTap showcased the variety of digital resources available even within one CALL resource. According to the coordinator, students acquired available designs through the "Learn It" section, in which they watched videos, listened to audio, and read texts. The students also completed short activities to put their available designs to practice. The students had unlimited attempts to complete these activities, and they received automatic feedback on their answers. In the subsequent section, "Practice," students completed a series of graded exercises. They received three attempts to answer the questions, and MindTap software typically graded the students' responses automatically. The coordinator noted that the instructors graded some of the exercises, which included written and spoken response questions that MindTap recorded and transmitted. Students' successful completion of MindTap exercises accounted for 10% of their course grade, and the coordinator indicated that students typically scored fairly high on the exercises. In sum,

[9] Consult section *2.3.3* for further information on the student questionnaire.

this program featured a myriad of digital resources including video, audio, digital texts, digital activities, automatic feedback, and voice recording.

Despite the advantages that MindTap offered in terms of the flipped classroom, its regularity, and the variety of digital resources offered, the instructors and students expressed many concerns about the program. The coordinator emphasized the technical difficulties that the program incurred, such as issues with playing and recording sound. She cited these problems as an impediment, especially for students and instructors to record and listen to spoken-response questions, respectively. The coordinator also criticized the videos' presentation of cultural content, referencing its "banal" treatment of the diversity of the francophone world. In classroom observations, I noted that some instructional time was dedicated to teaching available designs instead of only focusing on meaning design. The instructor interviews confirmed this observation, demonstrating that MindTap homework did not result in the full realization of a flipped classroom.

The students echoed the advantages and disadvantages that the instructor recognized in MindTap. Regarding the technical aspects of the program, some students described MindTap in their responses to the student CALL questionnaire as, "sometimes difficult to use" (Participant 1) and "slow to load" (Participant 6). Conversely, one student characterized the program as, "an easy to use website for the most part" (Participant 2, Student CALL Questionnaire). In terms of content, one student wrote, "I think that MindTap is an effective way to learn French. I appreciate the way that it offers notes and videos, as well as questions to evaluate my learning, however, I feel that it is too challenging for someone who has never taken French before" (Participant 5, Student CALL Questionnaire). While this student did highlight the advantages of MindTap's presentation of notes, videos, and questions, he/she also expressed concern with the difficulty of the content. The instructor's and students' reflections mirror recurrent issues associated with CALL: technical

difficulties, questions of cultural authenticity and banality, and inflexibility of content and feedback.

2.3.2.2 Multimedia Presentations: VoiceThread, Canvas Studio, & PowerPoint

The French 101 curriculum demonstrated significant valorization of digital resources through its emphasis on multimedia projects. The course included three projects over the course of the semester, which accounted for 30% of the course grade. Instructors required students to employ the Web 2.0[10] resources of VoiceThread and Canvas Studio, as well as PowerPoint, to complete these projects (Canvas, 2020; Microsoft, 2020; VoiceThread, 2019). The projects addressed the course objectives of "[using] target constructions creatively and naturally in simple speech" and "[studying] French and francophone cultures" (*Français 101, Automne 2019*, 2019, p.1). Following the recommendations of the multiliteracies framework, the projects facilitated cultural learning, meaning design, and textual production in oral and written modes.

In the first project, students utilized VoiceThread, a learning tool featuring audio, video, and visual presentation capabilities (VoiceThread, 2019). The instructors asked students to choose four portrayals of women in art at the Louvre. The students then orally described the works of art using adjectives that they had recently studied in class. In the second project, students employed the Studio feature on Canvas, a course management system. Canvas Studio is an online media platform within Canvas (Canvas, 2020). Using this tool, students dubbed over scenes from classic French films with their own, novel scripts. The coordinator emphasized her intention for students to learn about classic French films and their actors through the project. In the final project, students created PowerPoint presentations about a travel destination in the francophone world. The

[10] See section *1.3* for the definition of Web 2.0.

instructors required students to use French-language tourism websites for their project research, thus adding another digital medium for language learning.

Although these resources did engender technical challenges, the instructors expressed a departmental commitment to continuing and developing the use of multimedia in projects and in the classroom. The instructors expressed frustration with technological problems that occurred during the Canvas Studio project; they explained that some groups of students did not complete the second project because they had trouble using the Canvas Studio dubbing tools. They followed this discussion by enumerating other technological resources that the department would like to incorporate in subsequent semesters. One such resource was Google Docs, which the instructors proposed using so that students could keep their writing samples in one document and track their writing development over time (Google, 2020). The coordinator also suggested that the resource would increase students' noticing of feedback, as instructors would insert feedback in comments on the document and students could respond directly to this feedback. Other resources included Zoom,[11] a video communication platform, and TalkAbroad, an online conversation partner program (TalkAbroad, 2014; Zoom Video Communications, 2020). The coordinator's interest in expanding the technological resources used in the program proved that the department held positive and growth-oriented views regarding their implementation of CALL.

2.3.3 Student Questionnaire

The student questionnaire investigated three factors relative to students' appraisal of CALL: 1) evaluation of CALL use in class, 2) evaluation of the use of MindTap for homework,

[11] While the case study was conducted in the fall of 2019, the thesis was published in the spring of 2020. Due to the COVID-19 pandemic in the spring of 2020, language courses at many American universities transitioned to being delivered via Zoom. Future studies might benefit from studying language instruction via Zoom given its relevance to current developments in education.

and 3) evaluation of CALL generally (Cengage, 2020). In order to study these factors, the questionnaire included 7 questions, which provided both quantitative and qualitative data. I summarized this data through measures of central tendency and variance (see Appendix B, Table 3). I compared descriptive statistics with students' qualitative responses to identify themes underlying trends in the data.

Question 1 measured factor 1, evaluation of CALL use in class. The question asked, "In French 101 class, how often does your professor use technology as part of his/her lesson and class activities? Technology includes videos, websites, music, etc." Students responded to this question on a 7-point Likert scale in which 1 indicated "never" and 7 indicated "very frequently." The mean score was 6, and the variance was minimal. This signified that most students believed that their instructors used technology *pretty frequently* in class. The qualitative data provided a picture of the resources that were salient to students and students' appraisal of the function of these resources. The students' list of technological resources included PowerPoints, (music) videos, movie clips, cartoons, and the internet. This list expanded beyond that which I recorded in the class observations, offering greater detail about the resources used in daily classroom practices. The students employed positive language in their descriptions of the resources' functions, including "help," "guides," "vivid," and "interesting." These words communicated the beneficial and stimulating quality of these resources, conveying an overall positive appraisal of the resources that instructors use in class.

Question 2 measured factor 2, evaluation of the use of MindTap for homework. Question 2 asked, "How many hours per week do you spend completing MindTap homework exercises?" Students entered quantities of time to answer this question. The mean was 3.2 hours, or 3 hours and 12 minutes. Responses showed some variance, ranging from 2 to 5 hours per week. As the

syllabus required students to spend 3 to 4 hours per week on MindTap, the students did not demonstrate a very large amount of variation from the expected amount. In the qualitative responses, students enumerated reasons for the length of time that MindTap required. These reasons included effort, confusion or difficulty, lack of program infrastructure (hints, feedback), and complexity of activities. The qualitative section exposed many of the students' frustrations relative to MindTap, which enhanced my knowledge of their homework experience beyond knowledge of its length.

Question 3 also measured the evaluation of the use of MindTap for homework. The question asked, "How would you evaluate the MindTap program as a whole?" Students responded to this question on a 7-point Likert scale in which 1 indicated "strongly dislike" and 7 indicated "strongly like." The mean score was 4.6, and the variance was minimal. This signified that most students liked the MindTap program *somewhat*. Similarly to the qualitative responses for the previous question, these responses emphasized the difficulty of MindTap and areas for improving the resource. Students pointed to the length of the assignments, the speed and word density of the audio recordings, the familiarity of the vocabulary, and the inflexibility and difficulty of the questions as primary areas of concern with MindTap. Although the mean evaluation of MindTap was one point more positive than neutral, it is important to note that some students expressed strongly negative opinions about MindTap in qualitative responses (see Appendix B, Table 3).

Question 4 measured the evaluation of the use of MindTap for homework as well. The question asked, "How effective do you think your MindTap homework exercises are in helping you to learn French?" Students responded to this question on a 7-point Likert scale in which 1 indicated "not at all effective" and 7 indicated "very effective." The mean score was 5.2. The variance was notable, with scores ranging from 3 to 7. This signified that students on the whole

found MindTap to be *fairly effective* in helping to learn French, although some felt that it was *somewhat ineffective* and some felt that it was *very effective*. The qualitative responses displayed an overall positive view of the platform's efficacy. Two out of five responses referred to the platform as "helpful" or "useful" in reference to learning vocabulary and grammar and practicing language skills. The negative responses listed issues related to accessing materials, playing sound, and challenging oneself as hindrances to MindTap's efficacy.

The final question to measure the evaluation of the use of MindTap for homework was question 5. This question asked, "How would you evaluate your interactions with the MindTap website?" Students responded to this question on a 7-point Likert scale in which 1 indicated "strongly negative" evaluations and 7 indicated "strongly positive" evaluations. The mean score was 4.8, and the variance was notable, with scores ranging from 2 to 6. This signified that students on the whole rated their interactions with the MindTap website to be *fairly positive,* although some rated their interactions as *rather negative* and some rated their interactions as *rather positive*. The qualitative data also presented a mix of positive and negative appraisals of the MindTap website. Positive evaluations stated that the website was "easy to use for the most part," "effective" for learning, and "helpful." Negative evaluations focused on the content's difficulty and site's structural issues.

Question 6 measured factor 3, the evaluation of CALL generally. The question asked, "Outside of MindTap homework, how many hours per week do you spend learning French through digital technology outside of class? (This could be through listening to podcasts, watching YouTube videos, doing online exercises, etc.)." Students entered quantities of time to answer this question. The mean was 1.2 hours, or 1 hour and 12 minutes. Responses showed some variance, ranging from 0.5 to 4 hours per week. In the qualitative responses, students listed many of the

digital resources that they were using to learn French independently. Those resources included videos, including films, TV shows, and other videos, sometimes with subtitles; music; and social media. While the instructors incorporated the majority of these resources in the curriculum, TV shows and social media stood out as resources that were unique to students' independent language study. Thus, the instructors might benefit from incorporating these resources into the curriculum, especially given student interest in these media.

Question 7 also measured the evaluation of CALL generally. The question asked, "How would you evaluate your attitudes toward using technology to assist with learning a language? (This can be from your experiences learning French as well as other languages, if applicable)." Students responded to this question on a 7-point Likert scale; 1 indicated "strongly negative" evaluations and 7 indicated "strongly positive" evaluations. The mean score was 5.9, and the variance was minimal. This signified that most students rated their attitudes toward CALL to be *rather positive*. The qualitative responses highlighted positive attitudes about CALL's potential with regard to certain resources and aspects of learning. One student referenced MindTap, translators, videos, and websites as valuable digital resources for language learning. Two students underscored CALL's usefulness for pronunciation and general language practice. Finally, one student stressed the need for improvement in CALL.

In comparing factors 2 and 3, I found that students expressed more positive views about technological resources generally than about MindTap. This difference may be due to the regularity of their use of MindTap, or it might stem from considerable problems present in MindTap that other resources do not include. Beginner, college-level French curricula might benefit from trying to resolve the issues that led to students' negative attitudes toward this platform.

They might also benefit from increasing the use of the technological resources to which the students attributed positive attitudes, such as films, music, and social media.

2.3.4 Limitations & Future Directions

The primary limitations of the study resulted from the focus on observations from one class over the course of one semester. Due to schedule conflicts, I was only available at the meeting time of one of the graduate instructor's courses. While concentrating on one class allowed me to provide a nuanced analysis of that class, the focus on one instructor may have obscured the integration of, interaction with, and appraisal of CALL in other sections. Future studies would benefit from observing more course sections and comparing observations across sections. The study might also be expanded to include more observations over the course of a longer time period in order to capture the trajectory of CALL over time.

The observer's paradox might have also limited the results of this study. I understand the observer's paradox to indicate the phenomenon in which participants' behavior changes because they know that they are being observed. In this case, the instructor may have favored the use of technology in the semi-participant observations more than she would in other class sessions, as she knew that I was studying technology in the classroom. However, the responses to the student CALL questionnaire indicated that the observer's paradox was not a significant limitation in the study. The students reported that the instructor used the resources I noted in observations on a regular basis. Therefore, the diversity of methods incorporated in this study mitigated the potential for significant limitations resulting from the observer's paradox.

2.4 Conclusion

The present study demonstrated that CALL received significant authority and valorization from the students, the instructors, and the French department at the studied university. The most readily implemented CALL resources noted in this study were PowerPoint, MindTap, YouTube, Vimeo, Canvas Studio, Podcast Français Facile, and VoiceThread. Homework and projects using these tools accounted for 40% of the course grade, which illustrated the value that the instructors and the department attributed to including CALL in the curriculum. The omnipresence of PowerPoint in the classroom and the almost daily frequency of MindTap homework also showed that the instructors and department ascribed significant authority to these CALL resources. Students' attentional focus on the PowerPoints and deference to their content illuminated the extent to which PowerPoint assumed a role similar to that of the language instructor in the classroom. The syllabus revealed that developing digital literacies was one of the stated course goals, indicating that the instructors and the department aligned their practices and goals with the valorization of digital literacies that the multiliteracies framework recommended. The significance that that the students, instructors, and department attributed to these resources showed that CALL use was integrated considerably in the studied department as encouraged by the multiliteracies theoretical framework.

Despite the presence of and weight given to CALL resources, the instructors and students evinced dissatisfaction with several resources on theoretical and applied grounds. First, the instructors questioned the authority of MindTap and Podcast Français Facile based upon the resources' lack of cultural authenticity. Secondly, the instructors recognized that MindTap did not allow for the full achievement of a flipped classroom teaching style. The instructors and students also expressed frustrations with CALL due to the technology-related complications, such as issues

with recording and playing sound, that they encountered while using Canvas Studio and MindTap. Additionally, students identified the inflexibility of content and feedback in MindTap as another source of negative sentiment regarding CALL. While students and instructors criticized MindTap, Podcast Français Facile, and Canvas Studio, they conveyed largely positive sentiments regarding PowerPoint, YouTube, Vimeo, and VoiceThread.

Students and instructors communicated optimistic views regarding CALL generally, indicating that CALL use will likely continue to grow in the studied program to facilitate the attainment of curricular goals. Students reported “rather positive” views of CALL generally and reported utilizing CALL resources other than those assigned for French 101 coursework, such as TV shows and social media. The instructors indicated that they were considering adding different CALL resources to the curriculum, such as Google Docs and Zoom. The studied program may mirror the current state of language instruction and predict the trajectories of many other beginner, college-level French SLA programs.

III. Experimental Study

3.1 Introduction

The experimental study tested the efficacy of a specific resource for computer-assisted language learning (CALL) among beginner, university-level L2 French students. The experimental study complemented the case study's breadth of analysis of CALL resources by focusing on one particular resource. In controlling for potentially confounding factors, this study design provided a means of quantifying the efficacy of CALL resources. This quantitative approach balanced the qualitative analysis of CALL resource efficacy that the description of student, instructor, and curricular sentiment and interaction with CALL resources in the case study presented. I manipulated the use of one resource for CALL—Praat software—in the experimental study in order to measure its utility for French phonetic development (Boersma, 2001).

This study responded to a need identified within the discipline of Applied Linguistics for further research on the utility of CALL resources offering audio-visual interfaces, including Praat software, for phonetic instruction (Hardison, 2004; Lambacher, 1999; Molholt & Hwu, 2008; Olson, 2019; Saito, 2007). Language pedagogy research has repeatedly demonstrated the benefits of instruction that combines multiple modalities, including auditory and visual modalities, for memory consolidation and learning outcomes (De Bot, 1983; Gómez et al., 2008; Leakey, 2011). Thus, Praat's ability to provide simultaneous audio and visual feedback suggests a potential for efficacy in phonetic learning that researchers would benefit from investigating.

Several prior studies have demonstrated the advantage that computer-based audio-visual feedback offers for suprasegmental learning (De Bot, 1998; Hardison, 2004). In studying L2 English intonation acquisition, De Bot (1998) found that participants who received audio and visual feedback showed greater improvement and motivation to actively participate in the study

than those who only received audio feedback through a computer program. De Bot also noted that the audio-visual group demonstrated advantages over the audio-only group regardless of the length of the intervention. This finding mirrors Grgurović, Chapelle, and Shelley's (2013) conclusion from their meta-analysis of 37 CALL studies that CALL groups improved more than non-CALL groups regardless of the length of intervention. Hardison (2004) tested a prosody intervention for L2 French using audio-visual feedback in the Real-Time Pitch Program of Kay Elemetrics Computerized Speech Lab. Hardison (2004) found that the intervention group made significantly greater developments in prosody and in generalization of knowledge to new stimuli than the control group. These three studies provided evidence of the efficacy of audio-visual, suprasegmental-oriented CALL programs, including those for L2 French learning, for any length of use.

Based on the positive effects shown in previous studies, the current study employed a *visual feedback paradigm* in order to assess the transferability of audio-visual feedback advantages through Praat (Lambacher, 1999; Offerman & Olson, 2016; Olson, 2014a, 2014b, 2019). Olson (2014b) defined the visual feedback paradigm (VFP), also referred to as electronic visual feedback, as consisting of four elements:

> (a) A non-native speaker recording the stimuli
> (b) A visual display of the speech feature
> (c) A visual display of a native speaker production for comparison, often accompanied by a corresponding auditory presentation
> (d) A re-recording on the part of the non-native participant attempting to match the native-speaker productions (p. 175)

This paradigm was employed to test the efficacy of Praat for improving segmental production in L2 Spanish. Olson (2014b) found that the VFP offered an advantage for acquisition over the traditional, not computer-based method. Using a visual feedback paradigm similar to

Olson's (2014b), Saito (2007) observed that L2 English learners improved in vowel pronunciation accuracy over the course of a Praat-based intervention. Furthermore, Offerman and Olson (2016) demonstrated the applicability of VFPs generated through Praat to generalizable phonetic acquisition in their study of L2 Spanish voice activation time development. Given the success of prior research using visual feedback paradigms in Praat, I chose to adopt Olson's paradigm for the present study. Expanding on the wealth of prior research on segmental acquisition, the present study tested the applicability of Praat-based CAPT to suprasegmental acquisition.

The accuracy and volume of information that Praat provides, as well as its accessibility, augment its potential for utility in introductory French courses. Phoneticians commonly employ Praat to collect data given its reputation for precision (Saito, 2007). Praat offers precise data for many measures of segmental and suprasegmental features of speech, including speech duration, intensity, pitch, and formants. The program displays this information visually on waveforms and spectrograms, with which users can interact to play sound, study certain segments, and retrieve data. Praat also allows users to link the waveforms and spectrograms of two independent utterances. This function can allow students to compare their productions to those of a model speaker, as was employed in this study. Finally, Praat is an open-source software, allowing students and instructors to download the program free of charge. The advantages that Praat presents in terms of cost, accessibility, and information provided call for further investigation of Praat as a CALL resource.

The primary objective of this study was to contribute to scholarship assessing Praat's effectiveness in its application to computer-assisted pronunciation training (CAPT) for L2 French. The study focused specifically on the utility of audio-visual information that Praat provides through the comparison of participant and target waveforms and spectrograms. I investigated

whether the prosodic data that Praat offers through its audio-visual interface can contribute to learners' acquisition of aspects of French prosody, namely language-specific patterns of rhythm and stress that translate into syllable duration and intensity. I evaluated the extent to which learners generalized knowledge of French prosody that they acquired in the Praat intervention to words that they did not study in the intervention. As CALL researchers have described generalizability of learning as an important component of "ideal" CALL resources (Hardison, 2004, p.34), I considered testing for evidence of generalization to be an integral element of the study design. Additionally, researchers have identified a need for greater research on generalization in pronunciation training (Offerman & Olson, 2016). Thus, this study addressed the objective of evaluating students' acquisition and generalization of French prosodic information through a targeted Praat intervention in order to assess the program's potential usefulness as a tool for CAPT.

The second objective of this study was to render more objective the methods that CALL researchers use to test student's language skills in studies of resource effectiveness. In many of these studies (De Bot, 1983; Grgurović et al., 2013; Hardison, 2004; Olson, 2019), researchers have employed native speaker evaluations in order to assess language skills. Hardison (2004, p.41) measured student gains in French prosody acquisition by asking French native speakers to rate the "prosody" and "segmental accuracy" of students' utterances on a Likert scale from "definitely not native" to "definitely native-like." While Hardison (2004) and others did control for interrater variability, the innate subjectivity of human raters may present a problem to ensuring the validity of these evaluations (Lennon, 1990). Additionally, choosing native speakers with limited knowledge of linguistic terminology as the ideal population to evaluate learners' acquisition of prosody and segmental accuracy may have compromised the study's validity. As Praat allows users to calculate syllable duration and intensity with great accuracy, I considered Praat to be a

valid tool for measuring prosody acquisition. This study's methods ought to inform future CALL efficacy research in order to ensure the validity of the discipline's findings.

Based upon prior research demonstrating the effectiveness of similar CALL programs (De Bot, 1983; Hardison 2004; Molholt & Hwu 2008; Olson 2019; Saito 2007), I anticipated that the present Praat intervention would be successful in assisting students to acquire and generalize knowledge of French rhythm and stress. I hypothesized that if the intervention were effective, the experimental group's data would show significant differences between pre-test and post-test data, with post-test data being closer to the target data than pre-test data. The target data stemmed from a native speaker of French who was the instructor of the French 101 class described in the case study.[12] Secondly, if the intervention were effective, the experimental group's post-test data would be significantly closer to the target data than the control group's post-test data. Finally, if students effectively generalized knowledge acquired in the intervention, the experimental group would demonstrate significant differences between pre-test and post-test data for both novel and existing words. The present study tested the aforementioned hypotheses in order to report the effectiveness of Praat-based phonetic learning interventions.

3.2 Methods

3.2.1. Participants

The participants in this study included 10 students (*N=10*) who were enrolled in French 101 in the fall of 2019. These students were attending a mid-sized, private university in the southeastern United States. They were completing the first semester of college-level French offered at this university in a class of approximately 20 students. The course met four days per

[12] See section *3.2.3* for further explanation.

week for approximately one hour over the course of a 15 week-long semester. Based on a demographic questionnaire that students completed at the beginning of the study (see Appendix C), I found that the students came from all four sections of French 101, which three different instructors taught. All students tested into this course by receiving an A1 score on a placement examination, which denoted the lowest possible score on the CEFR proficiency scale (CEFR, 2020). However, 50% of participants reported prior experience with learning French. These participants described learning French briefly in middle or high school or studying French independently on language-learning applications such as Duolingo[13] (Duolingo, 2020). Despite this reported difference in prior experience, I did not note that certain participants seemed to demonstrate a higher initial proficiency level than others during interviews.

The participants constituted a volunteer sample from the studied university's French 101 program. Students received compensation for participation through a $20.00 Amazon gift card that they were awarded upon completion of all sessions of the study. These funds came from the 2019 Emory College Language Center Student Grant. The students also received extra credit for French 101 from their instructor based upon their participation. Although 11 students initially began the study, one student did not complete the study due to failure to attend study sessions. The reported results are based upon the 10 students who completed all sessions. Description and analysis of data from the demographic questionnaire is provided in section *3.3.1*.

3.2.2 Experimental Design

The study followed a pre-test, post-test design in order to assess proficiency before and after an intervention sequence. The interventions utilized a visual feedback paradigm through the audio-visual interface offered by Praat (Offerman & Olson 2016; Olson 2014a, 2014b, 2019).

[13] Duolingo is an app and website that offers language learning modules in French and other languages.

Participants completed pre-tests, interventions, and post-tests over the course of approximately one month during their enrollment in French 101. Participants were randomly assigned to experimental and control groups. While an experimental group (*N=5*) completed four targeted interventions, a control group (*N=5*) had unstructured study time for the same duration as the experimental group's interventions. The members of both groups individually attended four sessions of 30 minutes in length, totaling two hours of intervention duration. The interventions and tests addressed the students' acquisition of French syllable duration and intensity, on which I provided more detail in section *3.2.4*.

3.2.3 Stimuli

The phonetic training was based upon a set of 40 words from the French 101 textbook, *Atelier* (Jansma, 2018). These words came from chapters one through four of the textbook and included 10 words from each chapter. I chose to include these words because the curriculum dictated that they would have been introduced in class before the beginning of the study. I therefore sought to control for the confounding variable of augmented exposure to these words in class, which might have improved students' scores on the post-test. Although students certainly received greater exposure to the words over the course of the semester, the improvement in performance would have likely been much greater between the pre-test and post-test if they had not encountered the words before the pre-test. Unexpectedly, some students reported throughout the study sessions that they had never encountered some of the stimulus words. This may have stemmed from students forgetting the words, from infrequent usage in class, or from unanticipated departures from the curriculum dictated in the syllabus. As a minority of students made this comment, I did not find their reported lack of familiarity with the words as constituting reason to alter data analysis.

All of the stimulus words were between two and four syllables in length. I instituted this length maximum because I realized that words any longer than four syllables might have produced too heavy of a cognitive burden for A1-level learners to learn in such a short intervention. The length minimum needed to be two syllables because investigating the relative length of the final syllable requires words with at least two syllables, an initial and a final syllable. Among the stimulus words, 40% were two syllables long, 50% were three syllables long, and 10% were four syllables long. I determined syllable breakdowns based upon International Phonetic Alphabet (IPA) transcription, and I confirmed these breakdown distinctions with experts in French language and Linguistics.

In order to test for generalizability, I divided the stimulus words into three groups: 1) *existing* words—words present in testing and interventions, 2) *novel* words—words only present in testing, and 3) *filler* words—words only present in interventions. The pre-test and post-test, which were the same test, consisted of 20 words. The 20 words included 10 existing words and 10 novel words. The sets of existing and novel words were evenly distributed in terms of syllable length and the textbook chapter from which they originated. This even distribution prevented syllable length and exposure from confounding data on participants' generalization of learning. The interventions included 30 total words, 10 of which were existing words, and 20 of which were filler words (see Appendix E). Due to the time constraints imposed by administering the pre-test and post-test during the first and last sessions, the first and last interventions included five words each. The second and third interventions included 10 words each. I presented students with these words on a sheet of paper in which the words were printed in list format (see Appendix E).

Prior to commencing the interventions, I recorded a French 101 instructor reading all 40 words to function as a target for interventions in Praat. I chose this instructor to serve as the target

speaker because she was the instructor of the class section I was studying for the case study. She is also a native speaker of French, hailing originally from southwestern France. As all of the French 101 instructors have native or highly advanced proficiency in French, they all were eligible to function as the target speaker. It is important to note that I positioned the target speaker as an advanced or native speaker of French, as it is unrealistic for L2 French learners to be expected to achieve "native" proficiency in French. I decided to record the aforementioned instructor not because of her "status" as a native speaker, but rather because of the continuity that I desired to attain between the case study and the experimental study.

While interacting with participants, I referred to this instructor as the "professor" because the participants were aware that the target pronunciations were produced by one of the French 101 professors. I provided them with this information because I realized that her students completing the study might recognize her voice. Additionally, I predicted that students would respond more naturally to the term "professor" than "target pronunciation." By orienting more toward the teacher-figure (rather than an idealized native speaker), I underscore a more holistic intelligibility rather than perfect, "native" proficiency in itself as one of the goals of this exercise (Olson, 2014a).

3.2.4 Procedures

The pre-test and post-test required participants to read 20 words in order from a printed sheet of paper (e.g. fenêtre, commerce, frigo; see Appendix D). Before recording, participants briefly read over the word list to prepare for pronunciation. While reading the word list, participants repeated each word twice. I required two productions to control for issues in recording and to allow participants two opportunities to articulate their intended productions. I permitted participants to restart pronunciation if their productions broke down mid-utterance so that I could

record complete productions. Following the recording phase, I segmented each recording into individual sound files for each production of each word to facilitate data analysis.

During the interventions, participants in the experimental group compared the audio and visual information from their productions with that of the target speaker (see Figures 1 and 2). The interventions proceeded one word at a time. First, the participants recorded themselves pronouncing the first word. Then, I produced a waveform and spectrogram for that pronunciation on Praat. I also generated a waveform and spectrogram for the target pronunciation of the same word, and I grouped the participant and target data together through Praat's 'Group' function so that they would be on the same time scale.

I encouraged students to listen to each pronunciation while noting similarities and differences in aspects of the visualizations (see Figures 1 and 2). In order to focus students' attention on feedback related to syllable duration and therefore related to rhythm and stress, I asked the following questions, "What do you notice in comparing the timing of your pronunciations? Are your syllables longer, shorter, or the same length as those of the professor?" As students responded to these questions, I encouraged them to use Praat's duration function to measure and compare the length of syllables in each pronunciation. We then discussed key differences in syllable duration between the student's and the instructor's pronunciations, and the student described means of bridging this gap in future productions.

Concurrently, students focused on feedback related to intensity and therefore stress as I asked, "What do you notice in comparing the patterns in the waveforms? Are there sounds that the professor pronounces more intensely or weakly than you do?" I directed them to consult the amplitude of the sounds represented in the waveform as evidence for intensity. After the students

explored the intensity of the target's and their pronunciations, they proposed strategies for altering their productions in the future to replicate more closely the target patterns of intensity.

The students completed this process of recording their speech, comparing their production to the target, and discussing changes to be made in future productions for each word in each intervention. If time allowed, the student repeated the same process for a second recording of each word. Students typically spent 2-3 minutes on each word. This allowed for approximately 30 minutes of intervention in the second and third sessions and approximately 15 minutes of intervention in the first and final sessions.

The control group had unstructured, independent study time. They had access to *Atelier* (Jansma, 2018), their textbook, and any other resources that they brought to the study. However, they did not use Praat outside of the pre-test and post-test, and I limited my interaction with the control group members during the unstructured study time. As the control group members did not receive a targeted phonetic intervention, they represented the French proficiency of students in French 101 who did not undergo the experimental condition.

3.2.5 Measurements

Upon collecting the participants' pre-test and post-test recordings and the instructor's recordings, I parsed each recording by syllable on Praat. First, I divided the recordings so that each recording encompassed one utterance of one word. In order to segment the syllables of each word, I produced text grids in Praat that corresponded to each recording. The 'Grid Maker' Praat script created these text grids (Ryan, 2005). I annotated the start, end, and syllable breaks of each utterance using the 'Text Grid Reviewer' Praat script (Crosswhite & Antoniou, 2010). The start and end of each word corresponded with the start and end of the formants detected for each word. If there was a significant amount of meaningful sound that was not detected by the formants before

or after the beginning of formant detection, I moved the start or end of the word to include that sound. On Praat, formants are depicted via red dotted lines, which the 'Show Formants' command produces (see Figure 1). After determining the boundaries of the word, I determined the boundaries of syllables.

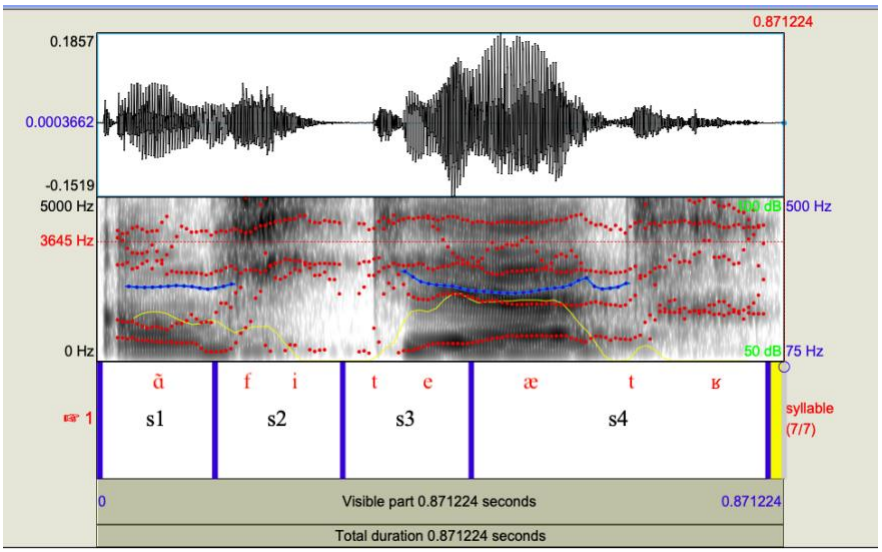

Figure 1: Syllable segmentation in Praat, Target pronunciation, *amphithéâtre*

I made decisions about the syllable boundaries of each utterance by referencing the list of syllable boundaries transcribed in IPA that I had produced for the stimulus words.[14] It is true that the syllable boundaries and transcription of stimulus words in this list were based upon the features of an advanced or native speaker of the variety of French that is taught in French 101. Therefore, many of the participants' productions differed in segmental and suprasegmental features from the target transcription. For example, one participant pronounced *amphithéâtre* as [æm.pɪ.di.ɑtɻ] instead of the target form of [ɑ̃.fi.te.ætʁ]. In such a case in which segmental differences between the participant's production and the target form rendered using the reference list difficult, I segmented syllables based upon the syllable boundaries that I discerned in the participant's

[14] See section *3.2.3* for further explanation.

utterance. In the case that a participant included more or fewer syllables than the target form, I chose to include all of the participant's syllables in order to maintain the integrity of the participant's production. The difference in the number of syllables from the target form reflected areas of development for learners.

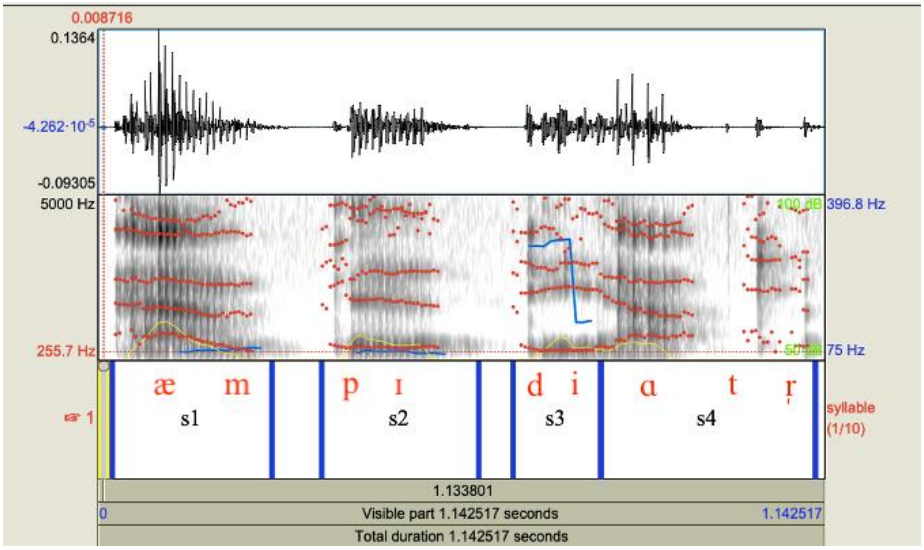

Figure 2: Syllable segmentation for Participant 2's pre-test pronunciation, *amphithéâtre*

I also took into account variation in word pronunciation. Two words in the pre-test/post-test stimulus list, *entreprise* and *médecin*, vary in their segmental features and length based upon speech rate and intonation. Thus, I transcribed *entreprise* as two syllables, [ɑ̃tʁ.pʁiz], or as three syllables, [ɑ̃.tʁə.pʁiz]. I transcribed *médecin* as two syllables, [med.sɑ̃], or as three syllables, [me.də.sɑ̃]. The choice of transcription ultimately depended on whether or not the speaker included a schwa [ə] in a second syllable, which I discerned through analyzing spectrograms. As both forms occur in spoken French, I considered both forms to be grammatical and included both forms in analysis.

Following syllable segmentation, I collected data on the duration and intensity of each syllable of each utterance. The 'Analyse Intervals' Praat script (Hirst 2009) provided syllable duration in milliseconds (ms) and intensity in decibels (dB). Upon organizing this data by utterance

in Excel, I calculated two measures. The first was *proportional final syllable duration*, or the duration of the final syllable of each utterance as a proportion of the utterance's length. I chose to calculate this measure as a proportion of duration instead of as duration in milliseconds to control for variation in speech rate between speakers (Deterding, 2001). Primary stress in French is assigned to the final syllable of a stress group, which is often the final syllable of a content word. This results in lengthening of the final syllable (Hirst & Christo, 1998). Therefore, I calculated the proportional length of the final syllable in order to discern if participants were practicing French-specific patterns of word-final syllable lengthening.

The second measure was *variance in syllable intensity*, or the standard deviation of the intensity values for each syllable. I chose to calculate the standard deviation of these values in order to control for differences in mean intensity between speakers. French patterns of assigning primary stress to the final syllable of content words result in augmented intensity in these syllables. Therefore, I calculated the variance in syllable intensity in order to discern if participants were practicing French-specific patterns of increases in intensity in word-final syllables.

3.2.6 Analysis

The analysis included 420 observations, which included 20 observations from the instructor and 40 observations from each of the 10 participants (20 observations per test, 2 tests: pre-test and post-test). Due to issues with recording, the proportional final syllable duration values were lost for eight observations. These observations came from a control group participant's pre-test data. As these missing data did not constitute a majority of the pre-test observations, I decided to include this participant in analysis.

I first evaluated the effects of the intervention through linear mixed-effects modeling in RStudio v.1.2.1335 (RStudio Team, 2018). Using the LME4 package (Bates et al., 2015), I set the

variables of group (experimental, control, or professor), test (pre-test or post-test), and word type (existing or novel) as fixed effects. I set the variables of stimulus word and participant as random effects, following the methodology of Offerman and Olson (2016). This analysis provided preliminary information about the variables' effects.

I evaluated participants' phonetic acquisition over the course of the intervention by comparing students' post-test scores to their pre-test scores. I ran paired t-tests on RStudio, which I interpreted to indicate through a p value of less than 0.05 ($p<0.05$) that statistically significant differences existed between students' pre-test and post-test scores. I ran paired t-tests for the experimental and control groups' data. I referenced the instructors' data in order to determine if students were moving toward or away from the target values over the course of the study. Lastly, I tested for evidence of generalization by running paired t-tests based upon word type; I tested if scores changed over time for the groups of existing and novel words.

I also evaluated participants' acquisition of target suprasegmental features by comparing students' pre-test and post-test scores to target scores. I ran independent two-tailed t-tests on RStudio, which I interpreted to indicate through a p value of greater than 0.05 ($p>0.05$) that statistically significant differences did not exist between the student's and the instructor's scores. I ran t-tests for the experimental and control groups' pre-test and post-test data.

3.3 Results

3.3.1 Demographic Data

Participants' demographic data is summarized in Table 4. The majority of participants in the study (70%) identified as female and 30% identified as male. The average age of participants was approximately 19 years. All of the participants had advanced proficiency in English, as is

required for admission at the university. Notably, a large majority of participants were multilingual (80%), and 60% of participants reported Mandarin Chinese as being one of their first languages. Upon running an independent two-tailed t-test between the pre-test data of L1 Mandarin participants and all other participants, I found insignificant differences between the two groups [$t(38)=0.7623$, $p=0.451$]. However, the L1 Mandarin groups' pre-test data was slightly closer to the target data than the other participants' data. In future analysis, it may be beneficial to examine the transfer effects of Mandarin on the students' acquisition of French prosody.

Table 4: Experimental Study Participant Demographic Data

Gender	
Female	70%
Male	30%
Mean Age (years)	19.3
Students with prior French experience	50%
Multilingual	80%
L1 Mandarin	60%

3.3.2 Syllable Duration

As seen in Figure 3 and in Table 5, the experimental group improved in score over the course of the intervention. The experimental group's mean proportional final syllable duration increased from 0.549 (SD=0.131) on the pre-test to 0.568 (SD=0.129) on the post-test, which more closely approximated the mean target proportional final syllable duration of 0.608 (SD=0.115). Conversely, the control group did not improve in score over the course of the study. The control group's mean proportional final syllable duration *decreased* from 0.561 (SD=0.127) on the pre-test to 0.548 (SD=0.129) on the post-test, moving away from the mean target proportional final syllable duration. In order to assess the effects of the variables on these findings, I ran a linear mixed-effects model.[15]

[15] See section *3.2.6* for further explanation.

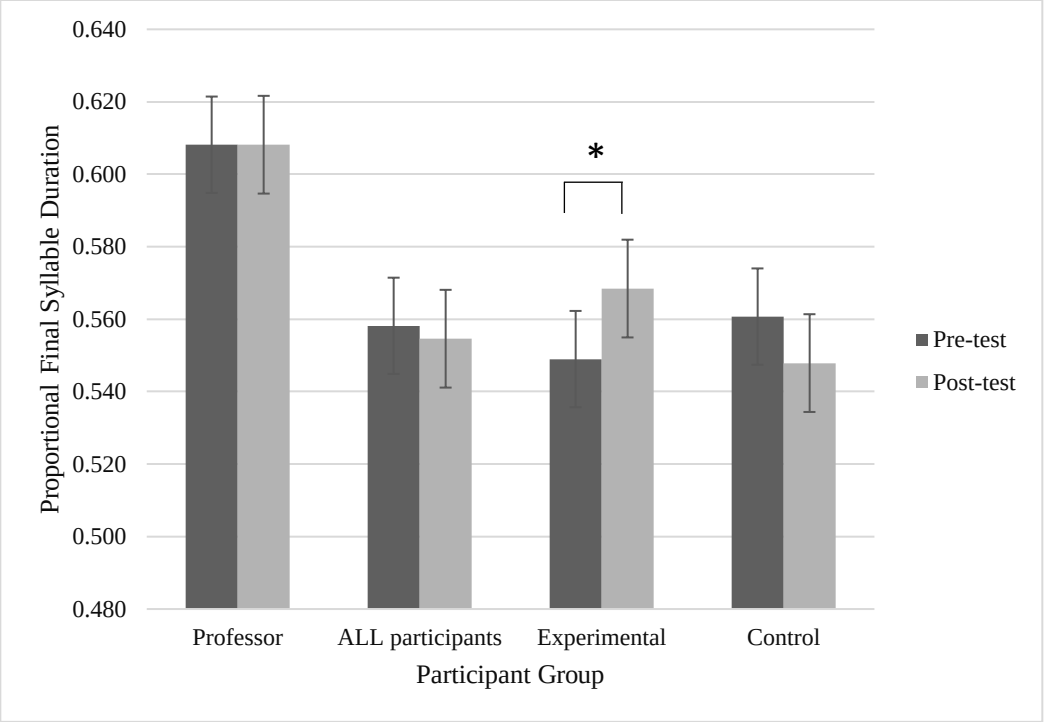

Figure 3: Mean proportional final syllable duration: Pre-test vs. post-test data

Table 5: Paired t-test of proportional final syllable duration between tests

	Pre-Test		**Post-Test**		**Paired T-Test**	
Group	**Mean**	**SD**	**Mean**	**SD**	**t**	**p**
Experimental	0.549	0.131	0.568	0.129	-2.066	0.041*
Control	0.561	0.127	0.548	0.129	0.376	0.708

I first conducted a linear mixed-effects model that included two random effects—participant (e.g. Participant 1, Professor) and word (e.g. étagère, fiancé)—to test for the inclusion of these variables as random effects. Both of these variables demonstrated significant effects ($p<0.05$), showing that participant and word served as random factors in the experiment. Subsequently, I ran the full linear mixed model with the two random effects and three fixed effects. The fixed effects included the variables of group (experimental, control, or professor), test (pre-test or post-test), and word type (existing or novel). None of the fixed effects showed significant

interactions ($p>0.05$), indicating that there was not a main effect based on group, test, or word type. This result prompted further analysis focused on each variable.

I tested for improvement over time, or the effect of the test variable (pre-test vs. post-test), through paired t-tests (see Table 5). A paired t-test comparing the experimental group's pre-test and post-test results demonstrated a significant effect of the intervention in the predicted direction [$t(99)=-2.066$, $p=0.041$]. A paired t-test comparing the control group's pre-test and post-test results did not demonstrate a significant effect of the study[16] [$t(91)=0.376$, $p=0.707$]. As the experimental and control groups' pre-test scores did not demonstrate significant differences in an independent two-tailed t-test [$t(189.44[17])=-0.626$, $p=0.532$], the differences in improvement between the experimental and control groups was not due to an initial advantage held by a particular group.

I tested for improvement in relation to the target proportional final syllable duration through independent two-tailed t-tests (see results in Table 6). A t-test between the experimental group's post-test data and the target data showed no significant difference between the two groups [$t(28.95)=1.355$, $p=0.186$]. Contrastingly, a t-test between the control group's post-test data and the target data demonstrated that there did exist a significant difference between the two groups [$t(28.99)=2.057$, $p=0.049$]. This test confirmed the noted trend that the experimental group performed closer to the target than the control group.

Table 6: Independent two-tailed t-test of proportional final syllable duration between target and participant post-test data

	Target Data		**Participant Data**		**T-Test**	
Group	**Mean**	**SD**	**Mean**	**SD**	**t**	**p**
Experimental	0.608	0.115	0.568	0.129	1.355	0.186
Control	0.608	0.115	0.548	0.129	2.057	0.049*

[16] The reason for the difference in the degrees of freedom (df) between the experimental and control group is the fact that eight observations of a control participant's pre-test data were missing because of technical issues (see section *3.2.6* for further detail).

[17] The Welch Two Sample t-test on RStudio uses the Welch (or Satterthwaite) approximation to the degrees of freedom, which can result in a degrees of freedom that is not an integer (RStudio Team, 2018; Welch, 1938).

Finally, I tested for the generalization of knowledge of French rhythm to novel words through paired t-tests between pre-test and post-test results for existing and novel words among the experimental and control groups. This statistical analysis did not indicate any effects, likely given the small sample size that resulted from running paired t-tests between such small subgroups of the data (*N=50* for each of the subgroups). Although I did not find any significant effects, the experimental group showed greater growth in scores for both existing and novel words than the control group (see Table 7). Additionally, the paired t-test between the experimental pre-test and post-test results for the existing words showed significant differences at a 90% confidence level. However, the paired t-test between the experimental pre-test and post-test results for the novel words did not show significant differences. These results demonstrated that participants did not generalize knowledge of French rhythm to new words.

Table 7: Paired t-test of proportional final syllable duration between tests based on word type

		Pre-Test		**Post-Test**		**Paired T-Test**	
Word Type	**Group**	**Mean**	**SD**	**Mean**	**SD**	**t**	**p**
Existing	Experimental	0.550	0.145	0.574	0.128	-1.705	0.095
Existing	Control	0.554	0.139	0.544	0.148	-0.191	0.850
Novel	Experimental	0.548	0.119	0.563	0.131	-1.186	0.241
Novel	Control	0.567	0.118	0.552	0.109	0.692	0.493

3.3.3 Intensity

Results from intensity analysis did not show significant effects for any of the research questions. This lack of significance was likely due to the imprecision of the measure, which was general variance in intensity between all syllables of a word.[18]

[18] See section *3.4.2* for further explanation.

3.4 Discussion

3.4.1 Syllable Duration Acquisition

In accordance with scholarship on patterns of stress and rhythm in French (Hirst & Christo, 1998), the target speaker did demonstrate elongated final syllables relative to other syllables in the stimulus words. The target speaker's mean proportional final syllable duration was 0.608, which proved the extent to which robust final syllable lengthening occurs in French for two, three, and four syllable-long words. The participants as a group had a mean proportional final syllable duration of 0.556 on the pre-test, with none of the participants' individual means surpassing 0.590, which illustrated that the participants had not yet acquired the final syllable lengthening rule at the beginning of the study in a manner comparable to that of a highly proficient French speaker. This finding is unsurprising given that the participants were in the beginning of their first semester of college-level French. The objective of the study was to test if the CALL intervention assisted experimental participants in acquiring the final syllable lengthening rule.

The results indicate that the intervention was effective in facilitating the acquisition of the final syllable lengthening rule for words present in the intervention. The experimental group showed improvement over the course of the study, whereas the control group's scores decreased. The control group's results were likely the result of random variation, as the control and experimental pre-test scores were not significantly different, and the two groups had in theory the same exposure to French outside of the study through the French 101 course. Additionally, the control group's post-test scores were significantly different from the target scores, while the experimental group did not show a significant difference from the target scores. These findings proved the efficacy of the Praat intervention.

Although the experimental group showed improvement overall, the group's phonetic acquisition was not generalized to novel words. The experimental group performed slightly but not significantly better than the control group on novel words in the post-test, and their growth over the course of the study was not significant for novel words. This finding demonstrated that this Praat intervention did not facilitate the application of knowledge about final syllable lengthening to words beyond those present in the intervention.

3.4.2 Limitations & Future Directions

As previously mentioned, the small sample size of this study (*N=10*) may have limited the study's statistical analyses and the generalizability of results. Given time and resource constraints, this study could not exceed a sample size of 10 participants. Future studies might benefit from expanding the study to include more participants.

Secondly, the eight missing observations from a control group member's pre-test may have slightly altered the study's results. Researchers might confirm the quality of recordings on Praat more frequently to ensure that their files do not become corrupted or lose quality.

Thirdly, the lack of findings regarding intensity might be remediated by using a more precise measure of relative final syllable intensity than the standard deviation of the intensities of each syllable of the word. The standard deviation measured relative final syllable intensity indirectly, as it is only an indicator of the overall variance in the intensity of each word's syllables. This measure is likely too imprecise to capture phenomena in the final syllable; unaccounted increases or decreases in intensity in prior syllables could have skewed the standard deviation so that it would not have demonstrated final syllable phenomena as clearly. Future studies ought to use a more precise measure, which would account specifically for the distinction of the final syllable relative to other syllables.

In addition, the study might benefit from expanding beyond words in isolation to include phrases and sentences as stimuli (Hirst & Di Cristo, 1998). French demonstrates patterns of phrase-final stress, through which the final syllable of the final word of a phrase typically shows augmented intensity and length (Darcy, Tremblay, & Simonet, 2017). Therefore, placing the stimulus words in carrier phrases or sentences may assist learners in acquiring additional aspects of French stress. Studying words in their phrasal or sentential context will also more closely approximate communication outside of a laboratory setting.

Future studies would also benefit from diversifying the varieties of French represented in the study. The presence of only one variety of French—the variety of an educated woman from southwestern France—was certainly a limitation. The inclusion of an educated, continental French variety was not intended to enforce standard language ideologies that assert the superiority of this variety of French. Although the limited resources for this study did not permit the inclusion of multiple, diverse French varieties, this limitation ought to be addressed in future research.

The length of the study was not a limitation, based upon Grgurović, Chapelle, and Shelley's (2013) finding in their meta-analysis of CALL studies that length of intervention is not a critical factor in the success of a CALL intervention. However, it may be interesting to extend the study for a longer duration, charting the phonetic acquisition of the participants over the course of their first two semesters of college-level study. It may also benefit researchers to study students' retention of implicit and explicit, metalinguistic, French phonetic knowledge after the end of the intervention to gauge the stability of the intervention's results.

Finally, future studies ought to investigate how this experiment might be adjusted to result in generalizable phonetic acquisition. The small sample size and the low proficiency level of the participants might have been responsible for this lack of effect. The students' limited prior

experience learning French might have resulted in them exerting unnecessary caution with rule generalization. Additionally, increasing the number of stimulus words might increase the contexts in which students are exposed to the rule, facilitating rule generalization. As the intent of the CALL program is to help students acquire aspects of French phonetics that they will apply in natural speech, it would be of value to maximize the generalizability of learning in the intervention.

3.4.3 Pedagogical Application

One unique aspect of this study design is the fact that I, the researcher, acted as a facilitator of CALL use. As Praat was not designed specifically for facilitating prosody learning, the program lacks an interface that could have guided students autonomously through this intervention. Due to the short period of the intervention, I felt that I would not be able to train students sufficiently to use the software autonomously. Therefore, I served as a facilitator of Praat use. However, much of the intervention was student-guided and could have been autonomous if students had received more training on how to use Praat; Olson (2014a) proved that students can learn how to use Praat independently for phonetic learning when provided with sufficient instruction. Although I led students to uncover feedback through the questions I asked and the notes that I made while examining their waveforms and spectrograms, students would be able to assume these responsibilities if they had greater familiarity with Praat. Teachers could thus provide students training in using the software and similar guiding questions to those used in this study in order to make the intervention autonomous.

I aligned instruction in the intervention with SLA principles in order to produce a CALL program that met Blake's (2008), Leakey's (2011), and Levy's (1997) requirements of CALL programs to be grounded in theory. The instructional style was *inductive* and *learner-centered* in that students were asked to generate rules based upon their interpretation of the data that they were

provided. The instruction at the end of each word's lesson was also *explicit* in that we discussed means of approximating a target articulation in metalinguistic terminology. I chose to include this particular instructional style because SLA theory stresses the importance of student-led discovery of knowledge and production using this knowledge (Blake, 2008; Paesani et al., 2016), which I catered to through the inductive approach. The instruction at the end of each word's lesson was explicit in order to ensure student comprehension and to formulate guidelines for future action in the short amount of time that the study allowed. Given the demonstrated efficacy of this intervention and the alignment of the intervention with CALL theory, French instructors might consider adapting this intervention for use in their courses.

The Praat intervention also offers practical, pedagogical advantages. As the French 100-level coordinator identified in the case study, CALL programs like MindTap are often costly for departments and students. It is certainly true that MindTap and similar programs are designed more intentionally for pedagogical purposes than Praat and, therefore, often offer more advanced options for feedback and user-program interaction. However, the benefits that Praat offers in terms of price, ease of access, precision and breadth of phonetic information, and efficacy for learning may outweigh its costs in terms of interface and feedback sophistication (Olson, 2014a). This decision remains to be made by language programs based upon their curricular and departmental goals and the human and technological resources available.

3.5 Conclusion

This study intended to expand knowledge of the applicability of Praat, a CALL resource offering audio-visual feedback, for L2 French suprasegmental acquisition. The results indicated that the Praat intervention was effective in facilitating the learning of French-specific patterns of

stress and rhythm for words present in the intervention. The participants did not generalize learning robustly to novel words, which might have been a function of the small sample size and beginner status of the participants. Despite the lack of evidence of generalization, the efficacy of the intervention demonstrated that audio-visual CALL tools such as Praat are effective for acquisition of suprasegmental information as well as segmental acquisition. This finding is important given that prior research has never tested the utility of Praat for suprasegmental acquisition, especially in L2 French.

Additionally, the study proved that quantitative, computerized means of calculating students' acquisition function effectively to measure efficacy in CALL studies. As these measures offer greater objectivity than the human-rater measures, the standard in prior CALL studies (De Bot, 1983; Grgurović et al., 2013; Hardison, 2004; Olson, 2019), CALL researchers might benefit from employing similar measures in future studies.

This study showed that Praat offers significant potential for pedagogical application. Through greater initial training of students, language instructors could transform this Praat intervention into an autonomous learning program. The advantages that this program would offer in terms of inductive, student-directed learning and the multimodality of feedback and accuracy of phonetic information that Praat provides might render Praat a very effective resource for L2 phonetic acquisition.

IV. Conclusion

The present study expanded knowledge of the current state and the potential of CALL resources in a beginner, college-level L2 French program. In response to a need for greater methodological variation to ensure validity in CALL studies, the present study described technology use in the French program from multiple angles. The two primary approaches included a case study and an experimental study. The case study featured classroom observations, instructor interviews, syllabus analysis, and student self-report questionnaires. Synthesizing the data from these sources allowed the study to present a multifaceted perspective on how students, instructors, and the department integrated, interacted with, and appraised CALL in the language program. The experimental study complemented the case study by testing the efficacy of one specific CALL program, Praat, using a pre-test, post-test design and a visual feedback paradigm. Given the paucity of research on Praat interventions for facilitating suprasegmental acquisition in L2 French, the experimental study also filled this gap in the literature. In responding to field-specific needs, the present study advanced the standards for validity in CALL studies and contributed novel information about suprasegmental acquisition and CALL implementation.

The case study first answered the question, "How do language departments and instructors implement digital technology in the curriculum and in the classroom?" Classroom observations revealed that instructors incorporated approximately three CALL resources into each lesson. Among these resources, instructors included presentations in PowerPoint for almost all of instructional time and integrated multimedia resources, such as YouTube, Vimeo, and Podcast Français Facile, for 10-30 minute intervals. Outside of class, students followed the instructors' and curriculum's expectations of spending 3-4 hours per week completing homework on the online learning platform MindTap. Students also completed three multimedia group projects using

resources for presentation and digital production including PowerPoint, Canvas Studio, and VoiceThread. The large portion of the course grade dedicated to CALL-based assignments, the frequency of CALL use inside and outside of the classroom, and the attention and deference that students gave to CALL resources demonstrated that CALL received great authority and value in this program.

The department and instructors' choices to implement educational technology in the curriculum and classroom reflected theoretical and practical concerns. Following the multiliteracies framework for language teaching, the department prioritized multimodal learning and the development of digital literacies through the inclusion of several genres of digital texts. Additionally, assigning MindTap as daily homework increased students' time-on-task, facilitated a learner-centered pedagogy, and heightened students' noticing through automatic feedback. Through the inclusion of culturally authentic materials such as videos on YouTube and Vimeo, the instructors and department emphasized the development of cultural competence. Students also honed cultural competence through the critical textual analysis and production that they completed in the collaborative multimedia projects. While not all resources allowed for full learner-centeredness or cultural authenticity, the instructors' and department's implementation of CALL resources showed that they were adhering to many of the multiliteracies framework's recommendations regarding CALL use.

The second research question asked, "How do students interact with and appraise their digital technology use for French language learning?" While interacting with PowerPoint, students read from and referenced the presentations throughout class. Students focused their attention on the presentations, similarly to how they dedicated attention to their instructor. While interacting with the videos and podcast, the students engaged in the activities that the instructor crafted based

upon the media included in the lesson. The students designed meaning by asking questions and inquiring about unfamiliar vocabulary. In the case that students felt overly challenged by the activities, they did not fully complete the assignments or articulated the issues to their instructor. In general, the students participated in and devoted attention to pedagogical activities involving interaction with CALL resources.

Students positively appraised digital technology use generally. When describing their instructors' inclusion of CALL in the classroom, students used verbiage emphasizing the helpful and interesting qualities of the CALL resources. Students also indicated that they use several CALL resources independently of class assignments, including videos, music, and social media. When asked about MindTap, students expressed less positive sentiments than for CALL overall. Students' frustrations related to the perceived rigidity and impersonal quality of feedback and the incompatibility between the intended proficiency level of MindTap homework and the proficiency level of students. Nonetheless, some students praised the effective, helpful, and easy to use qualities of MindTap. Students' overall optimistic appraisals of digital technology use in the classroom indicate a clear potential for CALL development and usage in this learning context and in similar contexts.

The experimental study addressed the final research question, "How effective are pronunciation interventions that use technology to provide audio-visual feedback at contributing to generalizable phonetic development?" The study assessed the extent to which a targeted Praat intervention assisted students in acquiring French-specific suprasegmental features, specifically patterns of increasing the length and intensity of word-final syllables. Results demonstrated that the intervention was effective in helping students to acquire the final syllable lengthening rule. Results for students' acquisition of patterns of intensity were inconclusive, indicating a need for

refinement of the measure. The intervention resulted in suprasegmental acquisition among intervention words, although the participants did not show significant evidence of generalization of learning to novel words. Further studies would benefit from expanding sample sizes and investigating factors in the participant population and in the intervention that may have prevented generalization. Despite insignificant generalization of learning, the improvement in prosody learning of participants in the Praat intervention confirmed Praat's efficacy for L2 French suprasegmental acquisition.

The present study was intended to inform instructors and language programs about how CALL has been and could be implemented in language classrooms. The case study's explanation of how CALL intersected with departmental, curricular, instructor, and student goals and actions might serve as a resource for the organization of other programs. In referencing the theoretical and applied basis of CALL use, the case study aimed to reveal how theory has been and could be translated into practice in language programs. Discussion of student sentiment regarding CALL might inform instructors' decisions of which digital resources to include in the curriculum and how to include them to cater most effectively to student needs. The experimental study's discussion of how language programs might adapt the Praat intervention to classroom settings could facilitate L2 French suprasegmental learning. Given the current rapidity of digital shifts, studies of this nature may become increasingly essential in order to capture the actual state as well as the potential of digital technology for language teaching and learning.

Appendix A: Student CALL Questionnaire

Table 2: Student CALL Questionnaire Questions & Rating Scale

Questions	Rating Scale
1. In French 101 class, how often does your professor use technology as part of his/her lesson and class activities? Technology includes videos, websites, music, etc.	*Likert scale (1-7)* 1: never 7: very frequently
2. How many hours per week do you spend completing MindTap homework exercises?	*Numerical entry*
3. How would you evaluate the MindTap program as a whole?	*Likert scale (1-7)* 1: strongly dislike 7: strongly like
4. How effective do you think your MindTap homework exercises are in helping you to learn French?	*Likert scale (1-7)* 1: not at all effective 7: very effective
5. How would you evaluate your interactions with the MindTap website?	*Likert scale (1-7)* 1: strongly negative 7: strongly positive
6. Outside of MindTap homework, how many hours per week do you spend learning French through digital technology outside of class? (This could be through listening to podcasts, watching YouTube videos, doing online exercises, etc.).	*Numerical entry*
7. How would you evaluate your attitudes toward using technology to assist with learning a language? (This can be from your experiences learning French as well as other languages, if applicable).	*Likert scale (1-7)* 1: strongly negative 7: strongly positive

Appendix B: Student CALL Questionnaire

Table 3: Student CALL Questionnaire Pre-Test Descriptive Statistics and Summary

Note: The optional elaboration section consists of direct quotations of the responses of all students who chose to provide responses. The quotations were not edited.

Factor	Question	Mean	SD	Optional Elaboration
Evaluation of CALL use in class	In French 101 class, how often does your professor use technology as part of his/her lesson and class activities? Technology includes videos, websites, music, etc.	6	0.89	• Powerpoints and videos • videos, power points • We often begin class with a French music video, use powerpoints and other online resources that help with learning French • Most often she uses PowerPoints • She uses Power points and present french videos (cartoon or song) • technology guides our everyday lessons • We sometimes watch videos of music or parts of the movies in french • My professor often use some vivid tools and interesting language learning materials to help us know French culture and French language.
Evaluation of the use of MindTap for homework	How many hours per week do you spend completing MindTap homework exercises?	3.2	0.95	• I make the effort to write all the new vocabulary down each day, so it takes a longer time for me to complete MindTap homework • Most of it is spent in confusion as to how an answer is incorrect I believe to be correct. • Sometimes mindtap gets very hard. And there is no specific hint if you miss the question few times. • One day's homework contains several tasks which includes listening, reading and grammar, I typically spend 1-1.5 hour per day on my French assignment.

Evaluation of the use of MindTap for homework	How would you evaluate the MindTap program as a whole?	4.6	0.80	• I often times feel like Mind Tap presents questions that are too difficult for a beginner's French class. For instance, I feel like passages often include words and phrases that are unfamiliar, and I also feel as if audio recordings of French speakers are too fast and unnecessarily wordy. • More chances and smaller assignments. • Sometimes, it is not that easy to understand.
Evaluation of the use of MindTap for homework	How effective do you think your MindTap homework exercises are in helping you to learn French?	5.2	1.08	• I feel that the MindTap exercises are helpful in applying grammar and vocabulary. • the translations are useful for new vocabulary words but it can be difficult hearing the pronunciation. • I wish the "review it" tap on the right for harder assignments can be accessed easily without going to that assignment. (since everything is organized in one page) • slightly effective because you can still complete the majority of the assignments without full effort • It helps me learn the language materials and then exercise with the knowledge just learned.
Evaluation of the use of MindTap for homework	How would you evaluate your interactions with the MindTap website?	4.8	1.33	• It is sometimes difficult to use. • It's an easy to use website for the most part which I like • I think that MindTap is an effective way to learn French. I appreciate the way that it offers notes and videos, as well as questions to evaluate my learning, however, I feel that it is too challenging for someone who has never taken French before. • The website is very slow to load.

				• it is very helpful in my language learning process.
Evaluation of CALL generally	Outside of MindTap homework, how many hours per week do you spend learning French through digital technology outside of class? (This could be through listening to podcasts, watching YouTube videos, doing online exercises, etc.).	1.2	1.05	• I mostly use the mindtap. • I will watch videos or songs in french ocassionly • I tend to watch Netflix movies or shows with French subtitles on, just to familiarize myself with common words or phrases. • Listening to music or from reading social media accounts that are in french. • I sing french classics, and I sometimes need to sit down and study them. Besides those, I might watch french moves but rarely. • I watch French movies, listen to French songs.
Evaluation of CALL generally	How would you evaluate your attitudes toward using technology to assist with learning a language? (This can be from your experiences learning French as well as other languages, if applicable).	5.9	0.83	• I like to hear how certain words are supposed to sound • I feel that technology offers so many resources in either helping me learn, review, or practice French. Especially through the use of MindTap, online translators, videos, and review websites. • If the technology was improved upon it could be very beneficial.

Appendix C: Student Demographic Questionnaire

Question Number	Question	Possible Response
1	First and Last Name	(short answer text)
2	Date of Birth	MM/DD/YY
3	Age	(short answer text)
4	Gender	Female Male Other (write in) Prefer not to say
5	Which section of French 101 are you in? Please the name of your professor and the time of your class meetings (e.g. 10am) or the number of your section (e.g. section 1).	(short answer text)
6	Please list your major(s) and minor, if applicable	(short answer text)
7	Have you learned French at all before taking French 101 this semester?	(long answer text)
8	Does anyone in your immediate family speak French? Would you consider yourself a heritage learner of French?	Yes No Other (write in)
9	Are you proficient in any other languages? If so, please list the language and your proficiency (bilingual, advanced, intermediate, novice)	(long answer text)
10	Where were you born? If you were born outside of the US, at what age did you come to US? If you have lived outside of the US, describe where and the age range during which you lived outside of the US.	(long answer text)
11	Have you been to a French-speaking country before? How many times and when was the most recent visit? How long have you stayed there? For what reason?	(long answer text)
12	Where do you speak French (e.g. in class, with friends/conversation partners, at home)? If you have to quantify your language usage, what percentage would be in English vs. French vs. other languages?	(long answer text)
13	How many hours do you spend speaking/listening to French in an average week?	(short answer text)
14	What are the main reasons that you are taking French (or you are not taking French) as a language course?	(long answer text)

Appendix D: Pre-Test and Post-Test

Please pronounce each the following words twice at a normal volume with pauses between each pronunciation of each word.

1. fenêtre
2. commerce
3. frigo
4. séance
5. étudiant
6. pantalon
7. janvier
8. fiancé
9. entreprise
10. ordinateur
11. horloge
12. hiver
13. jumelle
14. médecin
15. lumière
16. librairie
17. téléphone
18. étagère
19. randonnée
20. amphithéâtre

Appendix E: Interventions

Intervention 1:

Please pronounce each word one at a time at a normal volume:

1. tableau
2. médecin
3. examen
4. résidence
5. amphithéâtre

Intervention 2:

Please pronounce each word one at a time at a normal volume:

1. hiver
2. chômage
3. réveil
4. garçon
5. librairie
6. étagère
7. chemisier
8. oreiller
9. ouvrier
10. supermarché

Intervention 3:

Please pronounce each word one at a time at a normal volume:

1. jumelle
2. lycée
3. piscine
4. licence
5. lumière
6. randonnée
7. parapluie
8. appareil
9. cinéma
10. natation

Intervention 4:

Please pronounce each word one at a time at a normal volume:

1. horloge
2. prénom
3. téléphone
4. pompier
5. calculatrice

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