HOW TO SYNCHRONIZE? A STUDY OF VIDEO-BASED, VOICE-BASED & TEXT-
BASED SYNCHRONOUS COMPUTER-MEDIATED COMMUNICATION, WORKING
MEMORY, AND SECOND LANGUAGE LEARNING

A Dissertation
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Doctor of Philosophy
in Spanish and Portuguese

By

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Washington, D.C.
June 12, 2018
HOW TO SYNCHRONIZE? A STUDY OF VIDEO-BASED, VOICE-BASED & TEXT-BASED SYNCHRONOUS COMPUTER-MEDIATED COMMUNICATION, WORKING MEMORY, AND SECOND LANGUAGE LEARNING

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ABSTRACT

The growing presence of Synchronous Computer-Mediated Communication (SCMC), defined as ‘real-time, synchronous conversation that takes place online’ (Baralt & Leow, 2016, p. 200), via video-chat programs such as Skype in online language courses has been documented in the literature (Ziegler, 2016c). While research up to now has shown that text-based SCMC impacts positively on second language (L2) learning, the effects of video- and voice-based SCMC still need to undergo a formal investigation as a means for effective L2 instruction. On the other hand, the role of working memory capacity (WMC) in the SCMC mode has begun to be explored in previous research but only for text-based SCMC, whereas oral SCMC has yet to be addressed.

Using a controlled experimental design, the current dissertation helps fill these gaps in the literature by investigating the potential of these three SCMC modes (text-based, voice-based, and video-based) to promote L2 Spanish grammatical learning. Additionally, it addresses whether WMC mediates the effects of mode for L2 learning. Sixty-five intermediate L2 Spanish learners completed an interactive task in one of these three environments that targeted the learning of Spanish past subjunctive, a complex structure thought to be difficult to learn for L2 learners of Spanish (e.g., Collentine, 2010). Grammatical learning was assessed via pre-, post, and delayed posttest of written and oral production.
Results from a series of several repeated-measures ANOVAS, ANCOVAs, and correlational analyses indicate that participants in the three SCMC modes learned the past subjunctive and many retained that learning one week after the treatment, and that this learning was not significantly different across groups. No effects were observed for WMC, indicating that participants across the WMC spectrum successfully achieved grammatical learning under the given explicit experimental conditions. Finally, participants in the text-based group took a significantly longer time to complete the task than the other two groups, although they needed significantly fewer feedback episodes than participants in the voice-based group to achieve similar rates of learning. These findings point to the importance of designing theoretically motivated learning tasks that can promote meaningful interaction in written and oral SCMC environments for L2 grammatical learning.
ACKNOWLEDGEMENTS

Thank you so much to my committee members, to my family, to my fiancé, my friends, my professors and my students.

To Ron, for being the most wonderful dissertation director, academic father, language program director (LPD), boss, professor, and colleague I could have wished for. You have been a continuous source of support, inspiration and guide. You have taught me to think and read research critically, for which I will be forever grateful. You have pushed me to work and excel but have also listened to me when the path got rough or offered me your shoulder when I needed to cry. I would not be here without you. Also, thank you for writing my letters of recommendation and guiding me in the job search. I admire you as a professional, writer, scholar, LPD, but I admire you the most for being an amazing person.

To Cristina, for being an amazing committee member, scholar, boss, and colleague. Thank you for helping me during these five years, and especially during my dissertation period. Thank you for allowing me to work for you as a teaching assistant for three semesters and learn so much for you. Thank you for always encouraging my best work in your seminars, and for taking me to Barcelona and letting me work side by side with you on site. Also, thank you for writing my letters of recommendation and guiding me in the job search. I have learnt so much from you in all these different scenarios! Finalmente, gracias por poner siempre la nota de humor a todas las situaciones, por ser cómo eres, por las increíbles fiestas en tu casa, ¡y por hacer que estos cinco años hayan sido tan divertidos!

To Luis, for being such an incredible SCMC and CALL connoisseur, committee member, scholar, and colleague. I have been so lucky to have you in my committee, and work with you this past year and half. Thank you for your comments, feedback, conversations, and support. This dissertation is stronger thanks to you. Thank you for allowing me to read your work and benefitting from having your CALL expertise put into my dissertation. Finalmente, gracias por habarme hecho reír tanto en todos nuestros encuentros, ¡has hecho que este proceso fuera mucho más agradable y divertido! Te admiro mucho como profesional y persona.

To my wonderful fiancé, Taylor, because this would not have been possible without you. You are the best thing that has ever happened to me, and you have been my everything this past year, including my main source of happiness, laughter, encouragement and motivation. Thank for not
allowing me to go crazy, for always keeping me grounded, for always giving me a reason to continue, for allowing me to see the other side. Thank you for knowing me better than I sometimes know myself, you make me a better person and you make everything better! You have not given up on me even when I had myself, and for that, I will be forever grateful. In May, when I was unbearable, you were so patient, sitting down next to me in ‘the ball’, offering me your help with everything (excel, graphs, food, haha). I cannot believe I found a person like you to spend the rest of my life with, but I am so happy and grateful I did. Thank you for cooking every meal these past two months, for all the relaxing moments, for your written and oral feedback, for the (oh so many times) I rehearsed my presentations with you. You were as tough as my committee members! Thank you for being like you are! I love you to bits!

A mami y papi, Luis y Pablo. Mami, te quiero y te admiro. De ti he aprendido tu espíritu de superación y a no dejar de luchar. Gracias por tu apoyo incondicional, por siempre estar ahí, por escucharme, por ayudarme a cumplir mis sueños, y por no retenerme y dejarme ir, aunque para ti no haya sido siempre lo más fácil. Eres la mejor madre y amiga de mi mundo, y la mejor persona que conozco. ‘De mayor quiero ser como tú’. Gracias papi, por apoyarme y quererme, por llevarme y traerme al aeropuerto, por ser fuerte y animar a mami cuando me voy, por darme siempre ánimo, te quiero. Gracias Luigi por quererme y admirarme tanto, por ser mi fotocopia en color masculina versión mini (¡aunque ya no tan mini!). Gracias por estar siempre al otro lado, por estar y ayudar a mami. Te quiero y te admiro, porque sé que tu persistencia y tesón te llevarán muy lejos. Gracias Pablo por ser tan bueno, por quererme, por ser mejor hermano y amigo cada día. A los cuatro, habéis sido mi razón de luchar estos cinco años y os quiero con locura.

A mis amigos aquí y allí, gracias por vuestra amistad, vuestra comprensión y vuestro apoyo. A Tradi/Tra, mi bestie, mi gurú, mi media langosta. Gracias por estar SIEMPRE ahí en los últimos 14 años. Tenerte siempre a mi lado y saber que siempre estarás es la mejor sensación del mundo. Gracias por tus visitas a Salamanca, por nuestras conexiones (¡London-Linz entre otras!), tus audios, tus llamadas, tus Skype, por tus sorpresas de cumple, por tu regalo de doctorado, por comprarme el tren a tu boda. Por tanto. Gracias por ser tan buena amiga y persona, te quiero muchísimo. Gracias Jafte, Gesen, y María Mateos, por ser mi otro yo, por entenderme y apoyarme siempre, en persona y por teléfono. No sé qué hubiera hecho todo este tiempo sin vosotras. Habéis sido mi paño de lágrimas cuando he estado mal y mis compañeras de
risas y aventuras cuando teníamos algo que celebrar. Jafte y Gesen, amigas, vecinas, mi familia en DC. Sois lo mejor que me ha pasado en esta ciudad. Sé que no en DC no me siento sola gracias a vosotras. Habéis estado ahí desde el primer día de este doctorado hasta el último, para TODO, y sé que esta amistad seguirá toda la vida. Os adoro. María Mateos, desde peques juntas hasta hoy ¡y lo que queda! Gracias por estar siempre al otro lado, por entenderme con y sin palabras, eres como una hermana para mí, ¡’como dos gotas de agua’! Te quiero mucho, y sé que siempre estaremos ahí, como yoleras, amigas, hermanas. Nuestros audios interminables siempre hacen reír y llorar. Gracias por ser mi reflejo, y hacerme sentir que no estoy loca, jaja. Gracias Fito, por siempre estar ahí, por ser mi amigo a lo largo de tantos años, por tantas aventuras juntos. Eres un gran amigo y te quiero mi capitán.

Gracias al resto de mi familia, a las vidis, y a mi familia política, por compartir siempre mis alegrías como si fueran vuestras. Gracias al resto de mi familia en DC, Gabriela, Janire, Chrissy y Meagan. Habéis hecho de estos cinco años una delicia, gracias por compartir tantos momentos conmigo, buenos y malos, y siempre hacerme sentir querida. Gabi, mejor roomie del mundo. Gracias por tu apoyo siempre, por escucharme, por comprenderme, y por ser como eres. Te quiero mi pequeñita. Janire, roomie, colega y amiga, te quiero mucho. Chrissy, admiración total por esta mujer y madre de los pies a la cabeza, te admiro y te quiero. Meagan, pura dulzura y amor, gracias por ser tan tú, boluda, te quiero. Gracias María Gómez, por aparecer en mi vida y hacerla mejor, por ser tan tú, boluda, te quiero. Gracias por tu apoyo siempre, por escucharme, por comprenderme, y por ser como eres. Te quiero mi pequeñita. Janire, roomie, colega y amiga, te quiero mucho. Chrissy, admiración total por esta mujer y madre de los pies a la cabeza, te admiro y te quiero. Meagan, pura dulzura y amor, gracias por ser tan tú, boluda, te quiero. Gracias María Gómez, por aparecer en mi vida y hacerla mejor, por ser tan tú, boluda, te quiero. Gracias por tu apoyo siempre, por escucharme, por comprenderme, y por ser como eres. Te quiero mi pequeñita. Janire, roomie, colega y amiga, te quiero mucho. Chrissy, admiración total por esta mujer y madre de los pies a la cabeza, te admiro y te quiero. Meagan, pura dulzura y amor, gracias por ser tan tú, boluda, te quiero. Gracias María Gómez, por aparecer en mi vida y hacerla mejor, por ser tan tú, boluda, te quiero.

Gracias a mi amiga de corazón, Mina Niu, por ser mi mejor amiga, mi colega, y mi tabletita de guardería. Gracias por ser mi apoyo en todo, por ser mi reflejo, y por ser mi amiga. Te quiero muchísimo, Mina. Y a mis padres, por ser mi apoyo en todo, por ser mi reflejo, y por ser mi amiga. Te quiero muchísimo, mamá y papá.
life much smoother! Thank you for your advice, understanding, mentorship and friendship. Thank you to my later mentors, Celia Zamora and Allison Caras (Hoya Salamanca!), because you walked me through the intricacies of the last PhD years! Thank you so much for your mentorship and friendship. Thank you to my other colleagues at Georgetown (Sergio Adrada, Natalia Curto, Ángela Donate, Oscar Amaya, Marisa Filgueras, Ariel Zach, Alfredo Poggi, Yoel Castillo, Ana María Ferreira, Ivan Espinosa, John Chi) and my friends in the US and Spain (María Fraile, Alejandra, Anders, Manu, Vero, Lara, Bea, Silvia, Celia, Elisa, Clara, Laura, Carmen). To Nick Pandza, for being the best stats consultant ever! Thank you for being so helpful and sweet when I did not understand the stats! You are a great consultant and friend!

To my Georgetown students, who have made me love what I do and have contributed so much to my identity. Thanks for making my days so fun and interesting, you always say in your evaluations I have so much energy, but really, you are the ones energizing me! To my dissertation (and other studies) participants! Without you this dissertation would not have been possible.

To my B.A. and M.A. professors in Madrid and Salamanca, for all your passion and encouragement, letters of recommendation, and most of all, for making me start loving languages and linguistics! To Héctor Campos, from whom I have learnt so much, specially how to be an amazing educator. I admire you and have immense affection for you. Thank you for your mentorship, for sharing an office with me, for trusting me and seeing potential in me, for having me as your academic goddaughter. To the rest of my Georgetown M.S. professors, Thomas Walsh, Elena Herburguer, Alfonso Morales-Front, Lourdes Ortega, John Norris, Allison Mackey, John Davis, Luke Plonsky, and Rusan Chen. To Gwen Kirkpatrick, for being such an amazing human being, and to Kristen Hall and Haley Lentz, for everything you have done for me.

Finally, to my future students, I hope there are many of you in the upcoming years. I hope you keep contributing to make me who I am and who I hope to keep transmitting you my love for Spanish and Linguistics!

Many thanks,
Alexandra Martin
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CHAPTER 1: INTRODUCTION

The Statement of the Problem

The use of computer-assisted language learning (CALL), defined as “any process in which a learner uses a computer, and as a result, improves his or her language” (Beatty, 2010, p. 7), has grown during the last few decades in the second and foreign language classrooms. This rapid increase has been reflected in the growing number of distance-learning and hybrid courses in higher education contexts (Blake, 2007; Leow, Cerezo, & Baralt, 2016; Ziegler, 2016a).

The field of applied linguistics has witnessed a coming of age of the field of CALL (Plonsky & Ziegler, 2016), with increasing use of design features and theoretical underpinnings from mainstream second language acquisition (SLA) research, improvements in research techniques, and over 20 meta-analyses addressing several aspects of second language (L2) development. Overall, meta-analytic research seems to support the effectiveness of CALL for L2 learning, but these results should be interpreted carefully due to the holistic nature of meta-analyses, as will be discussed below.

Given the encompassing nature of CALL, it is important to classify its multiple applications into two main categories: e-tutors and the computer as a medium (Cerezo, Baralt, Suh, & Leow, 2014). To serve as an e-tutor, an electronic application must provide input and interactive practice to language learners, whereas to serve as a medium, the computer must just act as a platform for two or more interlocutors to communicate, either in real time (synchronously) or deferred time (asynchronously). The current dissertation will focus on synchronous computer-mediated communication (SCMC), which has been defined as ‘real-time, synchronous conversation that takes place online’ (Baralt & Leow, 2016, p. 200). New generations of young people who have grown up with a range of communication technologies
seem to show an affinity for synchronous over asynchronous alternatives (Thorne, 2003). In fact, Petersen and Sachs (2016) state that, over the past ten years, online communication has become normalized in the everyday lives of students and teachers as they interact with one another. As Ortega (2009, p. 248) rightly points out, if language teachers want to be educationally responsive, “the inclusion of SCMC in contemporary language classrooms is no longer a choice, but rather a necessity and even an ethical imperative”. More research on CALL and SCMC is needed to ensure that technology is integrated into the classroom in the best way possible given that technology is not just present in society anymore, but in the classrooms as well.

As the SCMC research grows, important considerations need to be borne in mind when designing new studies. Firstly, CALL and SCMC researchers need to frame their studies within SLA theoretical paradigms that allow them to design theoretically motivated tasks to promote L2 interaction and learning (e.g., Blake, 2007). Furthermore, as pointed out by CALL and SCMC scholars (e.g., Cerezo et al, 2014; Plonsky & Ziegler, 2016), the designs of CALL studies and their statistical practices need to be improved to be able to advance these relatively young fields within the instructed second language acquisition (ISLA) field.

For more than twenty-five years now, SCMC has provided a solid body of research that has addressed L2 learning from different standpoints, including an interactionist approach to L2 learning. Most of this research has focused mainly on text-based SCMC (see Ortega, 2009 for an early review). There is robust evidence that states that SCMC can promote negotiation of meaning, noticing, and uptake. In addition, the efficacy of this written mode has been confirmed by meta-analytic evidence (Lin, Huang, & Liou, 2013). However, when comparing this mode to FTF research or to other SCMC modes, it is hard to find solid evidence that advocates for one mode vs. the others (e.g., Baralt, 2013; Ziegler, 2016b).
Additionally, the growing presence of voice and video-chat programs such as Skype and Google Hangouts in online language courses has been well documented in the literature (e.g., Ziegler, 2016c). In fact, as claimed by SCMC scholars, SCMC is becoming increasingly video-centric (Petersen & Sachs, 2016). However, these new oral environments have been under researched by SLA research up to the present moment. While several studies have begun to explore these oral SCMC modes descriptively (e.g., Yanguas, 2010, 2012), in terms of how and to what extent they promote interactional moves said to promote L2 learning, only a handful of studies have empirically addressed L2 learning (e.g., Monteiro, 2014; Granena, 2016). While the investigations undertaken by these studies have contributed to our understanding of how these modes behave, more research is needed that compares these oral modes to the written SCMC modes to be able to link new research to the extant research, which to date, has been mostly carried out in the text-based mode (e.g., Baralt, 2013; Yilmaz, 2012; Yilmaz & Yuksel).

A productive line of research will continue to investigate the effects of text-based SCMC modes while comparing it to voice-based and video-based SCMC environments. This need has been voiced by SCMC scholars, who have called for more research into the overall effects of interaction in different SCMC modes on L2 development (e.g., Loewen & Wolff, 2016; Yanguas, 2010; Ziegler, 2016b). In fact, Petersen and Sachs (2016) have claimed that “online communication that simulates FTF interaction through the inclusion of audio and video has yet to undergo broad formal investigation as a medium for effective foreign language instruction” (p. 9).

Furthermore, interactionist-based research including feedback has started to investigate what factors moderate the effectiveness of interaction in different modes of communication when receiving different types of feedback (Yilmaz & Yuksel, 2011; Yilmaz, 2012; Yilmaz, 2013).
Importantly for the current study, there is some previous evidence that points to the fact that some cognitive abilities such as WMC may in fact moderate the impact of communication mode (Payne & Whitney, 2002) on L2 learning. Moreover, several previous studies have provided hints that WMC may mediate the effects of interaction with feedback (e.g., Mackey et al., 2002, Mackey et al., 2010). However, there is insufficient evidence to elucidate whether WMC mediates the effects of mode under different experimental conditions (i.e., more implicit or more explicit) for L2 learning. The investigation of the interaction between cognitive individual differences such as this one and different interactional modes and feedback conditions can help determine the optimal instructional practice that involve matching learners’ cognitive strengths to instructional techniques.
CHAPTER 2: SYNCHRONOUS COMPUTER-MEDIATED COMMUNICATION (SCMC)

The next sections will first situate the SCMC strand of research within a comparative framework to Face to Face (FTF), and then within an interactionist perspective. Following that, the extant literature on the impact of SCMC vs. FTF on negotiation of meaning, noticing, uptake, and L2 learning will be summarized. Finally, future directions of the SCMC strand of research will be identified.

Synchronous Computer-Mediated Communication (SCMC) vs. Face-to-Face (FTF)

Since its inception in the 1990s, SCMC has provided a substantial body of research that has addressed L2 learning from interactionist, cognitive and sociocultural standpoints, focusing mainly on text-based SCMC (see Ortega, 2009 for an early review). As of today, there seems to be meta-analytic evidence in favor of text-based SCMC for L2 learning (Lin, Huang, & Liou, 2013).

When comparing SCMC (including text, video, and voice modalities) to FTF, the only meta-analysis (Ziegler, 2016b) that has directly addressed this comparison for L2 learning concluded that interaction in both modes had a significant impact on L2 development, with a small advantage for interaction in SCMC ($ES = .13$). However, the sample only included fourteen studies, it included different types of SCMC environments (the majority being text-based SCMC environments) and most importantly, the sample included a multiplicity of dependent variables (e.g., oral performance, vocabulary acquisition, pragmatic development). Thus, the effects of the different interactional environments (text-based, video-based, and voice-based SCMC vs. FTF) on specific linguistic domains are still unclear.
Furthermore, as pointed out in Cerezo et al.’s (2014) review of the methodological validity of empirical CALL studies researching the effectiveness of e-tutors and SCMC vs. FTF, only three studies comparing SCMC vs. FTF were robust enough (in terms of the levels of their internal and external validity) to be included in their review. These and other researchers (e.g., Plonsky & Ziegler, 2016) have argued that it is important to analyze results from meta-analytic research critically, and therefore, future meta-analyses and researchers should explore the quality and not just the quantity of empirical studies, particularly in the realm of CALL research.

Consequently, further research that addresses the comparison of SCMC vs. FTF in a methodologically robust way is warranted. It is important to point out that while some scholars have called for better-designed comparative studies that can inform practitioners (e.g., Cerezo et al., 2014), others have called for the field to move beyond investigations comparing the learning outcomes of CALL versus non-CALL instructional environments, due to the fundamentally different nature of both learning conditions (Macaro, Handley, & Walter, 2012). While the first comparison (SCMC vs. FTF) is explored in the pilot study of the current dissertation, the main study moves beyond a comparison to FTF and focuses on comparing three different SCMC environments.

**Theoretical Underpinning: The Interactionist Approach in SCMC and FTF**

When language instructors use technology in their FTF or online classrooms, they should bear in mind that, as Blake (2007) discusses, any benefits from engaging in computer-mediated communication (CMC) are not automatically derived from the tools themselves, but rather from how CMC is used in service of promoting meaningful interactions. This statement points to the
crucial role of the language teacher in designing appropriate tasks and providing timely feedback to students. These pedagogical decisions should be informed by research findings.

CALL researchers have called for the need to frame such research within mainstream second language acquisition (SLA) theories (e.g., Chapelle, 1997; Cerezo, 2016) as well as for more rigorous research methodologies, research designs and better statistical reporting practices (e.g., Chapelle, 2001; Cerezo et al., 2014; Leow & Suh, 2016; Ziegler, 2016a). By grounding CALL-based research in mainstream SLA theories, such as the interactionist approach, researchers have a framework within which to examine aspects of interaction thought to be facilitative of learning, such as comprehensible input, feedback, and reformulated output (Ziegler, 2016a), and, consequently, move the CALL field forward.

Interactionist theories of SLA posit that in order to learn a language, learners need to be exposed to L2 input, receive feedback, and reformulate their output, especially through participation in conversation. Through interacting in the L2, learners are provided with opportunities to notice the gaps between their interlanguage and the target language features when provided with corrective feedback, and modify their output accordingly (e.g. Gass & Mackey, 2006). Feedback can be explicit or implicit, and while implicit feedback might not obstruct communication (Long 1996), it might also go unnoticed by learners because they might perceive them as responses to content rather than as positive or negative evidence (e.g., Lyster, 1998; Panova & Lyster, 2002). At present, the effectiveness of interaction with feedback for L2 development has been empirically demonstrated (Mackey & Goo, 2007), and researchers have recently shifted their focus to exploring in more detail how interaction works in different contexts and modes to impact L2 learning.
Following this, an increasing number of studies are researching whether developmental findings of interactional, FTF research hold for interactions in SCMC. This is an important question due to the different nature of SCMC (whether written or oral SCMC) when compared to FTF in terms of visual cues, turn-taking patterns, delays in communication and split routines patterns, among others. Text-based SCMC has been described as a hybrid between text and oral communication (de la Fuente, 2003; Roed, 2003; Smith 2005b), which means that while it bears some resemblance to oral communication, it also entails different social dynamics in terms of interruptions and competition for turn-taking. Particularly, as Yilmaz and Granena (2010) explain, some features of oral communication, such as short turns, immediacy, or discourse informality, are also present in text-based SCMC (Kern, 1995; Smith, 2003a). Text-based SCMC also shares some features with written communication, such as the amount of lexical density, the lack of intonation, the use of punctuation, and the possibility to monitor language production (e.g., Smith, 2003a; Payne & Whitney, 2002).

Voice-based SCMC might be more similar to text-based communication due to the absence of visual cues and the impossibility to rely on paralinguistic communication for understanding. Video-based SCMC, on the other hand, may be more similar to FTF communication, as learners are not deprived from visual cues to understand one another. In terms of corrective feedback and its oral enhancement through extra-linguistic elements such as intonation, all modes (FTF, voice-based SCMC, video-based SCMC) with the exception of text-based SCMC are similar. However, text-based chat has been argued to bring particular benefits that cannot be attributed to any of the other modes such as allowing learners to visually compare corrections to their erroneous forms on the screen, therefore not having to rely strictly on their
working memory to do so, and pre-plan out their output before sending their message (e.g., Baralt & Leow, 2016; Ortega, 1997).

Furthermore, the text-based SCMC mode has been claimed to amplify learners’ attention to form, and make learners feel less threatened (Blake, 2008; Smith, 2004). Some scholars (e.g., Chapelle, 2001; Long 2007) have in fact argued that because feedback given in the text-based mode is visually written out for the learner, its saliency is increased, and this may thus facilitate its noticing. On the other hand, some researchers have also stated that the voice-based mode, which can be extended to the text-based mode, is that these environments may force learners to make use of their linguistic resources (Yanguas, 2010), potentially benefiting their language development, a feature that can be superseded by visual cues in video-based and FTF environments. Moreover, interacting in the text-based environment involves slower turn taking, which is considered to afford learners extra time to process input (Beauvois, 1992). This extra time is hypothesized to assist learners in planning their linguistic output while engaging in interaction (Chapelle, 1998; Sauro & Smith, 2010). Do these different affordances result in differential L2 learning? It might be the case that although different, all four modes might be beneficial for L2 learning, but currently this is an empirical question that needs to be tested.

**SCMC Research and Negotiation of Meaning, Noticing, Uptake, and L2 Learning**

From the early through mid-1990s, a few studies produced anecdotal and empirical evidence of a number of pedagogical benefits from SCMC use, such as an equalizing effect on participation, an increased productivity in terms of overall language produced, and the fact that language produced in the SCMC mode was more complex and formal than in the FTF mode (Ortega, 1997).
As Thorne (2008) points out, the studies by Kern (1995) and Chun (1994) are widely regarded as some of the most influential from this early period. Kern (1995) conducted a within-groups quasi-experimental comparison of both a traditional whole-class discussion and an electronic discussion in two intact French classes, concluding that students in the SCMC environment wrote more words and sentences, and produced more turns than students talking FTF in the classroom (an average of 12.5 vs. 5.3 turns). Both Beauvois (1992) and Kelm (1992) reported increases in the participation pattern of shy students and low-motivated, unsuccessful language learners. These early studies all seemed to indicate that SCMC had an equalizing effect in participation. However, as Ortega (1997) rightly notes, it was justified to hypothesize at the time that group size and equality of participation are negatively related in traditional, FTF, oral interactions and positively related in computer-assisted interactions. Therefore, she called for comparison studies of SCMC and FTF environments that included small group interactions of equal size.

Sullivan and Pratt (1996) compared whole-class discussions and four-member group interactions in oral FTF classes versus SCMC classes over the course of a semester. As for whole-class discussions in both modes, their finding agreed with previous literature in that students’ participation increased in electronic discussion. In four-member group interactions, they found that while in FTF discussions one member of the group (the one whose essay was being discussed) largely dominated the interaction, no student dominated the interaction in the SCMC mode. Warschauer (1996) compared amount of student participation in FTF versus SCMC in groups of four students. He concluded that in three of the four groups, greater equality of participation was observed in the SCMC mode.
While it might be true that these first SCMC studies all seemed to agree on the fact that learner productivity increased in SCMC, it should be borne in mind that quantity does not necessarily amount to quality, and that is why it is important to consider the descriptive analysis of the early research in terms of language syntactic or lexical complexity as well. Chun (1994), Kern (1995), and Warschauer (1996) all undertook such complexity analyses and they produced mixed findings. Most importantly, as claimed by Ortega (1997), these early studies pointed to the need to use standardized measures (e.g., Warschauer, 1996) in contrast to ad hoc measures (e.g., Kern, 1995).

A few years later, at the turn of the millennium, the interactionist approach was identified as holding great promise for the study of L2 learning benefits of text-based SCMC (Ortega, 2009). The attention turned to whether SCMC interaction could foster the same interactional features as FTF discussion. Such interactional features included negotiation of meaning, noticing, or uptake, among others.

**Negotiation of Meaning**

The interactionist approach proposes that negotiating for meaning during communication is beneficial for L2 acquisition, because it may help learners notice the gap between their own production and target-like forms as a result of a breakdown in communication. While some studies found high rates of negotiation of meaning in SCMC (e.g., Kötter, 2003; Pellettieri, 2000; Smith, 2003b), other early studies found that negotiation of meaning did not arise as often (e.g., Blake, 2000; Blake and Zyzik, 2003).

Smith (2004) examined potential negotiation of meaning of lexical items during dyadic, SCMC interaction between twenty-four L2 English learners, together with lexical gains via immediate and delayed posttests. He found that unknown lexical items were negotiated and were
ignored about the same number of times (38% of the time). Results also showed that previously unknown lexical items that were negotiated were retained significantly better as measured by immediate and delayed recognition (receptive) and object labeling (productive) posttests than those items where preemptive input alone was provided and where target items were not engaged.

Other studies have compared negotiation of meaning in SCMC versus FTF. These studies have generally reported an advantage for the FTF mode. Fernández-García and Martínez-Arbeiza (2003) compared the conversation exchanges in FTF and SCMC on two similar conversational topics made by eighteen dyads, four Spanish L1-L2 speaker dyads, and fourteen L2-L2 speaker dyads. This study found that dyads composed on non-native speaker and native speaker resulted in more negotiation of meaning, which arose from more instances of nonunderstanding. These dyads also negotiated more in the oral FTF mode than in the written SCMC mode. Lai and Zhao (2006) researched six dyads of ESL learners completing a spot-the-difference task in both modes. They concluded that negotiation episodes were statistically more frequent in FTF than in SCMC.

More recent studies have investigated the interactional routines elicited by video or voice-based SCMC (Jepson, 2005; Loewen & Wolff, 2016; Yanguas, 2010). Jepson (2005) examined group chat interactions in an English language learning public chat room in both text-based and voice-based SCMC. He collected the data from unknown L2 learners while they chatted for five minutes in five different sessions, on five different days. While the text-based interactions showed only a total of six negotiation episodes, the voice-based interactions resulted in a total of thirty-six negotiation episodes.
Yanguas (2010) investigated how learners in video-based and voice-based SCMC groups negotiated for meaning during task-based interaction, and whether they differed from traditional FTF communication. A total of fifteen Spanish L2 learner dyads completed a jigsaw task. He found high rates of negotiation of meaning in general, most of them addressing lexical targets, being the percentage of negotiated turns somewhat higher for the voice-based condition (57%), as opposed to the video-based condition (48%) and FTF condition (50%). Results also showed differences in the way voice-based and video-based groups carried out the negotiations, with participants in the voice-based condition being forced to use their linguistic resources for being deprived of visual cues.

Loewen and Wolff (2016) investigated the occurrences of interactional features in three different communication modes, namely FTF, voice-based SCMC and text-based SCMC. A total of 24 English learner dyads completed several tasks. They operationalized negotiation for meaning in terms of confirmation checks, clarification checks, and comprehension checks. Results indicated that voice-based SCMC and FTF elicited a greater number of confirmation checks than the text-based SCMC.

Research on negotiation of meaning indicates that lexical items seem to yield more negotiation than grammatical items (e.g., Blake, 2000; Fernández-García & Martínez-Arbelaitz, 2002; Pellettieri, 2000; Yanguas, 2010), similarly to FTF research (e.g., Mackey & Goo, 2007). As for type of mode, negotiation seems to occur more frequently in FTF than in text-based SCMC (e.g., Fernández-García & Martínez-Arbelaitz, 2002; Lai & Zhao; 2006). Furthermore, voice-based SCMC seem to be more advantageous than text-based SCMC (Jepson, 2005; Loewen & Wolff, 2016), but the paucity of voice-based SCMC studies underscores the need to interpret these findings with caution. While Smith (2004) found that negotiation of meaning was
indeed conducive to lexical gains, scarce studies have investigated whether negotiation of meaning indeed leads to L2 learning or not.

**Noticing**

Other studies have investigated to what extent SCMC interaction promotes noticing of the formal features of the target language (even though no breakdown in communication occurs) or noticing of the feedback received, offering mixed results. Some studies found no statistical differences between text-based SCMC and FTF (Gurzynski-Weiss & Baralt, 2014; Gurzynski-Weiss & Baralt, 2015), while other studies found an advantage for the text-based SCMC interaction over FTF (Lai & Zhao; 2006; Shekary & Tahririan, 2006; Yuksel & Inan, 2014), and yet others found an edge for the FTF over SCMC (Baralt, 2014).

Studies that just researched noticing or awareness in text-based SCMC without establishing a comparison with FTF found that in text-based SCMC conditions, learners were able to notice recasts provided by an expert interlocutor (Sachs & Suh, 2007; Lai, Fei, & Roots, 2008), and learners reported similar levels of awareness of various target forms independent of type of recast - enhanced vs. unenhanced - received (Gurzynski-Weiss, Al Khalil, Baralt & Leow, 2016), whereas Sachs and Such (2007) did report that textual enhancement of the recasts affected the learners’ awareness of the targeted form. Sachs and Suh (2007) also found a positive correlation between reported awareness and subsequent L2 performance.

Yilmaz and Granena (2010), operationalizing focus on form through language-related episodes (LREs), instances where learners turn their attention to formal aspects of language by questioning the accuracy of their own or each other’s language use, found that the dictogloss task generated more LREs than the jigsaw task in text-based SCMC. They also found that L2 learners assist one another in attending to language forms through collaborative dialogue in SMC.
With respect to type of linguistic targets in the L2 data, Smith (2010), employing eye-tracking methodology and stimulated recall, concluded that learners noticed semantic and syntactic targets more easily than morphological targets in text-based interaction. Gurzynski-Weiss et al. (2016), employing think aloud protocols, reported noticing in the following order: Lexis> morphology> syntax.

The studies reviewed above have all measured noticing in text chat (and FTF), using different methodologies such as eye-tracking (Smith, 2010, 2012), stimulated recall (Gurzynski-Weiss & Baralt, 2014, 2015; Lai et al., 2008; Lai & Zhao, 2006; Smith, 2010; Yuksel & Inan, 2014), think-aloud protocols (Lai et al., 2008; Gurzynski-Weiss et al., 2016) and LREs (Shekary & Tahririan, 2006; Yilmaz & Granena, 2010). No study to date has investigated noticing in video-based or voice-based SCMC.

**Uptake**

Some SCMC studies have measured the construct of uptake, both in a comparative way to FTF (Gurzynski-Weiss & Baralt, 2015) and non-comparatively (Baralt & Leow, 2016; Shekary & Tahririan, 2006; Smith, 2005). Uptake has been generally defined as learner responses to feedback (Lyster & Ranta, 1997), and has been shown to predict subsequent learning in the FTF mode, but less consistently so in the SCMC mode. So far, studies that have researched uptake in SCMC have investigated the construct as a response to peer feedback (Shekary & Tahririan, 2006; Smith, 2005), or as a response to feedback given by an expert interlocutor (Baralt & Leow, 2016; Gurzynski-Weiss & Baralt, 2015). While some studies found that uptake was positively related to learning (Shekary & Tahririan, 2006), others did not find this facilitative effect of uptake (Baralt & Leow, 2016; Smith, 2005).
Smith (2005a) found no relationship between the degree of uptake (none, unsuccessful, and successful) and acquisition of lexical items. Shekary and Tahririan (2006) explored noticing of linguistic items in text-based SCMC, operationalized as LREs, and further analyzed all LREs in terms of several elements, including uptake. In disagreement with Smith (2005a), they found that successful uptake was the strongest predictor of learners’ correct response on customized posttests.

Baralt and Leow (2016) examined whether uptake during cognitively simple or complex tasks in SCMC was related to learning of the Spanish past subjunctive. A total of thirty-four learners of intermediate-level Spanish completed a task while receiving corrective recasts. They found that the amount of uptake production was identical in both groups (almost null) and it was found not to be related to learning. Importantly, they hypothesized that the construct of uptake in the SCMC mode might need to be revisited. Essentially, uptake, operationalized as observable learner responses to feedback in FTF, may have inherently different characteristics in SCMC (Baralt & Leow, 2016; Smith, 2005). Gurzynski-Weiss and Baralt (2015) have interestingly suggested that uptake might fulfill a socializing purpose in SCMC, or function as an acknowledgement of receipt of a correction to one’s conversational partner. Be that as it may, the construct of uptake, and its potential to lead to learning in SCMC, indeed warrants further research.

The studies reviewed so far have provided crucial information about interactional routines (negotiation of meaning, noticing, and uptake) in the different SCMC modes and how they resemble or differ from FTF. Fewer studies, however, have focused on investigating a more direct link between SCMC interaction (while comparing it to FTF) and L2 learning. Thus, more experimental research (especially oral SCMC research) that addresses the effect of mode on L2
learning is needed to be able to derive pedagogical implications for the L2 classroom. To this end, SCMC studies that have directly addressed L2 learning will be reviewed next.

**L2 Learning**

Early SCMC studies before 2000 did not generally address the issue of L2 learning, with Sullivan and Pratt (1996) being the only exception. This quasi-experimental study was the first to compare two classes of learners that only differed in that one of the two classes met once a week in the lab and completed all of the in-class discussions and writing assignments online. Writing samples were scored holistically on a five-point scale by two trained raters and pre- and post-test scores were compared. They found that while the mean score in the oral FTF decreased significantly at the end of the fifteen weeks, the mean of the SCMC class increased significantly.

Later studies from 2000 to 2010 increasingly addressed the ability of SCMC to promote different aspects of L2 learning, with only one including a *voice*-based SCMC condition (Sykes, 2005) and the rest including a *text*-based condition. Studies in the 2000s showed the ability of SCMC to advance general proficiency (Abrams, 2003; Hirota, 2009; Payne & Whitney, 2002; Satar & Ozdener, 2008), improve vocabulary (Choi, 2000; de la Fuente, 2003; Smith, 2004, 2005), oral fluency (Blake, 2009), advance pragmatic development (Sykes, 2005), or other specific aspects of L2 production (Coniam & Wong, 2004). Of special interest for the current investigation are studies that have researched how SCMC might promote L2 *grammatical* learning of some kind, all of which employed text chat before 2010 (Loewen & Erlam, 2006; Sachs & Suh, 2007; Shekary & Tahririan, 2006).

Studies after 2010 that have investigated L2 learning have continued to increase, targeting various aspects of L2 learning such as vocabulary learning (e.g., Tare, Golonka, Vatz, Bonilla, Crooks, & Strong, 2014; Yanguas, 2012), listening comprehension (e.g., Yanguas,
oral fluency (e.g., Tare et al., 2014), pronunciation or phonological development (e.g., Bueno-Alastuey, 2010, 2013; Loewen & Isbell, 2017; Parlak & Ziegler, 2016), or grammatical learning (e.g., Baralt, 2013; Granena, 2016; Monteiro, 2014; Shintani & Aubrey, 2016; Yilmaz, 2012; Yilmaz & Yuksel, 2011). After 2010, an increasing number of studies have addressed oral SCMC, including voice-based SCMC (e.g., Bueno-Alastuey, 2010, 2013; Granena, 2016; Loewen & Isbell, 2017; Yanguas, 2012) and video-based SCMC (e.g., Monteiro, 2014; Parlak & Ziegler, 2016; Yanguas, 2012).

In total, eleven SCMC studies have focused on grammatical learning (see Table 1 for details on these studies). These studies will be reviewed in detail below.
Table 1. Studies that measured the effects of SCMC (vs. FTF) on L2 grammatical learning.

<table>
<thead>
<tr>
<th>Study</th>
<th>SCMC mode(s)</th>
<th>Groups/ Comparison with FTF?</th>
<th>L2 &amp; proficiency level</th>
<th>n size</th>
<th>W M C</th>
<th>Assessment tasks &amp; Reliability reported</th>
<th>Target structure (number)</th>
<th>Treatment Task &amp; Length of treatment</th>
<th>Interlocutor</th>
<th>Delayed effect</th>
<th>Results</th>
<th>Power analysis &amp; Effect sizes reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loewen &amp; Erlam (2006)</td>
<td>Text-based</td>
<td>-Recast SCMC - Metalinguistic feedback SCMC - Test-only control</td>
<td>English Elementary</td>
<td>31</td>
<td>no</td>
<td>-Timed and untimed grammatical judgement tests (GJTs) - Not reported</td>
<td>Regular past tense (23 items, 8 distractors, and 15 critical items)</td>
<td>Two focused tasks From 40 min to 1h and 10 min</td>
<td>Group s (5-8 participants) with a teacher moderator</td>
<td>yes</td>
<td>No effects for group nor time (for both dependent measures)</td>
<td>No/no</td>
</tr>
<tr>
<td>Shekary &amp; Tahriyan (2006)</td>
<td>Text-based</td>
<td>N/A</td>
<td>English From low intermediate to advanced</td>
<td>16</td>
<td>no</td>
<td>-Individualized test items relating to the linguistic items targeted in the LREs - Not reported</td>
<td>LREs that arose in communication (depending on participant)</td>
<td>Dictogloss, jigsaw, and free discussion tasks Not clearly stated</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>Noticing in SCMC (operationalized as LREs) was associated with subsequent L2 learning</td>
<td>No/no</td>
</tr>
<tr>
<td>Sachs &amp; Suh (2007)</td>
<td>Text-based</td>
<td>- Enhanced recast - Unenhanced recast</td>
<td>English Intermediate to high-intermediate</td>
<td>30</td>
<td>no</td>
<td>-Paper-based multiple-choice text completion tests - Production interactive computer-mediated tests - Not reported</td>
<td>Backshifting in indirect reported speech from the past to the past perfect (8 targets, of which 4 were regular and 4 irregular verbs)</td>
<td>Guided story-retelling tasks 27.7-28.9 min</td>
<td>Dyad participant-researcher</td>
<td>no</td>
<td>Significant main effect for time but no main effect for treatment and no significant interaction effect</td>
<td>Yes/Yes Low power reported</td>
</tr>
</tbody>
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Table 1. Studies that measured the effects of SCMC (vs. FTF) on L2 grammatical learning (Cont’d).

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<tr>
<td>Sauro (2009)</td>
<td>Text-based</td>
<td>-Recast SCMC - Metalinguistic prompt SCMC - Test-only control</td>
<td>English</td>
<td>23</td>
<td>no</td>
<td>- Acceptability judgment tests -Reported</td>
<td>English zero article with abstract noncount nouns (15)</td>
<td>Two collaborative writing activities</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>No significant main effect for group or time. Only the metalinguistic group demonstrated a mean gain from pretest to immediate posttest. In fact, post hoc analysis showed that the metalinguistic group’s score increased significantly more from pre to immediate posttest than did the control group.</td>
<td>No/yes</td>
</tr>
<tr>
<td>Yilmaz &amp; Yuksel (2011)</td>
<td>Text-based</td>
<td>-Recast SCMC - Recast FTF</td>
<td>Turkish Naïve learners</td>
<td>24</td>
<td>no</td>
<td>-Two picture description tasks to measure production of structures in obligatory contexts -Not reported</td>
<td>Plural morpheme, and the locative case morpheme (16 of each)</td>
<td>Two tasks: describe the picture in their slide with two-word utterances ~30 min</td>
<td>Dyad participant-researcher</td>
<td>no</td>
<td>Scores were significantly higher when they received SCMC recasts than when they received FTF recasts</td>
<td>Not reported/ Not reported</td>
</tr>
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<tr>
<td>Yilmaz (2012)</td>
<td>Text-based</td>
<td>-Recast SCMC -Recast FTF -Explicit feedback SCMC -Explicit feedback FTF</td>
<td>Turkish Naïve learners</td>
<td>48</td>
<td>no</td>
<td>-Controlled oral production task (OP) - Comprehension task - Recognition task - Reported</td>
<td>Plural morpheme, and the locative case morpheme (16 of each)</td>
<td>Two one-way information gap tasks FTF task average of 6.39 min and SCMC average of 13.36 min</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>-Explicit feedback was more effective than recasts -Effect for communication mode (in favor of SCMC) on the immediate OP and both Recog posttests, but not on the Comp test. -No interaction between feedback type and communication mode</td>
<td>Not reported/report</td>
</tr>
<tr>
<td>Baralt (2013)</td>
<td>Text-based</td>
<td>-Recast SCMC -Recast FTF -Test-only control (+/- complexity)</td>
<td>Spanish Intermediate</td>
<td>84</td>
<td>no</td>
<td>-Two production tasks (one in FTF and one in SCMC) - Multiple-choice receptive test - Yes</td>
<td>Past subjunctive (10 uses in productive task and 15 uses in the receptive task)</td>
<td>Interactive dialogic story retell task 21-58 min (two treatment sessions)</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>In the SCMC mode, carrying out the cognitively simple task resulted in the highest mean scores for productive and receptive measures</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>Baralt (2015)</td>
<td>Text-based</td>
<td>-Recast SCMC (+/- complexity)</td>
<td>Spanish Intermediate</td>
<td>34</td>
<td>yes</td>
<td>-Two production tasks (one in FTF and one in SCMC) - Multiple-choice receptive test - Yes</td>
<td>Past subjunctive (10 uses in productive task and 15 uses in the receptive task)</td>
<td>Interactive dialogic story retell task</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>WMC was not related to learning in this study. As Pearson’s correlations revealed, WMC also did not moderate learning differently for different types of learners.</td>
<td>Yes/Yes</td>
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<th>WMC</th>
<th>Assessment tasks &amp; Reliability reported</th>
<th>Target structure (number)</th>
<th>Treatment Task &amp; Length of treatment</th>
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<tr>
<td>Shintani &amp; Aubrey (2016)</td>
<td>Text-based</td>
<td>- Synchronous corrective feedback (SCF)</td>
<td>English Intermediate</td>
<td>68</td>
<td>no</td>
<td>-Three reconstructi on tasks</td>
<td>Hypothetical conditional structure (depending on learner production)</td>
<td>Two writing tasks in which students had to explain what would have happened if certain events had not occurred</td>
<td>Group (7-9 students)- researcher</td>
<td>yes</td>
<td>Both experimental groups showed large effect sizes (EF) in the immediate posttest when compared with the comparison group. However, the EF for the SCF group maintained the statistically significant advantage over the comparison group in the delayed</td>
<td></td>
</tr>
<tr>
<td>Granena (2016)</td>
<td>Voice-based</td>
<td>- Individual task performance</td>
<td>English Intermediate</td>
<td>126</td>
<td>no</td>
<td>-Cloze tests</td>
<td>Modals, past tense verbs, and connectors (8 critical items and 16 distractors)</td>
<td>A jigsaw task (addressing one of the three target forms) to encourage focus on form</td>
<td>no</td>
<td>Main effect for time. Interactive condition significantly better than individual for past tense and marginally significant for connectors (p = .054)</td>
<td>No/yes</td>
<td>No/ Only some effect sizes reported</td>
</tr>
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<thead>
<tr>
<th>Study</th>
<th>SCMC mode(s)</th>
<th>Groups/ Comparison with FTF?</th>
<th>L2 &amp; proficiency level</th>
<th>n size</th>
<th>WMC</th>
<th>Assessment tasks &amp; Reliability reported</th>
<th>Target structure (number)</th>
<th>Treatment Task &amp; Length of treatment</th>
<th>Interlocutor</th>
<th>Delayed effects</th>
<th>Results</th>
<th>Power analysis &amp; Effect sizes reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monteiro (2014)</td>
<td>Video-based</td>
<td>-Focused task (FC) without feedback -FC plus recasts -FC plus metalinguistic feedback</td>
<td>English - Roughly low-intermediate level</td>
<td>42</td>
<td>no</td>
<td>-Timed and untimed GJT's - Metalinguistic knowledge test - Oral imitation test - Reliability reported</td>
<td>Regular simple past (not mentioned)</td>
<td>Two treatment sessions, Six FTs in total An average of 1h 20min for the two treatment sessions.</td>
<td>Dyad participant-researcher</td>
<td>yes</td>
<td>Main effect for time, no significant differences among groups</td>
<td>Yes/yes</td>
</tr>
</tbody>
</table>
The different independent and dependent variables investigated and measured, assessment tasks used, interlocutors and groupings included, and target languages learned, among others, make the comparisons across these nine studies difficult. Of the eleven studies, nine have addressed the effects of feedback, either comparing two types of feedback in one or two modes (Loewen & Erlam, 2006; Monteiro, 2014; Sauro; 2009; Yilmaz, 2012) or addressing the efficacy of one type of feedback in one or two modes (Baralt, 2013; Baralt, 2015; Sachs & Suh, 2007; Yilmaz & Yuksel, 2011). The other two studies that did not addressed feedback focused on the effects of SCMC on noticing, and whether noticing promoted L2 learning (Shekary & Tahririan, 2006), and on the effects of individual versus interactive task performance on L2 learning (Granena, 2016).

Studies comparing different types of feedback have resulted in mixed findings, either showing no differences between metalinguistic feedback and recasts (Loewen & Erlam, 2006; Monteiro, 2014; Sauro, 2009), or an edge of the explicit feedback group over the recast group (Yilmaz, 2012).

Loewen and Erlam (2006), in a partial replication of an FTF study of teacher-delivered negative feedback by Ellis, Loewen, and Erlam (2006), investigated the efficacy of online recasts and online explicit metalinguistic feedback given by an expert interlocutor, for the learning of L2 English past perfect in groups of 5-8 learners with the teacher. They found no significant learning when participants interacted in text-based SCMC and received either recasts or metalinguistic feedback.

Monteiro (2014) investigated the effects of video-based SCMC with recasts, metalinguistic feedback, or no feedback, for the learning of the English simple past. She found that all three groups in her study (recast, metalinguistic feedback, no feedback) developed
implicit and explicit knowledge during video-conference interactions. However, some limitations of the study restrict the reliability and generalizability of its findings. For example, proficiency of the target structure at the time of pretest revealed that the standard deviation was large for most measures, indicating that participants were possibly at different developmental stages and the current study did not control for that. In fact, while 69% of participants were enrolled in an English course (the target language of the study) at the time of the experiment, 31% were not. As the researcher mentions, while the power was high for main effect for time, it was low for group comparisons, indicating that more participants were needed. Finally, test reliability was also an issue for the timed GJT's, suggesting that the results of this particular test must be interpreted cautiously.

Sauro (2009) investigated the effects of two types of corrective feedback in text-based SCMC (i.e., metalinguistic information vs. recasts) on the acquisition of the zero article with abstract noncount nouns (e.g., employment, global warming, culture). Results on immediate and delayed computer-delivered tests (acceptability judgments) showed no significant advantage for either feedback type on immediate or delayed gains, although the metalinguistic group was descriptively superior to the recast group and the metalinguistic group showed significant immediate gains relative to the control condition. However, several limitations encourage caution when interpreting the results of this study. Firstly, the low number of participants per cell (8, 8 and 7 respectively), and the particularity of the target form under study (lending itself more to an item-based vs. a rule-based learning) limit the robustness of the study. Also, participants showed high scores at pretest, which may have impacted the learning results. Furthermore, power estimates were not reported. The low learning gains in this study might have been due to the nature of the assessment instrument, which provided multiple variations of each sentence to
participants and asked them to select the most acceptable. More robust measures of learning should be utilized in future studies in order to be able to make more solid claims regarding L2 learning in SCMC environments.

Yilmaz (2012) investigated the effects of negative feedback type (i.e., explicit correction vs. recasts), communication mode (i.e., FTF vs. SCMC), and target form salience (i.e., salient vs. nonsalient) on the acquisition of two Turkish morphemes. He found that SCMC scores were significantly higher than FTF scores on the immediate oral production posttest and on the immediate and delayed recognition posttests for the learning of two L2 Turkish morphemes. A clear advantage was found for explicit correction over recasts in the oral production and comprehension tasks on both immediate and delayed posttests, but not on a recognition measure. Finally, he found no interaction between feedback type and communication mode, meaning that the relative effectiveness of feedback type does not depend on communication mode.

After examining these four studies, the no differences between explicit and implicit feedback in Loewen and Erlam (2006), Sauro (2009), and Monteiro (2014) might be explained due to the lack of learning in any condition in the two first studies (Loewen & Erlam, 2006; Sauro, 2009), and similar rates of learning in all conditions in the second. In addition, several limitations mentioned above for Sauro (2009)’s study limit the generalizability of its findings. Thus, Yilmaz (2012)’s findings that show the superiority of explicit over implicit feedback might be more reliable. For this reason, the present study will examine whether the efficacy of explicit feedback is mediated by learning mode.

Studies including just one type of feedback have shown that participants were able to learn the target structure after receiving recasts in FTF and SCMC (Baralt, 2013; Baralt, 2015), have shown no difference between enhanced versus non-enhanced recasts in text-based SCMC
(Sachs & Suh, 2007), or have shown an edge of recasts in text-based SCMC over recasts in FTF (Yilmaz & Yuksel, 2011). However, no study has focused on just explicit feedback in different modes.

Baralt (2013) found that the effectiveness of mode depended on the cognitive complexity of the task performed. Specifically, participants who performed the more cognitively complex task in FTF showed more L2 Spanish learning of the Spanish past subjunctive than those who performed the simple task, while the opposite effect emerged for SCMC. Participants who performed the simple task in SCMC performed the best among all groups. Barat (2015) examined whether WMC moderated feedback efficacy in task-based computerized interaction, and if the SCMC mode would help learners with lower WMC. She found that WMC was not related to learning on simple or complex tasks.

Sachs and Suh (2007), investigated the efficacy of computer-delivered recasts for L2 English. They divided participants into four groups: +/- enhancement, +/- think-aloud protocols. They found that learners were able to acquire the English past perfect tense (backshifting in indirect reported speech) by interacting in text-based SCMC while receiving textually enhanced or unenhanced recasts by an expert interlocutor. Findings also indicated that textual enhancement of the recasts affected the learners’ awareness of the targeted form.

Yilmaz and Yuksel (2011) investigated whether learners would benefit from recasts on two Turkish morphemes differently depending on communication mode. Results of this study revealed that learners scored significantly higher after receiving recasts through text-based SCMC than recasts through FTF.

Finally, Shintani and Aubrey (2016) examined the effects of synchronous and asynchronous written corrective feedback on the learning of L2 English on text-based SCMC,
without establishing a comparison to FTF. They found that both experimental groups significantly improved from the pretest to the immediate and delayed posttests while the comparison group (without feedback) did not.

The two studies whose direct focus was not feedback were Shekary and Tahririan (2006) and Granena (2016). Shekary and Tahririan (2006) investigated the potential of text-based SCMC for promoting noticing (operationalized as LREs) and whether noticing led to learning. In their investigation of eight dyads of English as foreign language learners, they found that learners did focus on form through LREs and the results in the immediate and delayed posttest suggested that noticing in this context was associated with subsequent learning.

Granena (2016) investigated individual versus interactive task-based performance through voice-based CMC for the learning of L2 English. She found significant pre-to-post learning gains under both of her voice-based conditions (individual and interactive). Between-groups comparisons further showed that participants in the interactive condition outperformed participants in the individual condition on one of the three target structures investigated, namely the English past tense. However, this study did not report reliability of assessment instruments. Moreover, while ninety participants were assigned to the individual condition, only thirty-six were assigned to the interactive condition. According to the researcher, this was due to convenience reasons, “given that administering the task individually was easier than pairing students up at a day and time of their convenience for each of the target structures investigated” (p. 56). Future studies should aim to control for these limitations in order to increase the reliability of their findings.
Future Directions of the SCMC Strand of Research

This review has shown that much of the SCMC research to date has investigated whether the interactional moves that are said to promote learning in FTF also occur in SCMC. Research has generally reported that negotiation of meaning, noticing and uptake also occur in SCMC, but to different degrees than in FTF and not always in the same ways that they occur in FTF. Very few studies so far have investigated the interactional routines elicited by video-based and voice-based SCMC.

Only a handful of studies have addressed L2 learning in oral SCMC, despite the growing presence of video-chat programs such as Skype and Google Hangouts in online language courses (Ziegler, 2016c) and the fact that CMC is becoming increasingly video-centric (Petersen & Sachs, 2016). In addition, as Blake (2008) has pointed out, research into video- and voice-based SCMC has been predominantly within the area of distance language education, while fewer studies have focused on the potential of these modes to promote learning in the classroom. This observation points to the need for more studies that address the effects of oral SCMC for L2 learning in the L2 classroom. As Yanguas (2010, p. 75) claims, ‘investigations of non-text-based CMC are due at a time when technological resources, both hardware and software applications, are becoming more available’, while this mode communication has gone widely underresearched by SLA researchers.

In fact, only two out of eleven studies (18%) to date have researched the impact of oral SCMC on L2, either voice-based (Granena, 2016) or video-based (Monteiro, 2014) on L2 grammatical learning. These two studies, however, have only addressed the effects of one SCMC oral mode without establishing a comparison to other SCMC modes or to FTF interaction, thereby not allowing for a comparison to previous text-based SCMC or FTF research.
Indeed, as Table 1 shows, only one of the eleven SCMC studies addressing L2 learning (9%) has included more than one SCMC mode in their designs and interestingly, and only three studies (27%) have compared SCMC to FTF (Baralt, 2013; Yilmaz, 2012; Yilmaz & Yuksel, 2011), all of which included a text-based SCMC condition. Therefore, it will be informative to compare oral SCMC to written SCMC in terms of grammatical learning in future research, since no study to date has addressed such a comparison. This need has been voiced by SCMC scholars, who have called for more research into the overall effects of interaction in different SCMC modes on L2 development (e.g., Loewen & Wolff, 2016; Yanguas, 2010; Ziegler, 2016b). In fact, Petersen and Sachs (2016) have claimed that “online communication that simulates FTF interaction through the inclusion of audio and video has yet to undergo broad formal investigation as a medium for effective foreign language instruction” (p. 9).

A productive line of research will continue to investigate the effects of feedback on L2 development, while including new SCMC modes that have been only marginally researched to date (i.e., oral SCMC). Given that no study to date has investigated the efficacy of explicit or metalinguistic feedback in different modes, future research addressing this gap is clearly warranted. Findings would provide empirical evidence that would support or reject previous studies that have reported the efficacy of explicit feedback in both the FTF and SCMC modes, particularly at delayed posttest, and for the oral production measure (e.g., Yilmaz, 2012).

As can be seen in Table 1, most studies have investigated L2 English (63%), two studies have addressed L2 Turkish (18%) and two studies have researched L2 Spanish (18%). In fact, some scholars have recently voiced the need for replication research in the field of CALL in order to test important issues for languages other than L2 English (e.g., Chun, 2012). Although most studies investigated delayed effects (72%), only four studies (36%) reported both effect
sizes and having performed a power analysis. Following this, future SCMC comparative studies should aim for better research methodologies and research designs, better statistical reporting practices and the inclusion of delayed effects (e.g., Cerezo et al., 2014; Plonsky & Ziegler, 2016), in order to obtain solid results that can be trusted by practitioners, and with the ultimate goal of advancing the field of CALL.

Finally, only one of the eleven studies included the cognitive individual variable of working memory capacity (WMC) in their design, despite it being assumed to be one of the main cognitive variables affecting interaction-driven L2 learning overall (e.g., Goo, 2012; Mackey, Adams, Stafford, & Winke, 2010; Mackey, Philp, Fujii, Egi, & Tatsumi, 2002), an issue addressed in the next chapter. As mentioned by Yilmaz (2012), of special importance is the inclusion of WMC in studies addressing the efficacy of negative feedback, as it may moderate its effectiveness.
CHAPTER 3. COGNITIVE INDIVIDUAL DIFFERENCES IN SCMC: THE CASE OF WORKING MEMORY CAPACITY (WMC)

From a psycholinguistic perspective, which sees language learning as an internal process, one of the most interesting issues regarding technology for language learning might be how learners’ internal mechanisms actually interact with the mode, be it technology or the absence thereof. Indeed, it might be the case, as Robinson (2001) has suggested, that technology-mediated language learning transforms the cognitive processing constraints of tasks in a way that has direct benefit to certain types of learners. WMC is one such internal mechanisms that might interact with the mode through which learners interact to learn an L2.

As has been proposed by some researchers (e.g., Collentine & Freed, 2004), a comprehensive theory of SLA needs to consider both internal (e.g., memory, psycholinguistic input-processing principles, procedural and declarative knowledge) and external (e.g., sociolinguistic, interactional, institutional-contextual, affective) factors that affect and interact with learning. In the current dissertation, the internal factor under consideration is WMC, and the external one is interactional mode through which participants talk, receive feedback, and ultimately learn the target language.

**Definition and Measurement of Working Memory Capacity**

Working memory is the system of temporary storage and manipulation of information during complex cognitive activities such as language comprehension and learning (Baddeley, 2010). It has been defined as “the ability to maintain information in an active and readily accessible state, while concurrently and selectively processing new information” (Conway,
Jarrold, Kane, Miyake, & Towse, 2007, p. 3). While different models of working memory differ in their specific theoretical conceptualization (Miyake, 2001; Miyake & Shah, 1999; Sagarra, 2013), they generally agree that WMC is a limited-capacity construct that regulates online processing, storage, and retrieval (Serafini & Sanz, 2015).

The multiple-resource model proposed by Baddeley and colleagues (Baddeley, 1986, 2000, 2003, 2007, 2010; Baddeley & Hitch, 1974; Baddeley & Logie, 1999) remains dominant in the field (Miyake, 2001; Wen, Mota, & McNeill, 2015). This model proposes a ‘nonunitary’ view of WMC, or a multicomponent memory system, with specialized processing and storage components that comprise a domain-general construct (i.e., executive function, EF) responsible for various attentional functions (e.g., inhibiting, switching, and retrieving information, updating of goals based on feedback), and two domain-specific storage systems, the phonological loop (i.e., phonological working memory) that handles phonological and verbal information and has a span of about 1 to 2 seconds (Baddeley, 1986, 2003; McCabe, Roediger, McDaniel, Balota, & Hambrick, 2010), and the visuospatial sketchpad, which stores and processes visual and spatial information. Baddeley (2000) extended the original model to include a fourth component called an episodic buffer, which holds and integrates visual, spatial, and verbal information.

To measure the EF and WMC components, most studies addressing L2 learning have adopted WMC span tasks widely used in cognitive psychology (Conway et al., 2005). These tasks can be verbal (e.g., letter span, word span) or nonverbal (e.g., digit span), and simple or complex. Only complex span tasks that impose dual-task demands adequately capture learners’ WMC when being pushed to the limit (Logie, 2011) as they require subjects to maintain target items (letters, words, digits) in memory for later recall while reading or listening to sentences, as
in the Reading and Listening span tasks (Daneman & Carpenter, 1980; Waters & Caplan, 1996) or calculating simple mathematical operations as in the Operation span (Turner & Engle, 1989; Unsworth, Heitz, Schrock, & Engle, 2005). Nonverbal tasks administered in the learners’ L1, as opposed to their L2, are argued to be preferred to avoid a potential confound with verbal processing (e.g., Engle, 2002; Wen, 2012) and L2 proficiency (e.g., Alptekin, Erçetin, & Özemir, 2014; Juffs & Harrington, 2011; Sagarra, 2013; Van den Noort, Bosch, & Hugdahl, 2006).

**Working Memory Capacity, SLA, and Interactional Research**

Previous SLA research has posited that WMC is believed to be one of the main cognitive variables affecting *interaction*-driven L2 learning (e.g., Goo, 2012; Li, 2013; Mackey, Adams, Stafford, & Winke, 2010; Mackey, Philp, Fujii, Egi, & Tatsumi, 2002; Mackey & Sachs, 2012; Révész, 2012), and L2 learning overall (Juffs & Harrington, 2011; Linck, Osthus, Koeth, & Bunting, 2014). A sizable number of studies have provided evidence that greater WMC is favorable for L2 performance in several SLA areas including sentence processing, spoken output, reading, and writing (e.g., Abu-Rabia 2003; Erlam 2005; Harrington & Sawyer 1992; Mackey et al. 2002, 2010; Mackey & Sachs 2012; Miyake & Friedman 1998; Robinson 2005; Sagarra 2007; Sagarra & Herschensohn 2010). Of special importance to the current study are studies that have focused on SLA interactional research.

As Mackey et al. (2010) claim, WMC is quite relevant in the context of interaction research, as the interactional approach proposes that learner-internal processes such as those involved in selective attention mediate between input and learning. The provision of feedback and production of modified output during interaction might help to focus learners’ attention and
memory resources on what is particularly relevant for their L2 learning. Some empirical studies that have examined the relationship between face-to-face interaction and L2 learning, together with the role of WMC in that relationship, are reviewed below.

Ando, Fukunaga, Kurahashi, Suto, Nakano, and Kage (1992) explored the relationship between learners’ cognitive capacity and how much they benefited from different instructional approaches. This study explored the relationship between learners’ cognitive capacity and how much they benefited from different instructional approaches. They assessed 90 L2 Japanese fifth graders’ verbal WMC and their verbal WMC predicted their relative success in the L2 after 9 hours of explicit form-focused instruction, although only on a two-month delayed posttest. However, under a more communicatively-oriented condition that included meaning-focused production activities, results were reversed. Learners with low WMC benefited more from the implicit communicative approach. Ando et al. (1992)’s findings suggest that WMC may be a reliable predictor of successful L2 learning under more explicit learning conditions.

Yilmaz (2013) investigated the role of two cognitive factors (i.e., WMC and language analytic ability) and the extent to which L2 learners benefited from two different types of feedback (i.e., explicit correction and recasts). When each of the feedback types was compared with the control group, this study found that explicit correction worked both for low and for high WMC learners, whereas recasts only worked for low WMC learners. When the two feedback types were compared with each other, it was found that explicit correction worked better than recasts only when the learners in the compared groups had high WMC. Finally, when high and low WMC were compared with each other within each feedback group, it was found that only in the explicit correction group, the high WMC learners outperformed the low WMC learners.
In line with Ando et al. (1992) and Yilmaz (2013)’s findings, some researchers (e.g., Roehr, 2008) have suggested a possible link between WMC and explicit language exposure conditions, particularly when L2 learners need to retain metalinguistic information in memory whilst simultaneously producing and comprehending language, and because explicit rule-based processing should place demands on the central executive. In addition, WMC has been shown to impact L2 classroom learning, which is often associated with explicit processes (Linck & Weiss, 2011).

Mackey et al. (2002) examined the relationship between L2 learners’ WMC, their noticing of interactional feedback, and L2 development of English question forms by low-proficiency English learners. The learners received feedback in the form of recasts of their nontarget-like English question forms during three 30-minute sessions of dyadic task-based interaction. Interactions were followed up by stimulated recall activities to evaluate noticing. High WMC was associated with more noticing of relevant forms (although the effect was marginally significant over the small sample tested). In terms of actual learning gains, this study found evidence for more development amongst the high WMC group at delayed posttest (although this analysis was only based on a total of 7 participants).

Mackey et al. (2010) examined the association between WMC and the production of modified output. They found that high-span learners modified their output following interactional feedback (clarification requests, repetitions with rising intonation, and recasts) more often than low-span learners. It should be noted that whereas the regression analysis suggested that WMC was an important factor in the production of modified output, the relatively low effect
sizes for both models (both under 20%) indicated that variables other than WMC were also important to the production of modified output.

Goo (2012) explored the relative efficacy of recasts over metalinguistic feedback on the learning of the English that-trace filter and how WMC was related to the extent to which learners benefited from these two types of feedback. This study showed no statistically significant difference between the two experimental groups in their performance. With regard to the role of WMC in the effectiveness of recasts and metalinguistic feedback, WMC was shown to significantly predict the beneficial effects of recasts on the development of the that-trace filter, but it failed to predict the improved performance of the metalinguistic group.

Li (2013) investigated whether two components of language aptitude (language analytic ability and WMC) played different roles in mediating the effects of implicit and explicit feedback for the learning of Chinese. Results of this study showed that both aptitude components were significant predictors, and that whereas language analytic ability was sensitive to the effects of implicit feedback, WMC was sensitive to the effects of explicit feedback.

Taken together, the findings of these studies seem to indicate that learners with higher WMC exhibit more delayed benefits from communicative instruction and feedback than their counterparts with lower WMC (Ando et al., 1992; Mackey et al., 2002). As Mackey et al. (2002, p. 204) suggest, it might have been the case that although the learners with higher WMC may have taken longer to ‘consolidate and make sense of the feedback given to them, reflecting change only after an interval’, they may have been better able to make cognitive comparisons between the target language forms included in the feedback and their own versions of question forms, with lasting effects for L2 development. They further claim that the learners with lower
WMC may not have been cognitively comparing the target language forms with their own forms in the same manner as those with higher WMC. In other words, they might not have processed the input provided in the form of feedback in a sufficiently elaborative way such that encoding in long-term memory could occur. As a consequence, the lower capacity learners may have not been as able to access information from long-term memory at the time of delayed posttest as the higher capacity learners were.

On top of that, it seems that greater processing capacity may be related to greater production of modified output during interaction (Mackey et al., 2010). Finally, while some studies show that individual differences in WMC seem to mediate the effects of explicit feedback (Ando et al., 1992; Li, 2013), other studies show that WMC might predict, and therefore mediate the effects of, recasts but not metalinguistic feedback (Goo, 2012).

**Working Memory Capacity and SCMC Research**

As Ortega (2009) has claimed, the variable of WMC is increasingly emerging as an important moderator of learning not only in FTF interactional research but also in the SCMC mode, judging from the findings reported in the SCMC studies to date that have included the variable of WMC in their designs (Baralt, 2015; Lai, Fei, & Roots, 2008; Payne & Ross, 2005; Payne & Whitney, 2002) (see Table 2 for details on these studies and see Table 1 for Baralt, 2015).
Table 2. SCMC Studies that included WMC in their designs.

<table>
<thead>
<tr>
<th>Study</th>
<th>SCM C mode (s)</th>
<th>Group s/ Comparison with FTF?</th>
<th>n siz e</th>
<th>Dependent variable</th>
<th>Assessment tasks &amp; Reliability reported</th>
<th>WMC test(s) used</th>
<th>Treatment Task &amp; Length of treatment</th>
<th>Interlocutor</th>
<th>Results</th>
</tr>
</thead>
</table>
| Payne & Whitney (2002) | Text-based     | -SCMC -FTF                    | 58      | L2 oral proficiency | -Oral Proficiency Interview (OPI)                                                                     | -Recognition-based nonword repetition task | -Role plays, discussions of cultural texts or video, and other communicative activities | Groups of four to six students | -Relationship between the nonword repetition task and oral proficiency gain scores ($r = .30$)  
  -Pearson Correlation was higher for the control (FTF) group ($r = .33$) than for the experimental group ($r = .23$) |
| Payne & Ross (2005)    | Text-based     | -SCMC only                    | 24      | Occurrences of repetition and relexicalization (comparison between first and second halves of the semester) | -Speaking task that required speaking in Spanish for about 5 minutes                                   | -Recognition-based nonword repetition task, as a measure of phonological working memory  
  -Recognition-based reading span, as a measure of executive function/central executive | -Small-group discussion, role-plays, discussions of assigned texts and video content, as well as information gap activities | Groups of three to four students | -A median split divided participants into high- and low-span groups  
  -Significant difference between the first and second halves of the semester in both measures (decrease in both)  
  -No significant differences between high- and low-spans were found for both the reading span and nonword repetition with respect to both measures  
  -Low nonword repetition and high reading span group: highest production of all 4 groups  
  -High-span nonword repetition group outperformed low-span group on both measures |
Table 2. SCMC Studies that included WMC in their designs (Cont’d).

<table>
<thead>
<tr>
<th>Study</th>
<th>SCM C mode (s)</th>
<th>Group(s)/Comparison with FTF?</th>
<th>L2 &amp; proficiency level</th>
<th>n size</th>
<th>Dependent variable</th>
<th>Assessment tasks &amp; Reliability reported</th>
<th>WMC test(s) used</th>
<th>Treatment Task &amp; Length of treatment</th>
<th>Interlocutor</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lai, Fei, &amp; Roots (2008)</td>
<td>Text-based</td>
<td>- Contingent Recasts in SCMC - Noncontingent recasts in SCMC</td>
<td>English Intermediate (n=6) &amp; lower intermediate (n=11)</td>
<td>17</td>
<td>Noticing of recasts</td>
<td>-Think-aloud protocols and stimulated recalls</td>
<td>-Self-made reverse digit span test (language-independent measure)</td>
<td>-Two dyadic communication tasks: spot-the-difference tasks (one with prewriting the other without) -10-minute prewriting and 15-minute chatting task (30 minutes total)</td>
<td>Dyad participant-researcher</td>
<td>-46% of the total number of recasts were noticed: 53% of the contingent ones and 35% of the noncontingent ones -Spearman’s rho correlation (used due to small sample size) revealed that WMC was significantly correlated with the noticing of recasts (p = 0.58, p &lt; 0.05). WMC was strongly correlated with the noticing of noncontingent recasts (p = 0.79, p &lt; .001), whereas the correlation with contingent recasts was weak and not significant. -No effect for proficiency.</td>
</tr>
</tbody>
</table>

Baralt (2015) | See Table 1 | | | | | | | | | |
As Table 2 shows, these studies have researched the effects of text-based SCMC interaction on the noticing of recasts (Lai et al., 2008), the effects of text-based SCMC on grammatical learning (Baralt, 2015), the effects of text-based SCMC vs. FTF on general proficiency development (Payne & Whitney, 2002), and the effects of SCMC interaction on repetition and relexicalization (Payne & Ross, 2005).

Lai et al. (2008) investigated whether WMC would play a role in the noticing of contingent or non-contingent recasts by seventeen ESL learners in text-based SCMC whilst learning L2 English. These researchers measured noticing through think-aloud protocols during the completion of two spot-the-difference tasks, and stimulated recall while viewing the video-recordings of the performance of the tasks. They found a sizeable relationship between WMC and noticing of recasts, and most importantly, they found that the higher the WMC of participants, the more they noticed non-contingent recasts (that is, recasts that do not immediately follow the erroneous turn) in text-based SCMC. This finding is partially in agreement with previous FTF research (Mackey et al., 2002).

Baralt (2015) explored whether WMC would moderate the efficacy of recasts in task-based SCMC interaction, and whether the text-based SCMC mode would help learners with lower WMC spans. In this study, WMC was found to not be related to grammatical learning on simple or complex tasks. Additionally, as Pearson’s correlations revealed, WMC also did not moderate learning differently for different types of learners. While participants did learn the Spanish past subjunctive, the construct of WMC was not related to their benefitting from feedback in the form of recasts in the text-based SCMC mode in this study, regardless of whether it was provided during a cognitive simple or complex communicative task.
Payne and Whitney (2002) employed text-based SCMC and FTF interaction tasks to examine L2 development in relation to the WMC of fifty-eight L2 Spanish learners. This study compared the pre-posttest performance of participants who engaged in SCMC tasks with that of participants who engaged in FTF interactions on the same topics over the course of a semester. Oral performance was assessed by two examiners by means of a holistic rubric developed for this study. Results of the study showed greater improvements in oral proficiency for participants in the SCMC group compared to the FTF group. Furthermore, the correlation between WMC and L2 development was stronger for the FTF participants in a way that suggested that SCMC may have served as a support for learners who had less ability to maintain verbal information in memory.

Payne and Ross (2005) investigated how individual differences in WMC related to the frequency of repetition and other patterns of language use in text-based SCMC discourse. As seen in Table 2, Payne and Ross (2005) measured WMC with a reading span and non-word repetition test. They found significant differences only for phonological working memory with the high-span group outperforming the low-span group for their two measures. It was also found that participants who had low phonological memory, but high executive function produced the highest average number of words, utterances, and turns per chat session, a finding that aligns with previous research (e.g. Kern, 1995).

However, Payne and Ross (2005) divided the WMC scores of their twenty-four participants into artificial groups and then statistically compared the means of these artificial groups to their two dependent measures. This practice has been critiqued by SLA scholars (e.g., Plonsky & Oswald, 2016), because taking a continuous variable and artificially dividing it into two or more groups makes researchers “lose all the underlying continuous information for no
good reason” (p. 5), many times with the only objective of allowing for a comparison of a
means-type analysis (Plonsky, 2015). The fact that Payne and Ross (2005) just included twenty-
four participants especially discourages the division of scores into two arbitrary groups.

As far as the test used to measure WMC, it should be noted that both Payne and Ross
(2005) and Payne and Whitney (2002) employed recognition-based WMC tests, something that
might have influenced their results, as these tests are less challenging than production-based
WMC tests, such as the one used by Lai et al. (2008) and other SLA studies. In fact, Payne and
Whitney (2002) pointed out in their study that “a revision of the histograms of the frequency
distributions for the nonword repetition test and the reading span measure shows that the scores
are much more concentrated than is customary in the production-based reading span and
nonword repetition tests” (p. 21), meaning that a majority of participants scored high on the tests.

In a study investigating the efficacy of computer-delivered oral recasts, Sagarra (2007)
showed that the effects of online, pre-recorded feedback may be moderated by WMC. In her
study, 65 college students in first-semester Spanish courses completed fill-in-the-blank exercises
online that required the appropriate use of Spanish adjectives (number and gender agreement
between noun and adjective). After entering incorrect responses, participants either received
computer-delivered oral recasts on their errors (the feedback group) or did not receive recasts
(the control group). She found that providing recasts produced high learning gains as measured
by immediate and delayed posttests, and that learning gains correlated with WMC. The WMC of
learners in the feedback group predicted not only their linguistic accuracy on written posttests
but also the amount of target-like modified output they produced following feedback in
subsequent face-to-face (FTF) interactions, in agreement with Mackey et al. (2010). Sagarra
(2007)’s study, although providing some insights into the role of WMC, does not directly address
synchronous communication, as computer-delivered recasts had been prerecorded to be delivered in response to incorrect utterances, instead of responding to errors in spontaneous communication.

The three studies that directly investigated SCMC do not only differ in the dependent variables they measured, but also in other design features such as the length of their treatment, the L2 under study, and the interlocutor with whom participants interacted. While Payne and Whitney (2002) and Payne and Ross (2005) are studies that took place over the course of one semester, Lai et al. (2008) is a one-shot design study that measured L2 noticing and development in a very controlled environment, and Baralt (2015) is a pre-post-delayed posttest study with very controlled conditions too. On the other hand, while Payne and Whitney (2002) and Payne and Ross (2005) included groups of learners, Lai et al. (2008) and Baralt (2015) included learner-researcher dyads. The fundamental differences in the design of these studies prevent researchers from drawing any definite conclusions regarding the role of WMC in text-based SCMC.

For now, the findings in three of these studies appear to lend support to the idea that low-span learners may use the text-based SCMC as a compensatory mechanism, and may benefit from the SCMC interaction as much as their higher-span WMC counterparts do in FTF. In other words, it is assumed that the text-based SCMC might pose an advantage for those lower-span learners due to the fact that it provides a slower paced communication, as learners can refresh their memory traces through reading, and even re-reading the passages they wish. It is also assumed that the possibility exists for some learners to allocate attentional resources to different aspects of communication serially, that is, first to decoding their interlocutor’s message and second to encoding their own message when typing it in the chat. However, the fourth study
(Baralt, 2015) seems to point in a different direction and suggest that lower WMC span learners may not benefit when interacting in the text-based SCMC environment.

**Future Directions of Working Memory within the SCMC Strand of Research**

Future studies need to keep researching the relationship between cognitive individual differences and mode for L2 interactional-based learning. In fact, some scholars have noted that “asking which mode is most appropriate for certain tasks and certain individual differences is a logical and practical line of inquiry” (Baralt & Gurzynski-Weiss, 2011, p. 218). However, the paucity of comparative studies still poses more questions than provides answers.

The studies reviewed above all investigated text-based SCMC, and none of them, except for Payne and Whitney (2002), compared the text-based SCMC group with an FTF group. Therefore, whether WMC moderates the effects of mode for L2 learning indeed warrants further research. Indeed, no study to date has investigated the role of WMC in oral SCMC environments, despite the fact that SCMC is becoming increasingly video-centric (Petersen & Sachs, 2016). It will be interesting to research whether oral SCMC environments present the same advantages as the text-based SCMC does for lower-span learners (Payne & Whitney, 2002; Payne & Ross, 2005 but see Baralt, 2015 for conflicting results), or, on the contrary, whether these environments behave more similarly to FTF and tend to benefit higher-span learners (e.g., Ando et al., 1992; Mackey et al., 2002; Mackey et al., 2010).
CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

The current chapter outlines the pilot’s study design, methodology and results, together with modifications for the current study. After addressing the pilot study, this chapter focuses on the main study’s design, methodology, linguistic targets, materials, procedure, scoring, and coding.

Pilot Study

The pilot study was administered during the Spring 2017 semester. It aimed to fill several gaps outlined in the previous two chapters. Firstly, there is a dearth of studies that have addressed the effects of video-based SCMC on L2 learning, specifically grammatical L2 learning. Secondly, there is a need for further empirically robust research that compares the effects of different types of SCMC vs. FTF on L2 learning to be able to inform curriculum design (Blake 2015; Blake, Wilson, Cetto, Pardo-Ballester, 2008; Cerezo, Baralt, Suh, Leow, 2014). Thirdly, future SCMC research needs to keep investigating the efficacy of explicit feedback in promoting learning in the different interaction modes. Finally, SCMC research (especially video-based SCMC) needs to address whether the results of FTF interactional research that show higher benefits for individuals with higher working memory are replicated or not in this mode. Given its closer proximity to FTF than text-based SCMC, video-based SCMC might favor those participants with high WMC, supporting previous FTF interaction literature (e.g., Mackey et al., 2002, 2010). However, this is an empirical question. Considering these needs, the following research questions guided the current study:

RQ1. Does type of communication mode (video-based SCMC vs. text-based SCMC vs. voice-based SCMC plus explicit feedback) lead to differential L2 grammatical learning, as measured by oral and written production of the target structure?
RQ2. Does WMC moderate the relationship between communication mode and L2 grammatical learning?

Pilot Methodology

Participants

Participants were initially 31 Spanish L2 learners enrolled in a 4th semester (intermediate level II) Spanish class at a Mid-Atlantic university. They were recruited in the middle of the semester, after having had some exposure to the target structure. In spite of having had some exposure, out of the 31 original participants, only 1 was excluded from the analysis due to achieving an 86.6% score on the oral pretest, and a perfect score (100%) in the written pretest, signifying knowledge of the target structure. One additional participant was excluded because he did not attend the treatment session. Two other participants were excluded because their audio files were corrupted. Finally, four participants were excluded because they reported on the exit questionnaire having had external exposure between the second and the third session, which might have impacted the high scores they achieved at delayed posttest.

The final pool of participants consisted of 23 participants, whose mean age was 19.17. Out of the 23 participants, 21 were L1 English speakers, one was an L1 Bemba speaker, and one was a heritage speaker of Spanish (she self-identified as L1 speaker of Spanish). Of the ones who reported that English was their L1, one reported knowing Chinese ‘semi-fluently’, one reported being a native speaker of Polish, and one reported being a heritage speaker of Punjabi. Of the 23, 10 (43.4%) were male and 13 (56.5%) were female. On average, participants had been enrolled in a Spanish course for 4.5 years, (ranging from 0 to 12.5 years). Out of the 23 participants, none (0%) had studied abroad in a Spanish speaking country. Out of the 23 participants, 7 had studied
other romance languages before, four reported having studied French (ranging from 1.5 years to 5 years), three studied Latin (ranging from 4 to 6 years).

Target Linguistic Structure

The target structure chosen for the current study is the past subjunctive following verbs of emotion. In Spanish, the subjunctive involves two notions, namely modality and mood (Collentine, 2010). Modality refers to the speaker’s perception of a specific statement, whereas mood, on the other hand, is the inflectional representation of modality. Whereas the indicative is the default mood of independent clauses, one must be careful to select the correct mood in subordinate clauses. The subjunctive is used in the subordinate clause whenever one of the following five modalities appears in the main clause: doubt/denial, evaluations, reactions, reports of commands, or volition (Collentine, 1995).

As explained by Collentine (2010), the acquisition of the subjunctive entails acquiring mood-selection abilities as well as learning the subjunctive morphology, hence its complexity. In naturalistic input, the subjunctive is low in frequency and inflectional saliency (Collentine 2010; Gudmestadt, 2006). The subjunctive’s use by native speakers is sufficiently variable such that learners may not reliably discern its meaning/function from naturalistic input (Geeslin & Gudmestadt, 2006; Gudmestadt, 2012).

In order to learn this problematic structure, deliberate practice probably needs to focus the learner’s attention on various features simultaneously (e.g., antecedent reference and inflectional morphology concurrently) (Collentine, 2010). This type of practice is best attained by contextualizing the structure within some concrete situation for some communicative purpose (Cerezo, 2010; VanPatten & Benati, 2010), and by providing explicit feedback (Lyster & Saito, 2010).
Previous research has shown that the subjunctive is indeed difficult to acquire for L2 Spanish learners (e.g., Collentine, 1995; Farley, 2004; Fernández, 2008). Furthermore, research appears to indicate that the order in which L2 learners incorporate the subjunctive into their interlanguages seems to be mediated by the lexical class of the primary clause verb, among other factors (Gudmestad; 2012; Collentine, 1995). DeKeyser and Prieto Botana (2013) argue that L2 subjunctive development is probably best served by teaching approaches that “(1) channel learner attention to the form and (2) include explicit information to help the formation of form-meaning connections” (pp. 454-455). Research examining the efficacy of implicit and explicit instructional approaches has surmised that some sort of explicit intervention is necessary (e.g., Farley, 2004; Fernández, 2008).

The present study indeed contextualizes subjunctive practice within concrete situations for communicative purposes. In particular, it focuses on the expression of subjunctive following verbs of emotion (both evaluations and reactions) when talking about stories that happened in the past. Specifically, the focus on the study are three emotions (to be surprised, happy, and mad/irritated). For example, in the utterance *Me alegré de que mi madre me llamara por teléfono* (I was happy [that] my mom called me on the phone), the verb in the dependent clause, *llamara*, (called), is a past subjunctive form. At the time of the current study, participants had learned about the concept of modality in class, had practiced the present - but not the past - subjunctive, and had had extensive practice forming subordinate clauses.

**Materials**

Materials used in this study included a questionnaire targeting participant demographics and computer use, a tutorial on the present subjunctive with practice, one experimental task, two assessment tasks, an exit/debriefing questionnaire, and a working memory test.
Language Background & Computer Use Questionnaire (administered online through Google Forms):

https://docs.google.com/forms/d/e/1FAIpQLSd6Pb4cJLEYveMCpgBrXHSc-PwAJLbWE2UQ2N2fSldwMR6few/viewform

A background questionnaire was administered to obtain information about the participants (including computer and CMC use). Participants were asked to indicate their year of study, major, sex, native language, other languages studied, whether they had studied abroad in the past, as well as their motivation for taking Spanish as a foreign language. Additionally, participants were asked how much time they spend using the computer per week, to rate their typing skills, and to express their level of comfort and enjoyment using computers. The questionnaire was used both to ensure that participants were comparably familiar with communicating in both FTF and CMC modes and to provide a more qualitative picture of any patterns indicated by the quantitative analyses.

Exit Questionnaire (administered online through Google Forms):

https://docs.google.com/a/georgetown.edu/forms/d/1_qMS5JVjwdxhigUOAfzhE7unHH-Sqn-lU0XFp7wxst3Y/edit

An exit questionnaire was administered after the delayed posttests in order to debrief participants on the purpose of the study and control for external exposure to the target structure outside the experimental period (potential data contamination). It detailed the target linguistic structure and its use, and asked the participants if they had had any additional external exposure to the target linguistic structure during the experimental period. If participants indicated ‘yes’ to this question, they were further asked if this exposure took place through their instructor, their textbook, by looking up the forms on their own, or other. The debriefing questionnaire in the pilot
study resulted in four participants being excluded from the analysis. This questionnaire also asked participants what they liked and what they did not like about their interaction with the researcher in the second session, that is, they could comment on the easiness of the task, feedback provision, mode of the interaction, among other factors. This question was included to obtain some qualitative data regarding mode of interaction from the participants’ perspective.

Operation-Word Span Task (OWST):

One of the most widely used tasks for measuring WMC is the operation span task (Turner & Engle, 1989; Unsworth, Heitz, Schrock & Engle, 2005). In this test, administered through SuperLab and used in previous research (e.g., Tagarelli et al., 2011), participants see an equation and a word appear on the computer screen. They read the equation out loud, state whether the answer provided is correct or not, and then read the following word out loud. For example, if the participant sees “Is (4 x 3) + 1 = 10? CAT,” he/she says, “Is four times three plus one equal to ten…no…cat.” Once the participant says the word, he/she advances to the next operation and word in the set. There are 12 sets overall, with two to five words in a set. At the end of each set, a cue appears to prompt participants to write down all of the words that they can remember from that set. This type of task, known as a complex memory span task, is assumed to afford the closest approximation of WMC because it induces individuals to simultaneously process and maintain verbal information. If administered in the L2, a WMC test might confound WMC with L2 proficiency level, so the test was administered in participants’ L1 rather than the L2.

Treatment Task:

The treatment task chosen for this study was an interactive dialogic story retell, a type of task similar to other tasks used in previous research (e.g., Baralt, 2013; Gurzynski-Weiss et al.,
The story detailed three experiences that two students had while they studied abroad in Madrid (Spain) the previous semester. Participants were asked to read the stories in English and then use the corresponding prompts (also in English) to retell story events either in FTF or SCMC (text-based or video-based) to the researcher in Spanish. The story was divided into three parts (each targeting one experience in Madrid), to prevent participants’ memory decay. Prompts in the treatment task were aimed to elicit a total of 30 exemplars of the past subjunctive. The researcher consistently provided explicit feedback to participants as they interacted while completing the task. Metalinguistic feedback included the grammatical rule and its context of use was provided the first two times feedback was provided by the researcher. A sample of this production test is provided in Appendix A.

Assessment Tasks:

In order to establish that the target structure was learned, participants performed two production assessment tasks, one oral and the other written. Three equivalent versions of each production test were created, and their administration was counterbalanced for the three test administrations. Neither the oral or the written production test carried a time limit.

Oral production assessment task. A controlled, monologic retell story task was administered to measure learners’ ability to produce the target structure orally in obligatory contexts. As in the treatment task, participants read a story in English and then retold it using prompts also in English. A monologic task was deemed appropriate for the test because the researcher was not providing feedback during the retell, as opposed to the treatment task. Even though one of the treatments in the study had participants carry out a task through text-based SCMC, an oral production measure was used as posttest because previous research has shown that an intervention through text-based SCMC can in fact improve learners’ oral proficiency (e.g., Baralt, 2013; Payne & Whitney, 2002).
Because there is a paucity of studies addressing this issue, this study aims at providing further evidence for or against the fact that a writing treatment may result in oral development.

In this test, participants had 15 opportunities to produce the target structure. In addition, 15 distractor items were included, which addressed the subjunctive present tense (5 items) and the indicative preterit tense (10 items). The incorporation of these items aimed to fulfill the notion that participants’ knowledge of both the present subjunctive and the indicative preterit tense might be prerequisites to the formation of the past subjunctive (Baralt, 2013). The stories in the tests were similar to the stories in the treatment task. A sample of this production test is provided in Appendix B.

Written production assessment task. A semi-spontaneous picture description task was administered to measure participants’ ability to produce the target structure in the written form in obligatory contexts. This test was less controlled than the oral production test, as participants were not given the exact words they had to produce via prompts. Instead, they saw two pictures side by side and they had to describe how the character in the first picture (Natalia) felt (happy/mad/surprised) about an event depicted in the second picture that had taken place the previous semester. In this test, participants had 10 opportunities to produce the target structure. A sample of this production test is provided in Appendix C.

The target linguistic structure exemplars presented in the treatment task and both assessment tasks are presented in Table 3 below. Although some irregular exemplars were included (bolded in Table 3) due to their high frequency in natural input, points were not discounted if participants regularized those target items in the assessment tasks. A total of 30% (written assessment task) and 28.8% (oral assessment task) of the total items were old items, as they had appeared previously in the treatment task.
Table 3. Exemplars of target linguistic structure presented in treatment and assessment tasks.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Written test</th>
<th>Oral test</th>
</tr>
</thead>
<tbody>
<tr>
<td>invitara</td>
<td>-encontrar</td>
<td>-ayudara</td>
</tr>
<tr>
<td>hablara</td>
<td>-aceptar</td>
<td>-llegara</td>
</tr>
<tr>
<td>-fuera</td>
<td>-fuera</td>
<td>-diera</td>
</tr>
<tr>
<td>existieria</td>
<td>-llegar</td>
<td>-fuera</td>
</tr>
<tr>
<td>respondiera</td>
<td>-interactuar</td>
<td>-pulir</td>
</tr>
<tr>
<td>costara</td>
<td>-diera</td>
<td>-estuviera</td>
</tr>
<tr>
<td>requirieria</td>
<td>-invitara</td>
<td>-pusiera</td>
</tr>
<tr>
<td>pidieria</td>
<td>-costara</td>
<td>-invitara</td>
</tr>
<tr>
<td>-esperara</td>
<td>-estuviera</td>
<td>-abrieria</td>
</tr>
<tr>
<td>olvidara</td>
<td>-respondida</td>
<td>-planeara</td>
</tr>
<tr>
<td></td>
<td>-durir</td>
<td>-comiera</td>
</tr>
<tr>
<td></td>
<td>-llavera</td>
<td>-llegara</td>
</tr>
<tr>
<td></td>
<td>-fuera</td>
<td>-ayudara</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-mantuviera</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/30 (40%)</td>
<td>8/30 (26.6%)</td>
<td>14/45 (31%)</td>
</tr>
<tr>
<td>irregular</td>
<td>9/30 (30%)</td>
<td>13/45 (28.8%)</td>
</tr>
<tr>
<td>exemplars</td>
<td>exemplars</td>
<td>irregular</td>
</tr>
<tr>
<td>(bolded)</td>
<td>(bolded)</td>
<td>exemplars (bolded)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tutorial on the Present Subjunctive:

This tutorial had the form of a 16-slide PowerPoint that reviewed the concept of modality, together with the formation and use of the present subjunctive, including examples. At the end of this tutorial, participants practiced the information they just reviewed by performing three short multiple-choice tasks. If they did not get the answers right, they were redirected to the
grammatical information and after reviewing it for a second time, did the practice again. The rationale to include this explicit instruction component was to make sure all participants knew the present subjunctive before moving on to learning about the past subjunctive. The researcher deemed it appropriate to make sure all participants who took part in the experiment had mastered the concept of modality, knew how to form subordinate sentences, and knew the present subjunctive tense, but not the past subjunctive tense. This tutorial took participants approximately 10 minutes to complete.

Procedure

This study followed a pretest- treatment / immediate posttest- delayed posttest design. The 23 participants were randomly assigned to either the FTF group or one of two SCMC groups (text-based, video-based). Data were collected over the course of a semester, with each participant attending three sessions with the researcher. Only the treatment session (session 2), which included the immediate posttests, was a one-on-one session with the researcher. The first and third sessions were completed in small groups in the language laboratory.

During the first session, participants first listened to a digital recording on the lab computers explaining the procedure for the lab session. Upon listening to the recording in its entirety, written consent forms were administered and signed by participants, after which the researcher clarified the procedure in detail and addressed questions. Participants then completed the language background and computer use questionnaire online. After this, they went through the ~10-minute tutorial on the present subjunctive and completed the practice at the end of it. They then carried out the pretests (i.e., one oral story-retell production test, and one written picture-description production test). After that, they completed the working memory test. This session lasted ~one hour.
During the second session (the treatment session), which took part two weeks after the first session, participants made one-on-one appointments with the researcher. They were randomly assigned to one of the three groups. They were given instructions that they would be carrying out a story-retell task with the researcher and that the researcher would be providing feedback throughout the task. Additionally, they were told to ask the researcher at any time during the task if they needed assistance or wanted to know how to say a word in Spanish. All interactions were carried out in the lab with the participant and the researcher facing each other in case of the FTF group or in different rooms (within the same lab) with two different computers in the case of the SCMC groups. The text-based SCMC group was told not to worry about typing accent marks.

The researcher provided explicit feedback (‘X is wrong, you should say Z’) consistently to all three groups. This type of feedback unambiguously indicates where there is a problem with a learner’s utterance (Yilmaz, 2012). The first two times feedback was provided, the rule of how to form the past subjunctive, as well as when to use it (after emotions, in this case), was provided to participants across groups. Although participants were not timed, their time on task was recorded. Completion of the treatment task was expected to take around 20-25 minutes, but time on task varied widely across groups (see ‘Results’ section below). Right after the treatment task, participants completed the immediate posttests (i.e., one oral story-retell production test, and one written picture-description production test). This session was expected to last ~one hour, but this varied across groups, depending on their experimental group.

One week after the second session, the third and final session took place. On this day, participants completed the delayed posttests (i.e., one oral story-retell production test, and one written picture-description production test). Following this, the online exit questionnaire was administered. This session took ~20 minutes. Figure 1 shows the data collection procedure.
Figure 1. Pilot data collection procedure.

Coding and Scoring

Both assessment tasks (pre- and posttests) were scored for instances of production of the target structure in obligatory contexts. Although the language background and exit questionnaires were not coded per se, the former provided the researcher with data on the participants’ history with Spanish (and other romance languages), and the latter served to confirm the presence or absence of external exposure (contamination) to the target structure. The
computer use questionnaire was coded by calculating percentages of the different variables. A more detailed explanation of each of the coding processes follows.

**Assessment Tasks:**

*Oral production assessment task.* One point was awarded for every target structure (past subjunctive) correctly produced in the task, out of a total of 15 points. If participants produced the incorrect conjugation involving person, produced ser/estar mistakes, or ‘regularized’ irregular verbs, points were not discounted. Raw scores were converted into percentages for comparability purposes with the written production test.  

*Written production assessment task.* One point was awarded for every target structure (past subjunctive) correctly produced in the task, out of a total of 10 points. No points were omitted for orthography, incorrect conjugation involving person (e.g., if the correct answer was bebiera, a point was still awarded if the participant wrote bebieran), ser/estar mistakes (e.g., fuera embarazada instead of estuviera embarazada), or ‘regularization’ of irregular verbs. However, if the participant answered beberían, instead of bebieran, it was not marked as correct. Raw scores were converted into percentages for comparability purposes with the oral production test.

The pretests served to confirm that participants had no prior knowledge of the target linguistic structure and were thus novice learners. All participants did indeed score zero in the pretests, with only one participant scoring 10% in the written pretest and two participants scoring 6.6% in the oral pretest. Additionally, distractor items in the pretest were coded for every correctly produced instance of the present subjunctive or the preterit indicative. They served to confirm that participants had indeed knowledge of the two distractor forms, required to be able to conjugate the past subjunctive.
**WMC Test:**

This test was scored by assigning one point per correctly recalled word in the correct order if all the words in that series were correctly recalled and if the correct order, for a total possible score of 42 points. For example, if a participant produced the following string of words (see ‘Produced’ below), the score for this participant would be 2, because only the third series is completely correct:

<table>
<thead>
<tr>
<th>Target:</th>
<th>sea</th>
<th>class</th>
<th>paint</th>
<th>cloud</th>
<th>pipe</th>
<th>ear</th>
<th>flame</th>
<th>bike</th>
<th>hole</th>
<th>dad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produced:</td>
<td>sea</td>
<td>paint</td>
<td>cloud</td>
<td>pipe</td>
<td>ear</td>
<td>bike</td>
<td></td>
<td></td>
<td>hole</td>
<td>dad</td>
</tr>
</tbody>
</table>

**Pilot Results and Discussion**

*Results of the Computer Use Questionnaire*

As Figure 2 shows, participants’ weekly use of email, social networks, instant messenger, and word processing tools was reported to be high, which meant that participants were familiarized with these computer tools. Specifically, results of the Computer Use Questionnaire indicated that 10 participants (43%) spent less than 2 hours/week using email, 6 (26%) spent between 2 and 5 hours/week, 6 (26%) spent between 5 and 10 hours/week, and 1 (4%) spent more than 10 hours. Regarding the use of instant messenger, 9 participants (39%) reported using it less than 2 hours/week, 9 (39%) spent between 2 and 5 hours/week, 1 (4%) spent between 5 and 10 hours/week, and 4 (17%) spent more than 10 hours. Regarding the use of social networking, 2 participants (8%) reported using it less than 2 hours/week, 10 (43%) spent between 2 and 5 hours/week, 4 (17%) spent between 5 and 10 hours/week, and 7 (30%) spent more than 10 hours. As for the use of word processing tools, 3 participants (13%) reported using it less than 2 hours/week, 6 (26%) spent between 2 and 5 hours/week, 8 (34%) spent between 5
and 10 hours/week, and 6 (26%) spent more than 10 hours. Figure 2 below, summarizes the results outlined above.

**Figure 2.** Pilot study’s weekly use of email, instant messenger, social networking, and word processing tools.

As Figure 3 shows, the majority of students indicated feeling very comfortable using a computer, rated their typing skills as either adequate or very good, reported enjoying communicating with others through a computer, and used video-based conferencing programs often. Specifically, when asked about whether they were comfortable using a computer to communicate with others (i.e., chat, e-mail, etc.), 20 participants (86%) reported feeling ‘very comfortable’, 2 (8%) reported feeling ‘comfortable’, and just 1 (4%) reported feeling ‘very uncomfortable’. After this question, participants were asked to what extent they enjoyed using a computer to communicate with others (i.e., chat, e-mail, etc.), 5 participants (21%) reported that ‘they loved it’, 16 (69%) reported that ‘they liked it fine’, and only 2 (8%) reported that ‘not so
much’. When asked to rate their typing skills, 11 participants (47%) said they were ‘very good’ and 11 (47%) said they were ‘adequate’, while only 1 (4%) said they were ‘deficient’. Finally, when asked about how often they used video-based conferencing programs (e.g., Skype, Google Hangouts, Zoom), 9 participants (39%) reported having used them a couple of times in the past, 3 (13%) reported having used them a maximum of 10 times in the past, 10 (43%) reported using them often, and 1 (4%) reported using them very often. Figure 3 below, summarizes the results outlined above.

**Figure 3.** Pilot study’s levels of comfort and enjoyment using computers, self-rating of typing skills, and frequency of use of video conferencing programs.

**Results of the Production Tests**

Descriptive statistics were used to investigate the two research questions, and to observe what some other trends were present in the design. First, descriptive statics were calculated for a)
time on treatment task, b) time on oral assessment task, c) pretest scores on distractor items, d) scores on pretests and posttests, e) oral and written gains, and f) scores on the WMC test.

The times on tasks (a & b above) were calculated in order to ascertain whether times would be adequate for each of the data collection sessions. Pretest scores on distractor items (c above) were calculated to see whether the explicit instruction component at pretest was enough to establish a baseline on these two structures. Scores on pretests and posttests (d above) were calculated in order to investigate the first research question. Finally, oral and written gains (e above) and scores on the WMC test (f above) were calculated to investigate the second research question.

As Table 4 and Figure 4 below show, time on treatment task varied widely depending on the mode through which participants did the task. While FTF and video-based SCMC showed similar times (20.55 and 21.88 minutes respectively), text-based SCMC took more than double this time to complete. A One-Way ANOVA testing for differences in time-on-task for the three groups found a statistical difference between treatments, $F(2, 20)=73.48, p = .000$. Post-hoc tests found that text-based SCMC and FTF were statistically different from each other ($p < .001$), and that text-based SCMC and video-based were also statistically different from each other ($p < .001$).

Some of the reasons why this happened might have been that participants used more time to think of their answers, something the other two groups could not do, as in FTF and video-based SCMC, an immediate response was expected.
Table 4. Pilot study’s descriptive data for time on treatment task.

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTF</td>
<td>20.55</td>
<td>2.96</td>
</tr>
<tr>
<td>Text-based SCMC</td>
<td>49.20</td>
<td>7.39</td>
</tr>
<tr>
<td>Video-based SCMC</td>
<td>21.88</td>
<td>4.01</td>
</tr>
</tbody>
</table>

Figure 4. Time on treatment task.

Even though time on the oral assessment task was not limited, it was measured to see if it took a reasonable amount of time or, on the contrary, if it took too long. As Table 5 below shows, the time varied between pretest and delayed posttest, showing a decrease in time, possibly due to participants’ familiarity with the task at immediate and delayed posttest. Overall, the time spent during all three assessment sessions was considered adequate.

Table 5. Descriptive data for time on oral assessment task.

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>9.07</td>
<td>2.39</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>7.81</td>
<td>1.46</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>7.33</td>
<td>1.13</td>
</tr>
</tbody>
</table>

Descriptive data for pretest distractor items was also calculated to judge whether participants had an adequate baseline to be able to learn the past subjunctive. As observed below,
participants’ scores on the preterit were higher than those on the present subjunctive distractor items. This is interesting, especially because participants practiced the present subjunctive several times after they received explicit instruction (the PowerPoint Tutorial described above) at pretest. Even though participants only received a brief refresher on the preterit in this PowerPoint, they seemed to know it from before. Indeed, participants at the intermediate level (4th semester Spanish course) normally learn the preterit in Intro and Intermediate I (1st and 2nd semester Spanish course). They also learn about the present subjunctive, but not to the same extent as the preterit. Additionally, the subjunctive is generally considered to be one of the most difficult linguistic structures to be acquired by English-speaking learners of Spanish at all levels of instruction (e.g., Collentine, 1995, 2010). In order to facilitate a better learning of the present subjunctive structure two additional practice items will be added to the PowerPoint in the main study so that learners have a better baseline to be able to learn the past subjunctive. Although this will result in longer times for participants to go through the explicit instruction component (PowerPoint Tutorial), this will be compensated by moving the WMC test to the delayed session.

Table 6. Pilot study’s descriptive data for pretest distractor items.

<table>
<thead>
<tr>
<th>Distractors</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Subjunctive</td>
<td>66.95</td>
<td>31.68</td>
</tr>
<tr>
<td>Preterit</td>
<td>70.86</td>
<td>30.58</td>
</tr>
</tbody>
</table>

Descriptive statistics were used to investigate the two research questions. For the first question regarding the possible differential grammatical learning depending on mode, descriptive statistics in Table 7 below show that for the oral production test, the video-based SCMC group scored slightly higher than the other two groups at immediate posttest, a trend that seemed to disappear at delayed posttest, with the text-based SCMC group scoring the highest of the three groups at this delayed stage. For the written production test, the text-based SCMC group scored
the highest of the three groups at both immediate and delayed posttests. Figures 5 and 6 show a visual representation of the oral and written data, respectively. The advantage of the text-based group over the other two seems to be of special importance in the written tests.

Although these findings partially align with previous research (Ziegler, 2016b), it is premature to consider that they are in fact a result of the variable of mode alone, and not of the longer time on treatment task (see discussion on time on treatment task above), among others. It should also be pointed out that the text-based SCMC group was the one with the lowest number of participants ($n=5$), which made the groups not comparable in terms of $n$ sizes. Once the $n$ sizes are comparable, and after modifications explained in the section ‘Pilot Modifications’ below are introduced, results should be more reliable. Additionally, when examining the standard deviations and confidence intervals, a much wider variation can be observed in the delayed posttest when compared with the immediate posttest. To explain the large variation of scores at delayed posttests, delayed scores were entered into a correlation with WMC scores, but results were not significant, which is in disagreement with previous research (Ando et al., 1992; Mackey et al., 2002). The principal study will explore this potential relationship again with a larger number of participants per cell.
Table 7. Pilot study’s descriptive data for pretests and posttest (in percentages).

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral production test (OP)*</th>
<th>95% Confidence Interval</th>
<th>Written production test (WP)*</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>Lower Bound</td>
<td>Upper Bound</td>
</tr>
<tr>
<td>FTF ($n = 9$)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>.74</td>
<td>2.22</td>
<td>-.96</td>
<td>2.45</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>86.95</td>
<td>13.29</td>
<td>76.73</td>
<td>97.17</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>37.19</td>
<td>40.90</td>
<td>5.75</td>
<td>68.63</td>
</tr>
<tr>
<td>Video-based SCMC ($n = 9$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>90.37</td>
<td>16.36</td>
<td>77.78</td>
<td>102.9</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>41.48</td>
<td>49.30</td>
<td>3.58</td>
<td>79.37</td>
</tr>
<tr>
<td>Text-based SCMC ($n = 5$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>1.33</td>
<td>2.98</td>
<td>-2.36</td>
<td>5.03</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>89.33</td>
<td>12.11</td>
<td>74.29</td>
<td>104.3</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>59.72</td>
<td>37.23</td>
<td>13.48</td>
<td>105.9</td>
</tr>
</tbody>
</table>

*Percentages were calculated from a total of 15 items in the OP test and 10 items in the WP test.
Figure 5. Oral scores at pretest, immediate posttest, and delayed posttest.

Figure 6. Written scores at pretest, immediate posttest, and delayed posttest.
The superiority of the text-based SCMC group is further observed in Table 8 below, which shows the oral and written gains of the three groups. Linguistic gains were calculated as the difference between delayed posttest and pretest scores. Linguistic gains were calculated in order to be able to correlate them with the WMC scores.

**Table 8.** Descriptive data for oral and written gains.

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral gains</th>
<th>95% Confidence Interval</th>
<th>Written gains</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td></td>
<td>Lower Bound</td>
<td>Upper Bound</td>
<td>Lower Bound</td>
<td>Upper Bound</td>
</tr>
<tr>
<td>FTF ($n = 9$)</td>
<td>36.45</td>
<td>41.71</td>
<td>43.33</td>
<td>8.74</td>
</tr>
<tr>
<td></td>
<td>4.38</td>
<td>68.51</td>
<td>45</td>
<td>77.92</td>
</tr>
<tr>
<td>Video-based SCMC ($n = 9$)</td>
<td>41.48</td>
<td>49.30</td>
<td>38.88</td>
<td>2.74</td>
</tr>
<tr>
<td></td>
<td>3.58</td>
<td>79.37</td>
<td>47.02</td>
<td>75.03</td>
</tr>
<tr>
<td>Text-based SCMC ($n = 5$)</td>
<td>58.38</td>
<td>35.51</td>
<td>62.00</td>
<td>17.75</td>
</tr>
<tr>
<td></td>
<td>14.29</td>
<td>102.4</td>
<td>35.63</td>
<td>106.24</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As Table 9 below shows, the WMC test was able to capture the wide range of WMC of participants. This is further showed in the histogram in Figure 7, which represents a somewhat normal distribution of the WMC scores.

**Table 9.** Pilot study’s descriptive data for WMC scores.

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTF</td>
<td>6</td>
<td>25</td>
<td>15.33</td>
<td>5.26</td>
</tr>
<tr>
<td>Text-based SCMC</td>
<td>6</td>
<td>32</td>
<td>19.20</td>
<td>10.70</td>
</tr>
<tr>
<td>Video-based SCMC</td>
<td>4</td>
<td>35</td>
<td>15.88</td>
<td>10.85</td>
</tr>
</tbody>
</table>
Finally, several correlations were conducted between WMC scores and both oral and written linguistic gains, not with the aim of observing statistical findings (note the low $n$ sizes per cell), but with the goal of observing possible trends that might be confirmed in the principal study. Although visually the trends observed in Figure 8 below seem to suggest that WMC might be positively related to learning more in FTF and text-based SCMC than in video-based SCMC, all correlations were nonsignificant, and negative correlations were observed in the case of video-based SCMC. In the principal study, the higher number of participants per cell will hopefully shed more light on the relationship between WMC and mode for L2 learning.

Figure 7. Distribution of all WMC scores across treatment groups.
Figure 8. Relationship between WMC scores and oral and written gains by group.

A further analysis was conducted combining all 23 participants into a single group in order to measure the relationship between WMC and linguistic gains more globally, as seen below in Figure 9. As Figure 9 indicates, correlations were small\(^1\) and nonsignificant. When looking at the r\(^2\) values, they are close to zero, which means that scores on the WMC test explained close to zero of the variance in oral and written gains.

\(^1\) According to Cohen (1988)’s benchmarks, r = .1 (small), r = .3 (medium), r = .5 (large).
Additionally, two additional correlations were run between WMC scores and linguistic gains experienced by participants from pretest to immediate posttest (referred to as ‘immediate gains’), to observe potential additional trends. First, Table 10 below shows immediate linguistic oral and written gains:

**Figure 9.** Relationship between WMC scores and oral and written gains (all groups combined).
Table 10. Descriptive data for oral and written immediate gains.

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral gains</th>
<th>Written gains</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>95% Confidence Interval</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>FTF ($n = 9$)</td>
<td>86.21</td>
<td>12.64</td>
<td>69.23 100</td>
<td>87.77 21.08 40 100</td>
</tr>
<tr>
<td>Video-based SCMC ($n = 9$)</td>
<td>90.37</td>
<td>16.36</td>
<td>53.33 100</td>
<td>85.55 20.06 40 100</td>
</tr>
<tr>
<td>Text-based SCMC ($n = 5$)</td>
<td>87.99</td>
<td>11.92</td>
<td>73.33 100</td>
<td>92 10.95 80 100</td>
</tr>
</tbody>
</table>

As observed in Table 10, generally participants in all three groups scored high at both immediate posttests (between 85-92%), and given this lack of variability, it might be difficult to observe correlations between WMC and immediate gains. As Figure 10 indicates, correlations were small and nonsignificant. When looking at the $r^2$ values, they are close to zero, which means that scores on the WMC test explained close to zero of the variance in oral and written immediate gains.
Figure 10. Relationship between WMC scores and oral and written immediate gains (all groups combined).
Pilot Modifications

The purpose of this pilot was to test the validity of the materials to elicit the target structure prior to the principal study and to test whether instructions were clear, and session times were adequate. Throughout the pilot, various issues arose that, although minimal, served to provide insight as to how the overall study might be improved upon.

One of the main issues that were observed in the pilot study was the unexpected long time on treatment task of the text-based SCMC group, with respect to the other two groups, as mentioned above. Unfortunately, text chat interactions were not recorded (something that will be remedied in the principal study) to be able to elucidate the reasons as to why this large difference in task completion time. In other studies, this trend has also been observed. In some studies, participants took almost twice as much time to complete the SCMC tasks than to complete the FTF tasks (e.g., Baralt, 2013; Yilmaz & Yuksel, 2011). Other studies have reported that SCMC tasks took participants more than twice the time to complete than FTF tasks, both for the implicit and explicit conditions (e.g., Yilmaz, 2012). Whereas Yilmaz (2012) and Yilmaz and Yuksel (2011)’s treatment task was a one-way information gap, Baralt (2013)’s treatment task was an interactive dialogic story retell.

After considering whether trying to reduce time-on-task would be adequate, my dissertation committee and I determined that due to the nature of the text-based SCMC mode, participants would be allowed to take as much time as they needed to complete the task in the text-based SCMC mode. Another possibility under consideration was to try and decrease the time on task with the goal of having more comparable groups in terms of time. Nonetheless, this possibility was discarded because it would go against the nature of the text-based mode and its inherent characteristics (e.g., longer completion time due to typing). Because the researcher was
aware of this time difference, in the main study she tried to keep a fast rhythm for participants when doing the task in the text-based mode, by having the questions to elicit the target form pre-typed so that they can be copied and pasted during the treatment task itself, instead of typing all questions from scratch. Even if some efforts were implemented to try and have text-based SCMC participants complete the task at a somewhat faster pace, the natural rhythm of the mode was respected at all times.

In the exit questionnaire, some participants mentioned that they struggled with unknown vocabulary in the speaking assessment task. As the coding of the oral assessment task proceeded, it was apparent that participants did not even know some of the verbs they had to use to complete the task itself, despite every effort was made to select verbs that appeared in the textbook used at this level of instruction. Following this, two changes were introduced after the pilot: the main verbs’ translation would appear in parenthesis (similarly to the written assessment task) and the main vocabulary items would be glossed. In the treatment task, participants did not know many of the verbs either, so their Spanish translation was also introduced in parenthesis.

Furthermore, it was observed that planning times varied widely for the oral production assessment task. For this reason, instructions were modified to include a maximum planning time of 5 minutes. The researcher timed participants in the main study to make sure that they do not exceed this allotted time. Additionally, some participants used the planning time to take notes. Following that, instructions of this task included specific directions to not take notes during the planning time, and the researcher walked around to make sure participants followed instructions.

In the treatment task itself, the main issue that was observed was that participants sometimes skipped items or showed boredom. This might have been due to the way the task was presented to participants. Participants first read the mini-story in paper, and then turn the page
around and were presented with all the prompts listed on another paper. They were then asked to say the prompts one by one. In order to improve the format of this task in the main study, participants read the story in several PowerPoint slides with pictures, and then they looked at each of the prompts in one slide, also accompanied by a picture. In this way, the task was more attractive and less boring, and participants would be less likely to skip prompts, as they saw each prompt in one PowerPoint slide.

Another concern that came up during the pilot study was that the first session took much longer than the third session. The first session was expected to even take a little longer after two practice items are added to the explicit instruction component. This will be solved by moving the WMC test from the first to the third session, in order to keep the time duration of the three sessions more similar. Additionally, a few participants had trouble understanding the instructions of the WMC test and had to retake it in Session 3. To remedy that, the test instructions were refined for better understanding. Additionally, in order to optimize the coding of the processing component of the test, another modification was introduced to make the coding of this component more efficient. The third and final modification to this test was to change the recalled components from words to letters in order to make it more difficult for participants to potentially create a story with the words and, in this way, recall them better.

The assessment instruments and treatment task proved to be useful in terms of eliciting the target form. However, there was an issue during both the immediate and the delayed oral posttest with overgeneralization of the past subjunctive to all forms, including the distractors. In order to prevent that from happening in the principal study, instructions were modified to include a statement telling participants to take into account that they do not always need to use the subjunctive to complete the task.
One concern addressed in this pilot study was whether participants may perceive the explicit feedback as threatening. However, in the exit questionnaire, the majority of participants commented that they actually liked this particular component of the study, as it helped them learn by addressing what they did not know in a personalized way. Feedback was not analyzed in the pilot study as a variable, but the committee and the researcher determined that it was another independent variable to consider in the analysis, and therefore a third research question was added to the main study that specifically addressed the relationship between feedback and oral and written development: Is the amount of feedback related to oral or written gain scores of the target structure?

Finally, due to the close similarity between the FTF group and the video-group and considering the importance of including an additional voice-only group in the study, the committee and the researcher decided to substitute the FTF group for the voice-based SCMC group. Following this, the current study is the first one up to date to include three different SCMC groups, while measuring L2 learning in the same study, holding great potential to advance the SCMC field from a theoretical and a pedagogical standpoint.
Current Study

The above-discussed adjustments were applied to the current study, which was administered during the Fall 2017 semester.

Considering the main change from the pilot study to the main study, being it to include a voice-based SCMC group and to exclude the FTF group, some justifications are provided below, before presenting the final three research questions. Firstly, there is a paucity of studies that have addressed the effects of oral SCMC (both video-based and voice-based) on L2 learning, specifically grammatical L2 learning. Secondly, there is a need for further empirically robust research that compares the effects of different types of SCMC on L2 learning to be able to inform curriculum design (Blake 2015; Blake, Wilson, Cetto, Pardo-Ballester, 2008; Cerezo, Baralt, Suh, Leow, 2014), as no study to date has embarked on comparing more than one SCMC mode within the same study in terms of L2 learning. Thirdly, future SCMC research needs to keep investigating the efficacy of different types of feedback in promoting learning in the different SCMC modes. When considering the different types of feedback, explicit feedback holds a prominent position when researching the learning of complex L2 structures such as the one in the present investigation. Finally, SCMC research (especially oral SCMC) needs to address whether the results of FTF interactional research that show higher benefits for individuals with higher working memory are replicated or not in this mode. Given its closer proximity to FTF than text-based SCMC, video-based and voice-based SCMC might favor those participants with high WMC, supporting previous FTF interaction literature (e.g., Mackey et al., 2002, 2010pr). However, this is an empirical question.
Table 11. Overview of gaps in literature and motivation for current study.

<table>
<thead>
<tr>
<th>Study</th>
<th>FTF</th>
<th>Voice-based SCMC</th>
<th>Text-based SCMC</th>
<th>Video-based SCMC</th>
<th>WMC</th>
<th>Delayed Effects?</th>
<th>Feedback</th>
<th>Power analysis</th>
<th>Effect sizes reported</th>
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<tr>
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<td>Payne &amp; Ross (2005)</td>
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<tr>
<td>Lai, Fei, &amp; Roots (2008)</td>
<td>X</td>
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<td>x</td>
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<tr>
<td>Current study pilot</td>
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<td>Current study</td>
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</table>

Considering these gaps in previous research, the final three research question to be investigated in the principal study were the following ones:

RQ1. Does type of communication mode (video-based SCMC vs. text-based SCMC vs. voice-based SCMC plus explicit feedback) lead to differential L2 grammatical learning, as measured by oral and written production of the target structure?

RQ2. Does WMC moderate the relationship between communication mode and L2 grammatical learning?

RQ3: Is the amount of feedback related to oral or written gain scores of the target structure?
Methodology

Participants

Participants were initially 97 Spanish L2 learners enrolled in a 4th semester (intermediate level II) Spanish class at a Mid-Atlantic university. They were recruited in the middle of the semester. Out of the 97 original participants, 5 were excluded from the analysis due to achieving between 53% and 92% score on the oral pretest, and between 75% and 100% in the written pretest, signifying knowledge of the target structure. Nine additional participants were excluded because they did not attend all three sessions. Seven other participants were excluded because their audio files were corrupted. Finally, eleven participants were excluded because they reported on the exit questionnaire having had external exposure between the second and the third session, which might have impacted the high scores they achieved at delayed posttest.

The final pool of participants consisted of 65 participants, whose mean age was 18.56. When asked which language they considered their native language, out of the 65 participants, 59 considered themselves L1 English speakers, one was an L1 Polish speaker, one was an L1 Cantonese speaker, one was an L1 Vietnamese speaker, one was an L1 Portuguese speaker; two other participants reported being bilingual in Portuguese and English, and in Arabic and English, respectively. Of the 65, 49 (75.38%) were female and 16 (24.61%) were male. On average, participants had been enrolled in a Spanish course for 5.92 years, (ranging from 0 to 14 years). Out of the 65 participants, none (0%) had studied abroad in a Spanish speaking country. Out of the 65 participants, 8 had studied other romance languages before, five reported having studied Latin during high school, two studied French (2 and half and 4 years), and one studied Portuguese (3 years).
Target Linguistic Structure

The target linguistic structure remained the same as in the pilot study.

Materials

Operation-Letter Span Task (OLST):

As mentioned in the Pilot Modifications section, the Operation-word span task (OWST) was substituted for the Operation-letter span task (OLST), with the goal of preventing students from potentially creating a story with the words and therefore, recalling them better. Because in the pilot study students seemed to struggle to understand what they needed to do in this test, instructions were also revised in order to facilitate understanding on the part of the participants. Finally, and the goal of optimizing the coding of the processing component of the test, participants were asked to press a keyboard key when they thought the result of the math problem was correct, and a different keyboard key when they thought the result of the math problem was incorrect. The keyboard keys were clearly labeled in the lab to facilitate the process for participants.

Treatment Task:

The essence of the story-retell treatment task implemented in the pilot study was maintained, but the format of the task was completely modified. Instead of having a pen-a-paper task in which all prompts were presented at once, the stories and prompts were moved to a PowerPoint format. The reasoning for this change was twofold: (a) so that participants did not skip any of the prompts in the list (something that was observed in the pilot study), as they had to say one prompt per slide, and (b) so that the format of PowerPoint including pictures was more attractive for participants in order to prevent boredom as they advanced through the task. As
participants struggled with the translation of some of the main verbs, the Spanish translation for all target verbs was included in the infinitive form in parenthesis in each of the slides. Additionally, some vocabulary words with which participants struggled in the pilot study were also glossed in the PowerPoint. In terms of feedback, it was hypothesized (not confirmed, as text-based SCMC participants’ completion of the task was not recorded in the pilot), that text-based SCMC participants may scroll up to look at the metalinguistic feedback as they completed the task. In order to avoid that, they were asked to close the chat after the metalinguistic feedback was provided, and then open it again so that the metalinguistic feedback was not visible on the screen anymore. Metalinguistic feedback included the grammatical rule and its context of use was provided the first two-five times that the researcher provided feedback. The researcher provided the rule two-three times consistently to all participants. However, if a participant asked for further clarification on the rule, the researcher provided that information one additional time. As such, only two participants (see Results chapter below) received four and five metalinguistic feedback episodes, respectively. A sample of the treatment task is provided in Appendix D.

Assessment Tasks:

Oral production assessment task. In this test, participants had 15 opportunities to produce the target structure. The number of distractor items included was modified from the pilot study. Instead of having 15 distractor items, 5 of which addressed the subjunctive present tense and 10 of which addressed the indicative preterit tense, 14 distractor items were included, 7 of which addressed the subjunctive present tense and 7 of which addressed the indicative preterit tense. This change was implemented to have the same number of distractors of each tense. Furthermore, the translation of the main verbs was included in parenthesis, and some of the vocabulary words were glossed, similarly to the treatment task. A sample of this production test is provided in Appendix E.
To make this task more user-friendly, participants received a paper ‘Help Handout’ that they could use as they advanced through the PowerPoint. In the pilot study, the content of this handout was also provided to participants, but it was part of a larger pen-and-paper package, and therefore, presented in a less user-friendly way. Because this format did not prove to be intuitive, the merge to the PowerPoint format with the Help Handout being the only paper component indeed seemed to work better. Moreover, because of the variability in planning times observed during the pilot study, a maximum planning time of 5 minutes was included in the instructions of the task. Participants were also explicitly instructed to not take notes during the completion of this task. To try and control for the overgeneralization of past subjunctive to all forms, including distractors, a note was included in the instructions of the task to bear in mind that subjunctive was not needed for all prompts, and the researcher also orally reminded participants of that. A sample of the Help Handout is provided in Appendix F.

Written production assessment task. This test remained unchanged, with a slight modification in the instructions. To prevent participants from generalizing to the subjunctive present tense, the font size of ‘remember we are talking about last semester’ was increased so that participants bore that in mind. A sample of this production test is provided in Appendix G.

The target linguistic structure exemplars presented in the treatment task and both assessment tasks used in the pilot study remained unchanged.

Upon completion of the assessment tasks, several Cronbach’s Alpha tests were conducted in order to assess the reliability of the instruments.
Tutorial on the Present Subjunctive:

This tutorial remained mostly unchanged. Because the pilot study showed that the distractor subjunctive present tense items were not fully mastered, two more practice items were included at the end of this PowerPoint tutorial, for a maximum of five practice items.

Procedure

This study followed a pretest- treatment / immediate posttest- delayed posttest design. The 65 participants were randomly assigned to one of the three SCMC groups (text-based, video-based, or voice-based). Data were collected over the course of a semester, with each participant attending three sessions with the researcher. Only the treatment session (session 2), which included the immediate posttests, was a one-on-one session with the researcher. The first and third sessions were completed in small groups in the language laboratory.

During the first session, participants first read a handout explaining the procedure for the lab session. Upon reading the handout in its entirety, written consent forms were administered and signed by participants, after which the researcher clarified the procedure in detail and addressed questions. Participants then completed the language background and computer use questionnaire online. After this, they went through the ~10-minute tutorial on the present subjunctive and completed the practice at the end of it. They then carried out the pretests (i.e., one oral story-retell production test, and one written picture-description production test). In order to balance the duration time of the three sessions, the WMC test was no longer administered during the pretest session but during the delayed posttest session. This session lasted ~one hour.

During the second session (the treatment session), which took part two weeks after the first session, participants made one-on-one appointments with the researcher. They were randomly
assigned to one of the three SCMC groups. Right after the treatment task, participants completed the immediate posttests (i.e., one oral story-retell production test, and one written picture-description production test). This session was expected to last ~one hour, but this varied across groups, depending on the experimental group they belonged to.

One week after the second session, the third and final session took place. On this day, participants completed the delayed posttests (i.e., one oral story-retell production test, and one written picture-description production test), and the WMC test. Following this, the online exit questionnaire was administered. This session took ~45 minutes. Figure 11 shows the data collection procedure.
Coding and Scoring

Assessment Tasks:

Coding in both assessment tasks remained the same as in the pilot study.

The pretests served to confirm that participants had no prior knowledge of the target linguistic structure and were thus novice learners. All participants did indeed score very low in the pretests, with all participants scoring 0% in the written pretest and two participants scoring 7%, and 13% in the oral pretest.
Additionally, distractor items in the pretest were coded for every correctly produced instance of the present subjunctive or the preterit indicative. They served to confirm that participants had indeed knowledge of the two distractor forms, required to be able to conjugate the past subjunctive.

Twenty percent of the assessment tasks were randomly selected and coded by an independent rater (another SLA researcher with 4 years of research training). Percentage agreement between the researcher’s and the rater’s coding was 98% or above for all oral assessment tasks and 100% for all written assessment tasks.

**WMC Test:**

The coding of the OSLT was identical to the coding of the OSWT, but taking into account letters instead of words.
CHAPTER 5: RESULTS

This chapter presents the results of all the quantitative analyses necessary to answer the research questions, together with the results of the computer use questionnaire. Before presenting these statistical analyses performed to answer the research questions, the results of the computer use questionnaire are presented, together with the descriptive statistics on time on treatment task and distractor items. Also, results of the assessment task reliability tests are reported.

Results of the Computer Use Questionnaire

This computer use questionnaire was administered in order to ensure that all participants were comfortable with the mode of communication under study in the present dissertation. As Figure 12 shows, participants’ weekly use of email, instant messenger, social networks, and word processing tools was reported to be high, which meant that participants were familiarized with these computer tools. Specifically, results of the Computer Use Questionnaire indicated that 35% of participants spent less than 2 hours/week using email, 46% spent between 2 and 5 hours/week, 14% spent between 5 and 10 hours/week, and 5% spent more than 10 hours. Regarding the use of instant messenger, 34% of participants reported using it less than 2 hours/week, 28% spent between 2 and 5 hours/week, 24% spent between 5 and 10 hours/week, and 14% spent more than 10 hours. Regarding the use of social networking, 9% of participants reported using it less than 2 hours/week, 39% spent between 2 and 5 hours/week, 29% spent between 5 and 10 hours/week, and 23% spent more than 10 hours. As for the use of word processing tools, 12% of participants reported using it less than 2 hours/week, 28% spent between 2 and 5 hours/week, 45% spent between 5 and 10 hours/week, and 15% spent more than 10 hours. Figure 12 below, summarizes the results outlined above.
Figure 12. Weekly use of email, instant messenger, social networking, and word processing tools.
As Figure 13 shows, the majority of students indicated feeling very comfortable using a computer, rated their typing skills as either adequate or very good, reported enjoying communicating with others through a computer, and used video-based conferencing programs often. Specifically, when asked about whether they were comfortable using a computer to communicate with others (i.e., chat, e-mail, etc.), 89% of participants reported feeling ‘very comfortable’, 9% reported feeling ‘comfortable’, and just 2% reported ‘not comfortable’. After this question, participants were asked to what extent they enjoyed using a computer to communicate with others (i.e., chat, e-mail, etc.), 35% of participants reported that ‘they loved it’, 58% reported that ‘they liked it fine’, 5% reported that ‘not so much’, and only 2% reported ‘I hate it’. When asked to rate their typing skills, 57% of participants said they were ‘very good’, 40% said they were ‘adequate’, and only 3% said they were ‘deficient’. Finally, when asked about how often they used video-based conferencing programs (e.g., Skype, Google Hangouts, Zoom), 14% of participants reported having used them a couple of times in the past, 26% reported having used them a maximum of 10 times in the past, 58% reported using them often, and 2% reported using them very often. Of special importance to the current study is that the two participants who rated their typing skills are deficient were assigned to the video-based and the voice-based treatment groups. Of the nine participants who reported that they might have used video-based conferencing programs a couple of times in the past, three were assigned to interacted in the video-based SCMC condition. Figure 13 below, summarizes the results outlined above.
Are you comfortable using a computer to communicate with others (i.e., chat, e-mail, etc.)?

- Very comfortable: 89%
- Comfortable: 9%
- Not comfortable: 2%

Do you enjoy using a computer to communicate with others (i.e., chat, e-mail, Skype, etc.)?

- Like it fine: 58%
- I love it: 35%
- Not so much: 5%
- I hate it: 2%

How would you rate your typing skills?

- Very good: 40%
- Adequate: 57%
- Deficient: 3%

How often do you use video-based conferencing programs (e.g., Skype, Google Hangouts, Zoom)?

- I used them a maximum of 10 times in the past: 58%
- I use them often: 26%
- I might have used it a couple of times in the past: 14%
- I use them very often: 2%

**Figure 13.** Levels of comfort and enjoyment using computers, self-rating of typing skills, and frequency of use of video conferencing programs.
Descriptive Statistics on Time on Treatment Task and Distractor Items

As Table 12 shows, time on treatment task varied widely depending on the mode through which participants were doing the task, confirming the trend outlined in the pilot study. As shown in Table 12, while voice-based and video-based SCMC showed very similar times (22.27 and 22.09 minutes respectively), text-based SCMC took almost double this time to complete (42.34 minutes). Although the average time on task for the text group decreased slightly from the pilot study to the main study (49.20 to 42.34), the time difference between this group and the two oral groups was still major. In fact, a one-way ANOVA testing for differences in time-on-task for the three groups found a statistical difference between treatments, $F(2, 64) = 90.85, p < .001$. Post-hoc tests found that text-based SCMC was statistically different from both text-based SCMC and voice-based SCMC ($p < .001$). As Table 12 shows, the minimum time for the text-based SCMC condition was the maximum time for the voice-based and video-based SCMC conditions.

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text-based SCMC</td>
<td>42.34</td>
<td>7.90</td>
<td>30.00</td>
<td>60.00</td>
</tr>
<tr>
<td>Voice-based SCMC</td>
<td>22.27</td>
<td>3.50</td>
<td>15.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Video-based SCMC</td>
<td>22.09</td>
<td>3.49</td>
<td>15.00</td>
<td>30.00</td>
</tr>
</tbody>
</table>

As shown in Table 13, although participants’ scores on the preterit were still higher than those on the present subjunctive distractor items, participants in the main study scored 10% higher on the present subjunctive than they did in the pilot study (76.25% versus 66.95%). The two extra practice items in the tutorial seem to have had a positive effect on the present subjunctive scores. Furthermore, the score on the preterit distractor items was also higher than in
the pilot test (81.30% versus 70.86%). This establishes a more solid baseline for participants to be able to form the past subjunctive.

**Table 13.** Descriptive data for pretest distractor items.

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distractors Present Subjunctive</td>
<td>76.25</td>
<td>29.37</td>
</tr>
<tr>
<td>Distractors Preterit</td>
<td>81.30</td>
<td>20.81</td>
</tr>
</tbody>
</table>

**Results of the Assessment Task Reliability Tests**

Two assessment tasks (one oral, one written) were employed to measure participants’ learning of the past subjunctive. The oral test consisted of 15 critical items and the written test consisted of 10 critical items. Six Cronbach’s alpha reliability tests were conducted, one per version of the oral or written assessment task. The three versions of the oral test had a high level of internal consistency, as determined by a Cronbach’s alpha of 0.98, 0.99, and 0.98. The three versions of the written test also had a high level of internal consistency, as determined by a Cronbach's alpha of 0.99, 0.99, and 0.98.

**Results of the Statistical Analyses to Answer the Research Questions**

**Research Question 1**

*Does type of communication mode (video-based SCMC vs. text-based SCMC vs. voice-based SCMC plus explicit feedback) lead to differential L2 grammatical learning, as measured by oral and written production of the target structure?*

To answer research question 1, descriptive statistics were first calculated first for each groups’ pretest, immediate posttest, and delayed posttests performance. Means, standard deviations, and confidence intervals were computed and included in Table 14 in order to
examine the main trends, variability, and distribution of scores for each assessment, based on the 
three treatment groups (text-based, voice-based, and video-based SCMC). The pretest mean 
scores were calculated in order to ensure that participants did not already know the target form at 
the outset of the experiment. Additionally, to ensure comparability between participants in the 
three experimental groups at pretest, a one-way ANOVA was run to ensure that there were no 
statistically significant differences between the experimental conditions at the start of the 
experiment in the oral production test. There was no need to run a one-way ANOVA for the 
written production pretest, as all participants in the three groups scored zero.

Following that, two mixed-design repeated-measures ANOVAs were used to primarily 
address the first research question on the interaction between Time (pretest, immediate posttest, 
and delayed posttest performance scores), and treatment group (text-based, voice-based, and 
video-based SCMC), where Time was the within-subjects factor while Treatment group was the 
between-subjects factor. The dependent variable of each of the ANOVAs was oral development, 
or written development, respectively.

The programs used for these analyses was the Statistical Package for the Social Sciences 
(SPSS), version 21.

Table 14 below shows the descriptive statistics for the oral production (OP) test and the 
written production (WP) test at pretest, immediate posttest, and delayed posttest.
Table 14. Descriptive data for pretests and posttest (in percentages).

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral production test (OP)*</th>
<th>Written production test (WP)*</th>
<th>95% Confidence Interval</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>Lower Bound</td>
<td>Upper Bound</td>
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<tr>
<td>Voice-based SCMC ($n = 21$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.92</td>
<td>2.92</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>91.00</td>
<td>13.26</td>
<td>86.95</td>
<td>95.04</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>48.57</td>
<td>45.68</td>
<td>29.77</td>
<td>67.36</td>
</tr>
<tr>
<td>Video-based SCMC ($n = 21$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.62</td>
<td>2.83</td>
<td>-.18</td>
<td>1.41</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>95.52</td>
<td>7.72</td>
<td>91.45</td>
<td>99.59</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>62.90</td>
<td>41.05</td>
<td>44.00</td>
<td>81.81</td>
</tr>
<tr>
<td>Text-based SCMC ($n = 23$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>.30</td>
<td>1.46</td>
<td>-2.48</td>
<td>3.09</td>
</tr>
<tr>
<td>Immediate Posttest</td>
<td>97.09</td>
<td>5.60</td>
<td>93.22</td>
<td>100.9</td>
</tr>
<tr>
<td>Delayed Posttest</td>
<td>64.04</td>
<td>43.17</td>
<td>46.08</td>
<td>82.00</td>
</tr>
</tbody>
</table>

*Percentages were calculated from a total of 15 items in the OP test and 10 items in the WP test.

As Table 14 shows, all participants showed either zero or close to zero knowledge at pretest for written and oral production of the target structure. When looking at the oral production scores, all three groups seemed to show an improvement from pretest to immediate posttest, with the text-based performing the best of all three. At delayed, both the text-based and the video-based treatment groups outperformed the voice-based treatment group for oral development. When focusing on the written production scores, fairly similar performances reported for the oral production task were noted: All three groups showed an improvement from pretest to immediate posttest, with the text-based group slightly outperforming the other two. At delayed, both the video-based and text-based groups clearly outperformed the voice-based group.
For all three treatment groups in the written pretest, all participants scored zero on the task. As such, the mean and standard deviation are both zero. This is evidence that participants did not know the target structure prior to treatment.

For the voice treatment group in the oral pretest, all participants scored zero on the task. For the video and text treatment groups, all but one participant in each group scored zero on the task. The two participants for video and text who did not score zero, only scored 7% and 13% out of 100%. This indicates that the participants did not know the target structure well before
treatment and are therefore valid participants. The mean and standard deviation for all three groups were near zero.

For all three treatment groups in the written posttest, all participants scored nearly 100%. This indicates that the treatment task was effective in teaching participants the target structure in the three modes. The distribution of scores was narrow with standard deviations less than 10% for all three treatment groups.

For the video and text treatment groups in the oral posttest, most participants scored nearly 100% with a standard deviation of less than 8%, indicating a narrow distribution. For the voice treatment group, scores were slightly lower with a mean of 91% and a standard deviation
of 13%, indicating a slightly wider distribution than the video and text treatment groups. This indicates that while all treatment modes were effective in teaching participants the target structure, video and text were slightly superior to voice in the immediate oral posttest.

For all three treatment groups in the written delayed posttest, the distribution of scores appeared to have two peaks, or a bimodal distribution, with participants achieving either very low or very high scores. However, despite this similarity, the video and text treatment groups in the written delayed posttest had mean scores of 68.57 and 70% compared to 50% for the voice treatment group. Additionally, the standard deviations were very large, which indicates that while some participants scored very high, others scored very low.

Figure 18. Distribution of scores for written delayed posttest.

Figure 19. Distribution of scores for oral delayed posttest.
For all three treatment groups in the oral delayed posttest, the distribution of scores appeared to have two peaks again, or a bimodal distribution, with many participants scoring either 0%-10% or 90%-100%. However, despite this similarity, the video and text treatment groups in the oral delayed posttest had mean scores of 64% compared to 49% for the voice treatment group. Additionally, the standard deviations were very large, which indicates that while some participants scored very high, others scored very low.

Figures 20 and 21 show a visual representation of the oral and written scores at pretest, immediate posttest, delayed posttest.

Figure 20. Oral scores at pretest, immediate posttest, and delayed posttest.
Figure 21. Written scores at pretest, immediate posttest, and delayed posttest.

Inferential statistics were performed next, to check whether the trends observed in Table 14 turned out to be statistically significant or not. Prior to running statistical analyses, a one-way ANOVA was run separately for the oral production pretest scores, to ensure that there were no statistical significant differences between the three experimental groups at the outset of the experiment. The one-way ANOVA determined that the mean scores in the oral pretest were not statistically different between treatment groups ($F(2, 62) = .60, p = .55$). Therefore, all three groups (voice-based SCMC, video-based SCMC, and text-based SCMC) could be considered to be equivalent at pretest in their oral production of the target structure under study.

Assumptions for the mixed RM ANOVA were checked before running them. Assumptions 1-3 were met, as the dependent variables were measured at the continuous level, the within-subjects factor consisted of at least two categorical ‘related groups’, and the between-subjects factor consisted of at least two categorical ‘independent groups’. Assumption 4 states
that there should not be any significant outliers in any group. After examining this assumption through boxplots, it was determined that those considered to be outliers were not data entry errors or measurement errors, but genuinely unusual values. Just one outlier was eliminated due to achieving a 53% score in the oral pretest (the participant that was initially participant number 66). This participant belonged to the video group, which caused this treatment group to go from 22 to 21 participants, and to rerun the analyses performed so far. This participant can be seen in Figure 23 below, labeled as ‘32’. The other participants that were considered outliers were those who did not achieve as high scores as the majority of participants did in the immediate posttest, but they were not discarded for that reason.

![Boxplot for the voice treatment group.](image)

**Figure 22.** Boxplot for the voice treatment group.
Assumption 5 indicates that the dependent variable should be approximately normally distributed for each combination of the groups of the two factors. The assumption of normality was violated for all combinations. The distributions of the dependent variables at pretest, immediate posttest, and delayed posttest were shown in the histograms in Figures 14-19 above.
As explained above, the data at pretest were not normally distributed because virtually all participants scored zero. At immediate posttest, scores were not normally distributed because most participants scored close to 100%, and at delayed posttest the distributions observed were bimodal. Because ANOVA is considered to be fairly ‘robust’ to deviations from normality (Larson-Hall, 2010, p. 355), analyses were carried on regardless of this violation.

Assumption 6, ‘homogeneity of variances’, states that the variance of the dependent variables should be equal between the groups of the between-subjects factor. For the written development dependent variable, the Levene’s test was not statistically significant, which meant that there are equal variances, and the assumption was not violated. For the oral development variable, the Levene’s Test was again not statistically significant after removing the outlier, which meant that there are equal variances and, again, the assumption was met.

Finally, assumption 7, known as sphericity, states that the variances of the differences between the related groups of the within-subjects factor for all groups of the between-subjects factor must be equal. This assumption was violated for the oral and written dependent variables, and therefore a Greenhouse-Geisser correction was applied.

After testing the assumptions, two mixed-design RM ANOVAs were run to address the first research question. The first mixed-design ANOVA addressed oral development as its dependent variable, with Time (pretest, immediate posttest, and delayed posttest performance scores) as the within-subjects factor, and treatment group (text-based, voice-based, and video-based SCMC) as the between-subjects factor.

This first mixed-design ANOVA, shown in Table 15, revealed a significant main effect for Time ($F(1.07, 66.61) = 235.70, p < .001$, observed power =1.00), with a partial eta-squared effect size of .79, which means that 79% of the variance in oral development was attributable to
the variable of Time and no main effect for Treatment \((F(2, 62) = 1.42, p = .24, \text{ observed power } = .29)\), with a partial eta-squared effect size of .04. There was no significant interaction between Time and Treatment group \((F(2.14, 66.61) = .62, p = .55, \text{ observed power } = .15)\), with a partial eta-squared effect size of .02. This indicates that there were changes over time in oral development across the whole sample, and changes in oral development overtime were similar across the three treatment groups, which means that the group participants belonged to did not affect oral development. Post-hoc Scheffé analyses, shown in Table 16, revealed no significant differences between the three Treatment groups; the difference between the voice-based and video-based group was non-significant \((p = .40)\), as was the difference between the voice-based and text-based group \((p = .30)\), and the difference between the video-based and the text-based group \((p = .98)\).

**Table 15.** Mixed-design ANOVA results for oral development.

<table>
<thead>
<tr>
<th>Within-subjects</th>
<th>Type II Sum of squares</th>
<th>df</th>
<th>Mean Square</th>
<th>(F)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>294503.75</td>
<td>1.07</td>
<td>274125.50</td>
<td>235.70</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Time * Treatment</td>
<td>1562.70</td>
<td>2.14</td>
<td>727.28</td>
<td>.62</td>
<td>.55</td>
</tr>
<tr>
<td>Error</td>
<td>77467.54</td>
<td>66.61</td>
<td>1163.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 16.** Pairwise comparisons by treatment (oral development).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig</th>
<th>95% Confidence Interval for difference</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>Video</td>
<td>-6.49</td>
<td>4.77</td>
<td>.40</td>
<td>-18.48</td>
<td>5.49</td>
</tr>
<tr>
<td>Voice</td>
<td>Text</td>
<td>-7.29</td>
<td>4.67</td>
<td>.30</td>
<td>-19.01</td>
<td>4.43</td>
</tr>
<tr>
<td>Video</td>
<td>Text</td>
<td>-.80</td>
<td>4.67</td>
<td>.98</td>
<td>-12.52</td>
<td>10.93</td>
</tr>
</tbody>
</table>
Time main effect was further explored to elucidate where the time difference specifically occurred. Results, shown in Table 17, revealed that there was a significant difference between pretest and posttest ($p < .001$), and between pretest and delayed ($p < .001$). This indicates that participants significantly improved both from pretest to immediate posttest and from pretest to delayed posttest (from the beginning to the end of the study). Results also indicated that there was a significant decrease in oral scores from immediate to delayed posttest ($p < .001$).

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig</th>
<th>95% Confidence Interval for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>94.22</td>
<td>1.19</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>-36.03</td>
<td>5.20</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pretest</td>
<td>Delayed Posttest</td>
<td>58.19</td>
<td>5.40</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

In order to address the score growth for each individual group over time, separate individual repeated-measures, post-hoc ANOVAs with a zero between-subject, one within-subject (Time) were performed on the participants’ scores obtained on the three assessment tasks for each learning condition. Results indicated that the increase from pretest to immediate posttest was significant for all groups (all groups: $p < .001$). The increase from pretest to delayed was also significant for all groups (all groups: $p < .001$). Finally, the decrease from immediate posttest to delayed posttest was also significant for all groups (voice-based: $p < .001$; video-based: $p = .002$; text-based: $p = .001$).

The second mixed-design RM ANOVA addressed written development as its dependent variable, with Time (pretest, immediate posttest, and delayed posttest performance scores) as the
within-subjects factor, and treatment group (text-based, voice-based, and video-based SCMC) as the between-subjects factor.

This second mixed-design RM ANOVA, shown in Table 18, revealed significant main effects for Time ($F(1.03, 64.23) = 229.29, p < .001$, observed power = 1.00), with a partial eta-squared effect size of .78, which means that 78% of the variance in oral development was attributable to the variable of Time, and no main effect for Treatment ($F(2, 62) = 1.37, p = .26$, observed power = .28), with a partial eta-squared effect size of .04. There was no significant interaction between Time and Treatment group ($F(2.07, 64.23) = 1.24, p = .30$, observed power = .26), with a partial eta-squared effect size of .04. This indicates that there were changes overtime in written development across the whole sample, and changes in written development overtime were equivalent across the three treatment groups, which means that the group they belonged to did not affect written development. Post-hoc Scheffé analyses, shown in Table 19, revealed no significant differences between the three groups; the difference between the voice-based and video-based group was non-significant ($p = .46$), as was the difference between the voice-based and text-based group ($p = .30$), and the difference between the video-based and the text-based group ($p = .96$).

### Table 18. Mixed-design ANOVA results for written development.

<table>
<thead>
<tr>
<th></th>
<th>Type II Sum of squares</th>
<th>df</th>
<th>Mean Square</th>
<th>$F$</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>316311.79</td>
<td>1.03</td>
<td>305336.76</td>
<td>229.29</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Time * Treatment</td>
<td>3425.40</td>
<td>2.07</td>
<td>1653.27</td>
<td>1.24</td>
<td>.30</td>
</tr>
<tr>
<td>Treatment</td>
<td>1980.83</td>
<td>2</td>
<td>990.41</td>
<td>1.37</td>
<td>.26</td>
</tr>
<tr>
<td>Error</td>
<td>44750.44</td>
<td>62</td>
<td>721.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>1980.83</td>
<td>2</td>
<td>990.41</td>
<td>1.37</td>
<td>.26</td>
</tr>
<tr>
<td>Error</td>
<td>44750.44</td>
<td>62</td>
<td>721.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 19. Pairwise comparisons by treatment (written development).

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig</th>
<th>95% Confidence Interval for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice Video</td>
<td>-6.03</td>
<td>4.78</td>
<td>.46</td>
<td>-18.03 - 5.60</td>
</tr>
<tr>
<td>Voice Text</td>
<td>-7.34</td>
<td>4.68</td>
<td>.30</td>
<td>-19.08 - 4.39</td>
</tr>
<tr>
<td>Video Text</td>
<td>-1.31</td>
<td>4.68</td>
<td>.96</td>
<td>-13.05 - 10.43</td>
</tr>
</tbody>
</table>

Time main effect was further explored to elucidate where the time difference specifically occurred. Results, shown in Table 20, revealed that there was a significant difference between pretest and posttest \((p < .001)\), and between pretest and delayed \((p < .001)\). This indicates that participants significantly improved both from pretest to immediate posttest and from pretest to delayed posttest (from the beginning to the end of the study). Results also indicated that there was a significant decrease in oral scores from immediate to delayed posttest \((p < .001)\).

Table 20. Pairwise comparisons by time (written development).

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig</th>
<th>95% Confidence Interval for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest Immediate Posttest</td>
<td>97.18</td>
<td>.86</td>
<td>&lt;.001</td>
<td>98.91 - 95.45</td>
</tr>
<tr>
<td>Immediate Posttest Delayed Posttest</td>
<td>-.32</td>
<td>5.60</td>
<td>&lt;.001</td>
<td>-23.12 - -45.52</td>
</tr>
<tr>
<td>Pretest Delayed Posttest</td>
<td>62.85</td>
<td>5.62</td>
<td>&lt;.001</td>
<td>74.10 - 51.61</td>
</tr>
</tbody>
</table>

In order to address the score growth for each individual group over time, separate individual repeated-measures, post-hoc ANOVAs with a zero between-subject, one within-subject (Time) were performed on the participants’ scores obtained on the three assessment tasks for each learning condition. Results indicated that the increase from pretest to immediate posttest was significant for all groups (all groups: \(p < .001\)). The increase from pretest to delayed was
also significant for all groups (all groups: p < .001). Finally, the decrease from immediate posttest to delayed posttest was also significant for all groups (voice-based: p < .001; video-based and text-based: p = .006).

Summary of Results of Research Question 1

Participants in all three groups significantly improved their oral and written development of the target structure, given the significant main effects for Time for both measures (oral and written development) showed by the two mixed-design repeated-measures ANOVAs. These significant main effects were observed from pretest to immediate posttest and from pretest to delayed posttest, indicating that all participants improved their knowledge, and that this improved was maintained one week after the treatment was administered. There was no statistically significant difference among the three treatment groups (video-based, voice-based, text-based SCMC) in oral or written development, which means that changes over time were similar across the three treatment groups.

Research Question 2

Does WMC moderate the relationship between communication mode and L2 grammatical learning?

To answer the second research question, two mixed-design repeated-measures ANCOVAs were performed, entering WMC as the covariate. The analysis of covariance (ANCOVA) is an extension of the ANOVA to incorporate a covariate. This covariate is linearly related to the dependent variable and its inclusion into the analysis can increase the ability to detect differences between groups of an independent variable. An ANCOVA was used to determine whether there were any statistically significant differences between the adjusted
population means of the three independent (unrelated) groups when partialling out any effect of WMC.

Before running the ANCOVAs, the distribution of the covariate was explored. Table 21 shows the descriptive data for the working memory scores per group. As Table 21 shows, the WMC test was able to capture the wide range of WMC of participants. Figure 25 shows the histogram with the WMC distribution for all three treatment groups (text, video, and voice).

**Table 21.** Descriptive data for WMC scores.

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All groups combined</td>
<td>3</td>
<td>42</td>
<td>22.27</td>
<td>9.29</td>
</tr>
<tr>
<td>Voice (n = 21)</td>
<td>7</td>
<td>42</td>
<td>23.19</td>
<td>7.96</td>
</tr>
<tr>
<td>Video (n = 21)</td>
<td>4</td>
<td>37</td>
<td>23.95</td>
<td>9.76</td>
</tr>
<tr>
<td>Text (n = 23)</td>
<td>3</td>
<td>39</td>
<td>19.91</td>
<td>9.93</td>
</tr>
</tbody>
</table>

**Figure 25.** Working memory distribution across all participants.
ANCOVA has the same assumptions as ANOVA except that there are two important additional considerations: (1) independence of the covariate and treatment effect, and (2) homogeneity of regression slopes (Field, 2009, p. 397). Assumption 1 was met because the distribution of WMC scores was not different across the three treatment groups. This was shown by a one-way ANOVA testing for differences in WMC between the three groups ($F(2,64) = 1.19$, $p = .31$). As the $p$ value was not significant, the assumption was met. This is further seen in Figure 26, which shows a stacked histogram with WMC scores split by group. Figure 26 shows how much the scores overlap across the three groups, and how similar the means and standard deviations of the three groups are. Assumption 2 was also met, because the interaction between treatment group and the covariate was not significant (oral development, $p = .91$; written development = .97), and therefore there is homogeneity of regression slopes. Because the assumption of sphericity was violated, the Greenhouse-Geisser correction was applied.

![Figure 26. Stacked histogram with working memory distribution for all three treatment groups.](image)
The first mixed-design ANCOVA, shown in Table 22, looked into the effect of treatment on oral development scores with the covariate of WMC. The between-subjects results below show that the covariate, WMC, was not a statistical covariate \( (F(1,61) = .29, p = .58, \text{ observed power} = .08) \), with a partial eta-squared effect size of .005, and that the between-subjects effect of Treatment is still non-significant \( (F(2,61) = 1.48, p = .23, \text{ observed power} = .30) \), with a partial eta-squared effect size of .04. This means that WMC did not have a strong effect on how the participants performed on the immediate posttest and delayed posttest.

Additionally, the two-way interaction between WMC and Time was not significant \( (F(1.07, 65.52) = .15, p = .71, \text{ observed power} = .06) \), with a partial eta-squared effect size of .00. The two-way interaction between Time and Treatment group was also not significant \( (F(2.14, 65.52) = .65, p = .53, \text{ observed power} = .16) \), with a partial eta-squared effect size of .02, similar to the ANOVA results in RQ1, which were \( (F(2.14, 66.60) = .62, p = .54, \text{ observed power} = .15) \), with a partial eta-squared effect size of .02. This means that when partialling out the effect of WMC, results showed the same pattern for the treatment by time interaction, as it was still non-significant.

**Table 22.** Mixed-design ANCOVA results for oral development.

<table>
<thead>
<tr>
<th>Within-subjects</th>
<th>Type II Sum of squares</th>
<th>( df )</th>
<th>Mean Square</th>
<th>( F )</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>41680.59</td>
<td>1.07</td>
<td>38805.48</td>
<td>32.90</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>WMC * Time</td>
<td>193.06</td>
<td>1.07</td>
<td>179.74</td>
<td>.15</td>
<td>.71</td>
</tr>
<tr>
<td>Time * Treatment</td>
<td>1645.85</td>
<td>2.148</td>
<td>766.16</td>
<td>.65</td>
<td>.53</td>
</tr>
<tr>
<td>Error</td>
<td>77274.48</td>
<td>65.52</td>
<td>1179.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Between-subjects</th>
<th>Type II Sum of squares</th>
<th>( df )</th>
<th>Mean Square</th>
<th>( F )</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>2161.66</td>
<td>2</td>
<td>1080.83</td>
<td>1.48</td>
<td>.23</td>
</tr>
<tr>
<td>WMC</td>
<td>216.97</td>
<td>1</td>
<td>216.97</td>
<td>.29</td>
<td>.58</td>
</tr>
<tr>
<td>Error</td>
<td>44378.27</td>
<td>61</td>
<td>727.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The second mixed-design ANCOVA, shown in Table 23, looked into the effect of treatment on written development scores with the covariate of WMC. The between-subjects results below show that the covariate, WMC, was not a statistical covariate \((F(1,61) = 1.42, p = .23, \text{ observed power} = .21)\), with a partial eta-squared effect size of .02, and that the between-subjects effect of Treatment was still non-significant \((F(2,61) = 1.58, p = .21, \text{ observed power} = .32)\), with a partial eta-squared effect size of .04. This means that WMC did not have a strong effect on how the participants performed on the immediate posttest and delayed posttest.

Additionally, the two-way interaction between WMC and Time was not significant \((F(1.03, 63.17) = .91, p = .34, \text{ observed power} = .15)\), with a partial eta-squared effect size of .34. The two-way interaction between Time and Treatment group was also not significant \((F(2.07, 63.17) = 1.35, p = .26, \text{ observed power} = .28)\), with a partial eta-squared effect size of .04, similar to the ANOVA results in RQ1, which were \((F(2.07, 64.23) = 1.24, p = .30, \text{ observed power} = .26)\), with a partial eta-squared effect size of .04. This means that when partialling out the effect of WMC, results showed the same pattern for the Treatment by Time interaction, as it was still non-significant.

Table 23. Mixed-design ANCOVA results for written development.

<table>
<thead>
<tr>
<th>Within-subjects</th>
<th>Type II Sum of squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>43336.08</td>
<td>1.03</td>
<td>41842.58</td>
<td>31.37</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>WMC * Time</td>
<td>1266.73</td>
<td>1.03</td>
<td>1223.07</td>
<td>.91</td>
<td>.34</td>
</tr>
<tr>
<td>Time * Treatment</td>
<td>3748.23</td>
<td>2.07</td>
<td>1809.52</td>
<td>1.35</td>
<td>.26</td>
</tr>
<tr>
<td>Error</td>
<td>84262.73</td>
<td>63.17</td>
<td>1333.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Between-subjects</th>
<th>Type II Sum of squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>2272.28</td>
<td>2</td>
<td>1136.14</td>
<td>1.58</td>
<td>.21</td>
</tr>
<tr>
<td>WMC</td>
<td>1018.45</td>
<td>1</td>
<td>1018.45</td>
<td>1.42</td>
<td>.23</td>
</tr>
<tr>
<td>Error</td>
<td>43731.99</td>
<td>61</td>
<td>716.91</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary of Results of Research Question 2

Results from the two mixed-design repeated-measures ANCOVAs indicated that the covariate of WMC did not have a strong effect on how the participants performed on the immediate posttest and delayed posttest, given the non-significant results of WMC in the model. A comparison between the ANOVAs (Tables 15 and 18) and the ANCOVAs (Tables 22 and 23) show that results were very similar. This means that after partialling out the effect of WMC (results from the ANCOVAs), main effects for time and interaction between time and treatment barely changed from the results of the ANOVAs. Therefore, WMC was not a factor explaining the variance on written or oral development scores.

Research Question 3

Is the amount of feedback related to oral or written gain scores of the target structure?

To answer this third RQ, two variables were considered: (a) number of feedback episodes provided to participants by the researcher as they were completing the treatment task, and (b) oral and written linguistic gain scores at immediate posttest and delayed posttest. Linguistic gains were calculated by subtracting the pretest scores from the immediate posttest scores and by subtracting the pretest scores from the delayed posttest scores.

Given that the dependent variables were not normally distributed (see Figures 27 and 28 below), a Pearson’s correlation or a linear regression were not selected, and instead, a non-parametric Kendall’s tau-b correlation was chosen. The assumptions for this correlation were met: (1) the two variables were continuous, (2) the two variables represented paired observations, and (3) although it is desirable that the data appear to follow a monotonic relationship, this is not a strict assumption (Laerd Statistics, 2018). Of the two non-parametric correlations, Kendall’s Tau and Spearman’s Rho, the former was chosen because it is more
robust to violations of the monotonic relationship assumption. Furthermore, Kendall’s tau should be used rather than Spearman’s coefficient when there is a small data set with a large number of tied ranks, which means that if you rank all of the scores, many scores have the same rank (Field, 2009, p. 181).

Both Kendall’s Tau and Spearman’s Rho correlation coefficients assess statistical associations based on the ranks of the data. Ranking data is carried out on the variables that are separately put in order and are numbered. These correlation coefficients, similarly to Pearson’s and Spearman’s correlations, also takes the values between minus one and plus one. The positive correlation signifies that the ranks of both the variables are increasing. On the other hand, the negative correlation signifies that as the rank of one variable is increased, the rank of the other variable is decreased.

![Figure 27](image)

**Figure 27.** Distribution of oral and written gain scores at immediate posttest.
Oral and written gains were calculated at immediate posttest and at delayed posttest, and they are shown in Table 24 and 25 below, respectively.

**Table 24.** Descriptive data for oral and written gains at immediate posttest.

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral gains</th>
<th>Written gains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Voice ($n = 21$)</td>
<td>91.00</td>
<td>13.26</td>
</tr>
<tr>
<td>Video ($n = 21$)</td>
<td>94.90</td>
<td>7.86</td>
</tr>
<tr>
<td>Text ($n = 23$)</td>
<td>96.78</td>
<td>6.66</td>
</tr>
</tbody>
</table>

**Table 25.** Descriptive data for oral and written gains at delayed posttest.

<table>
<thead>
<tr>
<th>Group</th>
<th>Oral gains</th>
<th>Written gains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Voice ($n = 21$)</td>
<td>48.57</td>
<td>45.68</td>
</tr>
<tr>
<td>Video ($n = 21$)</td>
<td>62.28</td>
<td>41.92</td>
</tr>
<tr>
<td>Text ($n = 23$)</td>
<td>63.73</td>
<td>43.02</td>
</tr>
</tbody>
</table>

**Figure 28.** Distribution of oral and written gain scores at delayed posttest.
Table 26 shows the descriptive data for total number of feedback episodes. A One-Way ANOVA was run to test for differences among groups. Results of the ANOVA \( F(2,64) = 5.81, \ p = .005 \) showed that there was a statistically significant difference among groups. Post-hoc Scheffé analyses showed that the voice-based and the text-based groups were statistically different from each other \( (p = .005) \) in terms of total number of feedback episodes (metalinguistic and explicit) received.

**Table 26.** Descriptive data for total number of feedback episodes.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>All groups ((n = 21))</td>
<td>7.73</td>
<td>4.00</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Voice ((n = 21))</td>
<td>9.85</td>
<td>4.24</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Video ((n = 21))</td>
<td>7.47</td>
<td>3.50</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Text ((n = 23))</td>
<td>6.04</td>
<td>3.41</td>
<td>1</td>
<td>13</td>
</tr>
</tbody>
</table>

Figure 29 shows the distribution of total number of feedback episodes across groups. This histogram represents a somewhat normal distribution of the variable feedback, slightly positively skewed.
The number of just metalinguistic feedback episodes (vs. total number of feedback episodes) was also explored. Table 27 includes descriptive statistics for number of metalinguistic feedback episodes. A One-Way ANOVA was run to test for differences among groups. Results of the ANOVA \((F(2,64) = 3.75, p = .02)\) showed that there was a statistically significant difference among groups. Post-hoc Scheffé analyses showed that, like the total number of feedback episodes, it was the voice-based and the text-based groups that were statistically different from each other \((p = .02)\) in terms of metalinguistic feedback episodes received.
Table 27. Descriptive data for number of metalinguistic feedback episodes.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>All groups</td>
<td>1.78</td>
<td>.83</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Voice</td>
<td>2.14</td>
<td>.96</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Video</td>
<td>1.76</td>
<td>.76</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Text</td>
<td>1.47</td>
<td>.66</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Due to the initial intention of the researcher to just provide two-three metalinguistic feedback episodes, a fourth or fifth metalinguistic explanation was only provided if the participant asked for clarification on the rule. The provision of this fourth or fifth metalinguistic feedback episode was infrequent, as shown in Table 28 below. Only one participant in the voice-based SCMC group received five metalinguistic feedback episodes, and one participant in the video-based SCMC group received four. No participant in the text-based SCMC group received more than three.

Table 28. Frequency data for number of metalinguistic feedback episodes.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of feedback episodes</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>1</td>
<td>5</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
<td>47.6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>5</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>4.8</td>
</tr>
<tr>
<td>Video</td>
<td>1</td>
<td>8</td>
<td>38.1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>11</td>
<td>52.4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>4.8</td>
</tr>
<tr>
<td>Text</td>
<td>1</td>
<td>14</td>
<td>60.9</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Four Kendall's tau-b correlations were run to determine the relationship between total number of feedback episodes and oral and written gain scores among the 65 participants. As
shown in Table 29, there were small, negative associations between total number of feedback episodes and oral and written gain scores at immediate posttest, which were statistically significant ($\tau_b = -.24, p = .013, \tau_b = -.21, p = .036$), and small, negative associations between total number of feedback episodes and oral and written gain scores at delayed posttest, which were also statistically significant ($\tau_b = -.22, p = .013, \tau_b = -.22, p = .026$).

**Table 29.** Kendall’s tau-b correlations between total number of feedback episodes and oral and written gain scores.

<table>
<thead>
<tr>
<th>Feedback (n = 65)</th>
<th>Oral gains at immediate</th>
<th>Written gains at immediate</th>
<th>Oral gains at delayed</th>
<th>Written gains at delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficient</td>
<td>-0.24*</td>
<td>-0.21*</td>
<td>-0.22*</td>
<td>-0.22*</td>
</tr>
<tr>
<td>$p$ value</td>
<td>.01</td>
<td>.03</td>
<td>.01</td>
<td>.02</td>
</tr>
</tbody>
</table>

According to Laerd Statistics (2018), there are no hard-and-fast rules for assigning strength of association to particular values, but Kendall’s Tau coefficients tend to be more conservative than Pearson correlation coefficients. The negative correlation coefficients signify that as the rank of the variable ‘number of feedback episodes’ is increased, the rank of the variables ‘gain scores’ is decreased.

After exploring the relationship between total number of feedback episodes and gains for all groups combined, the relationship between feedback and gains was explored for the different treatment groups separately in order to see if any group or groups in particular were driving the observed correlations. As Table 30 shows there were very small and non-significant correlations in the text-based SCMC group. When looking at the results for the voice-based SCMC group, there was a small-medium correlation that was significant between feedback and written gains at immediate posttest. As for the results of the video-based SCMC group, there were medium-large
correlations that were significant between feedback and written and oral gains at delayed posttest.

Table 30. Kendall’s tau-b correlations between total number of feedback episodes and oral and written gain scores per group.

<table>
<thead>
<tr>
<th>Feedback</th>
<th>Oral gains at immediate</th>
<th>Written gains at immediate</th>
<th>Oral gains at delayed</th>
<th>Written gains at delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice (&lt;i&gt;n = 21&lt;/i&gt;)</td>
<td>Correlation coefficient</td>
<td>-.23</td>
<td>-.37*</td>
<td>-.04</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.18</td>
<td>.04</td>
<td>.77</td>
</tr>
<tr>
<td>Video (&lt;i&gt;n = 21&lt;/i&gt;)</td>
<td>Correlation coefficient</td>
<td>-.18</td>
<td>-.26</td>
<td>-.66*</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.30</td>
<td>.16</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Text (&lt;i&gt;n = 23&lt;/i&gt;)</td>
<td>Correlation coefficient</td>
<td>-.04</td>
<td>-.02</td>
<td>-.08</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.78</td>
<td>.87</td>
<td>.60</td>
</tr>
</tbody>
</table>

Figures 30 and 31 show a visual representation of these correlations:
Figure 30. Kendall’s tau-b correlations between total number of feedback episodes and oral and written gains at immediate.
Figure 31. Kendall’s tau-b correlations between total number of feedback episodes and oral and written gains at delayed.

The relationship between metalinguistic feedback episodes and gains was explored next. As shown in Table 31, there were small, negative associations between metalinguistic feedback episodes and oral and written gain scores at immediate posttest and delayed posttest. This relationship was only statistically significant for oral gains at immediate posttest ($\tau_b = -0.24, p = 0.02$).
Table 31. Kendall’s tau-b correlations between metalinguistic feedback episodes and oral and written gain scores.

<table>
<thead>
<tr>
<th>Feedback (n = 65)</th>
<th>Correlation coefficient</th>
<th>Oral gains at immediate</th>
<th>Written gains at immediate</th>
<th>Oral gains at delayed</th>
<th>Written gains at delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-.24*</td>
<td>-.21</td>
<td>-.15</td>
<td>-.20</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.02</td>
<td>.06</td>
<td>.13</td>
<td>.06</td>
</tr>
</tbody>
</table>

After exploring the relationship between number of metalinguistic feedback episodes and gains for all groups combined, the relationship between feedback and gains was explored for the different treatment groups separately in order to see if any group or groups in particular were driving the observed correlations.

Table 32. Kendall’s tau-b correlations between number of metalinguistic feedback episodes and oral and written gain scores per group.

<table>
<thead>
<tr>
<th>Feedback (n = 21)</th>
<th>Correlation coefficient</th>
<th>Oral gains at immediate</th>
<th>Written gains at immediate</th>
<th>Oral gains at delayed</th>
<th>Written gains at delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td></td>
<td>-.40*</td>
<td>-.46*</td>
<td>-.13</td>
<td>-.21</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.03</td>
<td>.02</td>
<td>.48</td>
<td>.27</td>
</tr>
<tr>
<td>Video</td>
<td></td>
<td>-.27</td>
<td>-.16</td>
<td>-.40*</td>
<td>-.44*</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.89</td>
<td>.43</td>
<td>.03</td>
<td>.02</td>
</tr>
<tr>
<td>Text</td>
<td></td>
<td>-.24</td>
<td>-.16</td>
<td>-.13</td>
<td>-.15</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>.21</td>
<td>.43</td>
<td>.45</td>
<td>.43</td>
</tr>
</tbody>
</table>

As Table 32 shows, there were very small and non-significant correlations in the text-based SCMC group, again, similar to the results for the total number of feedback episodes. When looking at the results for the voice-based SCMC group, there were medium negative correlations that were significant between feedback and written and oral gains at immediate posttest. As for the results of the video-based SCMC group, there were medium negative correlations that were significant between feedback and written and oral gains at delayed posttest.
Summary of Results of Research Question 3

Results from the descriptive analyses indicated that the voice-based SCMC group received a significantly higher amount of metalinguistic and total number of feedback episodes than the text-based SCMC group. Further descriptive analyses exploring the frequency of participants receiving a higher number of metalinguistic feedback episodes showed that while the majority of the participants in the text-based group (60.9%) received only one metalinguistic feedback episode, the majority of participants in the voice-based group and the video-based group (47.6% and 52.4% respectively) received two metalinguistic episodes. When considering the number of participants receiving three metalinguistic feedback episodes, the percentages were as follow: 8.7% of participants in the text-based group, 4.8% in the video-based group, and 23.8% in the voice-based group. These trends indicate that the oral SCMC groups needed more metalinguistic feedback than the text-based group, and that this difference was significant between the voice-based group and the text-based group.

Results from the correlation analyses (including all groups) indicated that the total number of feedback episodes was negatively correlated with oral and written gains at both immediate posttest and delayed posttest. These correlations were small and significant. Results from the correlation analyses (including all groups) indicated that the number of metalinguistic feedback episodes was also negatively correlated with oral and written gains at both immediate posttest and delayed posttest. These correlations were small and only significant for oral gains at immediate posttest.

Results from the correlation analyses (per treatment group) indicated that the total number of feedback episodes was negatively correlated with oral and written gains at both the immediate posttest and delayed posttest, the correlations being very small and non-significant in
the text-based group, small-medium and significant in the voice-based group for written gains at immediate posttest, and medium-large correlations in the video-based group for oral and written gains at delayed posttest.

Results from the correlation analyses (per treatment group) indicated that the number of metalinguistic feedback episodes was also negatively correlated with oral and written gains at both the immediate posttest and delayed posttest, the correlations being small and non-significant in the text-based group, medium and significant in the voice-based group for written and oral gains at immediate posttest, and medium correlations in the video-based group for oral and written gains at delayed posttest.
CHAPTER 6: DISCUSSION, LIMITATIONS AND FUTURE RESEARCH, PEDAGOGICAL IMPLICATIONS AND CONCLUSION

Discussion

Research Question 1

Does type of communication mode (video-based SCMC vs. text-based SCMC vs. voice-based SCMC plus explicit feedback) lead to differential L2 grammatical learning, as measured by oral and written production of the target structure?

This dissertation is the first attempt to compare several SCMC modes in one study in terms of L2 learning. This need has been voiced by SCMC scholars, who have called for more research into the overall effects of interaction in different SCMC modes on L2 development (e.g., Loewen & Wolff, 2016; Yanguas, 2010; Ziegler, 2016b). This research is not only pedagogically important, but also theoretically crucial, as CALL and SCMC researchers need to establish how new modes of communication in language pedagogy fit within previous research and findings. To this end, new findings of how these oral SCMC environments (video-based and voice-based) work need to be integrated with what previous research on text-based SCMC and FTF has established. First, in an attempt to link how new communication modes behave with previous research, the pilot study in this dissertation corroborated a finding that seemed intuitive, but not empirically supported, that video-based and FTF environments behaved almost identically both in terms of time on task and L2 grammatical learning. The reason why this seemed intuitive is because both modes share a lot of their communication features: they provide visual cues and intonation, they both entail immediate communication, they allow for similar interruption patterns, and they provide paralinguistic communication opportunities, among others.
Additionally, and following a call in the recent literature to frame CALL research within mainstream second language acquisition (SLA) theories (e.g., Chapelle, 1997; Cerezo, 2016), this study has been grounded in the interactionist framework (e.g. Gass & Mackey, 2006). Additionally, with the goal of improving research designs and better statistical reporting practices (e.g., Chapelle, 2001; Cerezo et al., 2014; Leow & Suh, 2016; Ziegler, 2016a), this study reports effect sizes and power for all statistical analyses, as well as reliability analyses for all assessment instruments.

Results in the present study showed that all three modes under investigation (text-based, video-based, and voice-based SCMC), in conjunction with explicit feedback, impacted positively on L2 grammatical learning. The grammatical, interaction-driven learning was significant from pretest to immediate posttest and from pretest to delayed posttest. This means that even one week after the treatment, participants in all groups were able to retain what they learned in the treatment. This is a very important finding that underlines (a) the importance of designing theoretically motivated learning tasks that can promote meaningful interaction and that encourage learners to experiment with new linguistic structures and discourse features that facilitate the process of language learning (e.g., Blake, 2007; Sotillo, 2016) and (b) the importance of interactional moves such as the provision of feedback to participants in a relatively unambiguous and explicit way in order to learn a complex L2 structure such as the Spanish past subjunctive (e.g., Carroll, 2001; Collentine, 2010; Swain, 2005).

One possible reason why participants in the three groups showed learning is that the focused task, accompanied by metalinguistic and explicit feedback, was useful for learning a complex/hard grammatical form. Spanish L2 researchers have determined that the development of the Spanish L2 subjunctive is difficult to acquire for L2 Spanish learners due in part to its low
communicative value, and that channeling learners’ attention to the form may be necessary for the form to be acquired (e.g., Collentine, 1995; 1998; 2010; Farley, 2004; Fernández, 2008). After learners’ attention is channeled to the form, it is crucial how they process such grammatical information (Leow, 2015). Thus, learners may indeed benefit from explicit feedback and contextualized practice (e.g., Cerezo, 2010; DeKeyser & Prieto Botana, 2013; VanPatten & Benati, 2010), and from the provision of explicit feedback (Lyster & Saito, 2010) for further processing and learning of complex forms.

The present study tried to incorporate these suggestions from Spanish L2 scholars to achieve optimal conditions for the learning of L2 Spanish past subjunctive. The treatment task in this study contextualized the structure within concrete situations for communicative purposes (how a student felt about situations she encountered when she first arrived to college the previous semester; and how two students felt about their study abroad experience in Spain the previous semester), and channeled participants’ attention to the form when providing explicit feedback. Furthermore, participants received explicit information in the pretest session (two weeks before the treatment, in the form of a PowerPoint tutorial) on the present (not past) subjunctive. It seems that these suggestions had a positive impact in the learning of such a complex form for L2 Spanish learners.

As pointed out by Swain (2005), feedback is effective when it leads learners to notice holes, and as Carroll (2001) has noted, this sort of noticing can take place only if the language learner realizes that the feedback provider is not talking about the extralinguistic world but about the language itself. Carroll (2001) suggests that what leads learners to view the contingent input as a comment on language itself is the irrelevance of the feedback move to the ongoing topic of the conversation. This sort of digression from the task itself to the language form may lead to
deeper processing of this feedback on the part of the learners (Leow, 2015). This was a consistent trend observed by the researcher during the completion of the treatment task, as participants showed confusion at first when the researcher provided metalinguistic or explicit feedback, showing that they were interpreting the contingent input as a comment on language (in this case, the past subjunctive), rather than about the extralinguistic worlds created in these tasks.

Similar to Yilmaz (2012)’s explicit feedback, which included explicit verbal indicators (i.e., ‘X is wrong, you should say Y’), the current study’s feedback might have given a clear message that the utterance was not relevant to the ongoing talk. As a consequence, this message might have helped learners not only notice the feedback as a comment on the linguistic code but also process it deeper to make a comparison between the nontarget-like forms and the target-like form (Leow, 2015). Recall that while previous studies have operationalized explicit feedback as metalinguistic feedback (e.g., Ellis, 2007; Loewen & Nabei, 2007 Sanz, 2003), and others as direct correction (e.g., Yilmaz, 2012), the current investigation included a mixture of both. The first one-three times that participants made a mistake, the rule to form the past subjunctive, together with the context of use, were provided. After that, direct corrections were provided every time participants made a mistake.

Following suggestions of other studies (e.g., Loewen & Erlam, 2006), this study tried to provide an optimal learning experience by selecting learners who had the right pedagogical preparation to learn the past subjunctive. Before the study, participants had had extensive practice with modality and mood, as they had studied the contexts that required the subjunctive, and they had had practice forming subordinate clauses with the present subjunctive tense. It seemed that having a solid base on the present subjunctive forms helped learners learn the past subjunctive effectively (Baralt, 2013, 2015). As well as having studied and practiced the present
subjunctive in their class, providing participants with a refresher of how to form the present subjunctive and the contexts of use relevant to the present study through the PowerPoint Tutorial in the pretest session seemed to be useful in priming them to process the new target structure.

While the three modes were not significantly different from each other, the text-based SCMC condition seemed to show a slight descriptive edge over the other two modes. While this advantage was minimal when compared to the video-based condition, it was more apparent when compared to the voice-based condition (as Table 24 and 25 above indicate, descriptive mean gains at immediate: 96.78 and 98.69 for the text condition vs. 91.00 and 96.66 for the voice condition; descriptive mean gains at delayed: 63.73 and 70.00 for the text condition vs. 48.57 vs. 50.00 for the voice condition). In fact, and different to what was observed in the pilot study, in the main study the video-based condition and the text-based condition behaved very similarly (as Table 24 and 25 above indicate, descriptive mean gains at immediate: 96.78 and 98.69 for the text condition vs. 94.90 and 96.19 for the video condition; descriptive mean gains at delayed: 63.73 and 70.00 for the text condition vs 62.28 vs. 68.57 for the voice condition).

The close similarity in performance between the text and the video conditions might have been due to the fact that both modes offer unique affordances that the other mode does not. For example, while the text-based condition offers participants the possibility of being able to compare corrections with their erroneous utterances on the screen, the video-based offers other participants the ability to see their interlocutor while communicating, therefore allowing them to process the input and feedback received accompanied by extralinguistic communication elements such as intonation or paralinguistic communication strategies such as face and body gestures.

While the three modes were not statistically different, the reasons why the text condition showed a slight descriptive edge over the other two modes, specially over the voice-based mode,
may have been several. Firstly, it seems that participants in the voice-based condition perceived the task to be more difficult than participants in the other two modes, including the text-based condition. This was shown by a response to one of the questions in the exit questionnaire, in which participants were asked to report which of the three tasks had been harder for them to perform (the treatment task with the researcher, the oral assessment task, or the written assessment task). While the majority of participants indicated that the most difficult task had been the oral assessment task (75% of participants), 14 of the 65 (21% of participants) indicated that the most difficult task for them had been the interaction task with the researcher. Interestingly, the majority of these participants belonged to the voice-based condition (8 out of 14, or 57%). Reasons participants mentioned were related to the difficulty of communicating quickly and being able to understand the researcher. Some of the comments from participants were the following ones: ‘It was hard for me to understand the researcher because she was speaking fast. I have trouble with listening’, ‘there's more pressure when you know someone is listening to you live and is able to correct your mistakes right away’, or ‘having to communicate on the fly in a new tense was a little difficult’.

Secondly, and echoing scholars who have observed an advantage for the text condition, this mode allows participants to visualize the feedback received on the screen and compare it their erroneous utterances, as mentioned above. Participants in the text condition could also pre-plan their output before sending their message, taking longer to write their utterances when interacting with the researcher because they were processing input and producing output sequentially. When compared to the text-based mode, the video-based and the voice-based modes do not allow so easily for this sequential processing, as oral communication is more immediate than written communication. Also, participants in the text condition were able re-read
the messages through the scrolling feature, an opportunity than the other two modes could not provide.

The affordances just mentioned take us to a third reason, which is that participants in the text-based condition took significantly longer time to complete the task than participants in the video-based and voice-based conditions. The longer time on task (due in fact to the reasons mentioned in the previous paragraph and due to the fact that typing itself takes longer than speaking) provides participants with longer practice time, which logically might lead to better results. This finding of the text mode taking longer time than oral modes is in agreement with previous studies that have compared a text-based condition with an oral condition, which was an FTF conditions in all previous studies (e.g., Baralt, 2013; Yilmaz, 2012; Yilmaz & Yuksel, 2011). In some studies, participants took almost twice as much time to complete the SCMC tasks than to complete the FTF tasks (e.g., Baralt, 2013; Yilmaz & Yuksel, 2011), which mirrors the findings in the current dissertation (22 minutes for the oral modes vs. 42 minutes in the text mode). Other studies have reported that SCMC tasks took participants more than twice the time to complete than FTF tasks (FTF task average of 6.39 min and SCMC average of 13.36 min), both for the implicit condition and the explicit condition in the study (Yilmaz, 2012). Whereas Yilmaz (2012) and Yilmaz and Yuksel (2011)’s treatment task was a one-way information gap, Baralt (2013)’s treatment task was an interactive dialogic story retell. The current study also used an interactive dialogic story retell task, similar to Baralt (2013).

In terms of how the findings in this study fit with previous research, they partially agree with findings in previous SCMC studies (e.g., Baralt, 2013, 2015; Granena, 2016; Monteiro, 2014; Sachs & Suh, 2007; Yilmaz, 2012), while partially disagreeing with other SCMC studies (e.g., Baralt, 2013; Loewen & Erlam, 2006; Sauro, 2009; Yilmaz, 2012; Yilmaz & Yuksel,
While the current dissertation found learning in all three modes, Loewen and Erlam (2006) and Sauro (2009) did not find learning in any of their treatment conditions under study: recasts in text-based SCMC, metalinguistic feedback in text-based SCMC, and test-only (control). The lack of differences among the experimental groups found in Loewen and Erlam (2006) and Sauro (2009) may be due to how participants processed the recasts and explicit feedback in these studies (Leow, 2015).

The inconsistent findings between this study and Loewen and Erlam (2006)’s study might have been due to the fact that Loewen and Erlam (2006) included groups of 5-8 learners with a teacher moderator, while this study included pairs of learners-expert interlocutor, which might have also impacted the learning results in both studies. Indeed, many participants echoed their liking of the one-on-one nature of the interaction task in the exit questionnaire. Even if this one-on-one scenario is not easy to recreate in the traditional FTF language classroom, it might be the ideal one for complex structures like the one under study in this dissertation.

Another difference between the current study and Loewen and Erlam (2006) is that, as argued by the researchers themselves, participants in their study might not have been developmentally ready to learn about English regular past tense, as the past tense is late acquired by L2 English learners. Similar to what Loewen and Erlam (2006) refer to as ‘developmentally ready’, in this study every effort was made in order to ensure that participants were ‘pedagogically ready’ to learn the Spanish past subjunctive. Following that, the researcher carefully chose participants who would be ready to learn this the target form, in terms of them having had exposure to the present subjunctive (not past) and its contexts of use, as well as the preterit indicative, given that both of these forms are said to be requirements to form the past subjunctive, which seem to have had a positive effect.
The conflicting findings between this study and Sauro (2009)’s study might have been due to several aspects. For example, the absence of an inclusion criterion for participants in Sauro (2009)’s study, including participants who scored up to 75% at pretest, while the current study only included participants who scored zero or close to zero at pretest, something that inevitably allowed more room for learning. Additionally, the lack of learning in any of Sauro (2009)’s treatment groups might have been due to the nature of the target form (English zero article with abstract noncount nouns such as ‘unemployment’ or ‘culture’), which does not naturally lend itself to rule-based learning, and therefore might not benefit from feedback so obviously as the Spanish past subjunctive does. Also, the amount of feedback was different in both studies (2-3 total feedback episodes on average in her study, vs. 1-19 feedback episodes, 7.73 on average in this study).

In partial disagreement with Baralt (2013), Yilmaz (2012), and Yilmaz and Yuksel (2011), this study did not show an advantage for the text-based condition versus the oral conditions, while Baralt (2013)’s, Yilmaz (2012)’s and Yilmaz and Yuksel (2011)’s text-based condition outperformed the oral condition in their study (being their oral condition an FTF-based interaction). While the superiority of their text-based group over their FTF group was not seen in the current study, the text-based group showed a slight descriptive advantage the other two oral SCMC modes (instead of an FTF group).

On a different note, both Baralt (2013), Baralt (2015), and the present study showed learning at immediate posttest and delayed posttest, whereas Yilmaz and Yuksel (2011) just included an immediate posttest in their design. While Baralt (2013), Baralt (2015), and Yilmaz and Yuksel (2011) included recasts, the present study included metalinguistic and explicit feedback, which points to the fact that learning may take place when incorporating different
types of feedback, as long as the task used is psycholinguistically motivated. While Yilmaz and Yuksel (2011) found that recasts worked better in the SCMC environment than FTF, the current dissertation did not find that explicit feedback was more effective in one more than another, but equally effective in all three modes.

However, linguistic gains in the current study were higher than the ones in Baralt (2013) and Yilmaz and Yuksel (2011), although the latter study’s gains were impossible to compute due to pretest scores not being reported, and just having posttest scores available. Despite this missing information, the researchers mentioned in their discussion that learners’ scores were low in general, and that in fact six learners scored zero on both structures in the posttest. As for comparison with Baralt (2013), while gains in the present study at immediate posttest were between 91 and 98.69% and at delayed posttest were between 48.57 and 70%, Baralt’s (2013) linguistic gains in her two productive assessments were between 18% and 48% at immediate posttest and between 5% and 47% delayed posttest. It is important to point out that Baralt (2013) and the current study both included the same target form (Spanish past subjunctive) and time-on-task was very similar for the written and oral modes as well between both studies.

In accordance with Baralt (2013), Baralt (2015), Sachs and Suh (2007), Shekary and Tahirian (2006), and Yilmaz (2012), the current study also provided evidence that learning through a text-based SCMC condition is possible. While Baralt (2015), Sachs and Suh’s (2007) and Shekary and Tharirian’s (2006) studies did not compare the text-based SCMC mode to other SCMC or FTF modes, the fact that dyadic participant-researcher interaction through written SCMC resulted in significant learning from pretest to immediate posttest is a shared feature of their studies and the present one. As Baralt (2013), Baralt (2015), and Yilmaz and Yuksel (2011), Sachs and Suh (2007) focused on researching the effects of recasts, instead of
metalinguistic or explicit feedback, which was the focus of this dissertation. Shekary and Tahririan (2006) did not focus on feedback but on investigating the link between noticing and learning. Moreover, Sachs and Suh (2007) and Shekary and Tahririan (2006) did not include a delayed posttest to measure retention, unlike the present study.

The findings in this dissertation were partially in agreement with Monteiro (2014), who found that all three of her video-based groups (recast, metalinguistic feedback, no feedback) improved after performing tasks in this oral SCMC environment. Specifically, her video-based, metalinguistic feedback group is the most similar to one of the groups in the current study. Results in both studies also found that learning was retained at delayed posttest. However, Monteiro’s (2014) participants were at all levels of proficiency while the current study focused on a very narrow pool of participants’ proficiency (4th semester Spanish course), therefore establishing more controlled experimental conditions. Another difference between Monteiro’s (2014) study and the current dissertation is that while her study included six treatment tasks and the number of exemplars of English simple past tense was not reported, the current study just included one treatment task and the number of exemplars was thirty.

Some difficulties that Monteiro (2014) encountered since most of her participants were connected with the researcher from their houses, such as the treatment sessions being constantly interrupted by phone calls, diverse outside noises (e.g., ambulances, TV sounds), messages coming from different sources on the participants’ computers, or accessing Internet tools (e.g., dictionaries, translators), were not experienced in the present dissertation because participants were connected with the researcher from the laboratory computer. This allowed for control of which programs could be accessed in the computer and allowed for complete silence due to the sound-proof features of the language laboratory used. A common denominator of both studies,
however, was the presence of problems with technology that, although not major, sometimes resulted in a slower Internet connection during the treatment sessions in this study. As suggested by Monteiro (2014), connections with a bandwidth of 1.2 megabits or more are suggested for Skype.com (and other similar programs) for high video-conference quality.

Findings of the current study partially align with Granena’s (2016) findings that a voice-based condition may promote language development of grammatical features in the L2. Her study had an interactive task condition and an individual task condition, her interactive group being similar to the voice-based SCMC group in the present dissertation, with the difference that in her study the interactions were learner-learner, and in this dissertation, the interactions were learner-expert interlocutor. The findings in both of these investigations, however, differ in the sense that while her interactive condition did not maintain learning at the delayed posttest, participants in the voice-based group in the current study were able to retain the grammatical knowledge. This difference might have been due to participants in her study interacting for a slightly shorter time (an average of 14.42 minutes vs. an average of 22.27 minutes in the current study). Additionally, Granena’s (2016) study focused on different target structures (English past tense, modal verbs, or connectors depending on participants’ group assignment) than the present study (Spanish past subjunctive tense).

Findings in this dissertation were partially in agreement with Yilmaz (2012) as well, as he also found L2 learning for his SCMC group (text-based). He further compared SCMC to FTF, and explicit feedback to recasts. He found an edge for SCMC (vs. FTF), although this advantage was significant, whereas the current study did not find a statistical difference between the written and the oral modes. He also found an edge for explicit feedback (vs. recasts). This finding is in agreement with the meta-analysis of classroom-based studies by Lyster and Saito (2010) that
found that prompts (including metalinguistic feedback) were statistically more effective than
recasts. Taking this into account, together with the understudied behavior of metalinguistic and
explicit feedback in the SCMC mode, prompted its inclusion into the present dissertation.

Additionally, Yilmaz (2012) found no interaction between feedback type and mode, meaning that explicit feedback was more effective in both modes. The purpose of my
dissertation was to further investigate whether the efficacy of explicit feedback was mediated by
learning mode, and the answer was that it was not, similar to Yilmaz (2012) but including three
SCMC modes versus one SCMC mode (text-based) and an FTF mode in his study. This
dissertation provides further empirical evidence that supports previous studies (e.g., Yilmaz,
2012; Monteiro, 2014) that explicit (Yilmaz, 2012) or metalinguistic feedback (Monteiro, 2014)
may work in SCMC environments. Therefore, taking these three studies together, it can be
concluded that explicit feedback may be beneficial for the learning of some grammatical
features, when provided in different SCMC modes.

However, what is different between Yilmaz’s (2012) explicit feedback group and this
study’s explicit group is that while in Yilmaz (2012) participants improved in the oral production
measure from pretest to immediate posttest but did not maintain improvement at delayed
posttest, in the present study many participants did maintain oral production improvement at
delayed posttest. They also maintained written production improvement from immediate to
delayed posttest. This difference might have been due to the fact that the linguistic structures in
both studies were different; while the current study investigated the Spanish past subjunctive,
Yilmaz (2012) investigated the Turkish plural morpheme and the locative case morpheme. These
two linguistic structures are fundamentally different in terms of salience and arguably also in
terms of difficulty, which might have impacted the differential learning at the delayed posttest

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stage. Furthermore, the current study provided both metalinguistic and direct (explicit) correction while Yilmaz (2012) just provided direct (explicit) correction, which might have also affected learners’ retention of the rule.

The fact that at immediate and delayed posttest, the three groups were not significantly different in this dissertation is a new finding difficult to fit in with previous research, as to the best of my knowledge, no previous studies have included more than one SCMC mode in their designs. What the study does agree with previous research (e.g., Baralt, 2013, 2015; Sachs & Suh, 2007; Yilmaz, 2012; Yilmaz & Yuksel, 2011) is the encouraging results that speak for the use of SCMC-based tasks (not only in distance education but also in traditional face-to-face classes) as an option to learn difficult L2 grammatical structures.

Finally, this study confirmed that transferability of L2 development from one mode to the other (oral/written) is possible, mirroring the findings of previous research that showed that an intervention through text-based SCMC can in fact improve learners’ oral proficiency (e.g., Baralt, 2013; Payne & Whitney, 2002), and that an intervention through an oral mode can also improve learners’ written production (Baralt, 2013). Therefore, this study adds to the body of literature that states that a writing treatment may indeed result in oral development and vice versa.

**Research Question 2**

Does WMC moderate the relationship between communication mode and L2 grammatical learning?

This study was the first attempt to include a cognitive individual difference while investigating different SCMC modes together with feedback for L2 learning. In that sense, this study is a pioneer as all previous SCMC studies that included WMC in their designs did not include more than one SCMC mode. In fact, no previous SCMC studies have incorporated WMC
while investigating grammatical learning. In light of this, the findings in the current dissertation are compared to previous FTF interactional research that has incorporated WMC with or without feedback in their research designs.

Importantly, the current study shied away from a practice that has been critiqued by SLA scholars (e.g., Plonsky & Oswald, 2016) but, in fact, has been put into practice in some of the studies cited here (e.g., Baralt, 2013; Payne & Ross, 2005; Yilmaz, 2013). This practice is that of dividing participants into two artificial groups on a continuous variable. By doing this, the researcher loses underlying important continuous information to adjust the analysis to a means-type analysis. In order to avoid that, the analysis in this study avoided dividing participants into two artificial groups of ‘low WMC participants’ and ‘high WMC participants’. In terms of WMC measures used, contrary to Payne and Ross (2005) and Payne and Whitney (2002), who employed recognition-based WMC measures, the current study employed a production-based WMC measure, which resulted in a more normally-distributed set of scores (see Figure 25 above) than in Payne and Ross (2005) and Payne and Whitney (2002).

This study ran two mixed-design ANCOVAs to determine whether the results in RQ1 would change after partialling out the effects of the covariate, in this case, WMC. In other words, this analysis tested whether the effects of the independent variable SCMC mode on the dependent variable grammatical learning would change after controlling for WMC. Given that the results remained virtually unchanged from RQ1 to RQ2, it was determined that WMC did not play a role in any mode or moderate L2 grammatical learning in this study. In other words, it seemed that participants in all three groups, regardless of their WMC, showed improvement at immediate and delayed posttest.
While it has been suggested (e.g., Roehr, 2008) that WMC may play a role under explicit language exposure conditions, particularly when L2 learners need to retain metalinguistic information in memory while simultaneously producing and comprehending language (as was the case in the current study), this was not found here. One reason might have been that the productive oral posttest was monologic (vs. interactive) in nature, and the written posttest did not involve any interaction either, not forcing participants to produce and comprehend language at the same time. Another explanation may be that because learners had no time limitations in the posttests, their WMC was not overloaded and participants could take their time to retrieve metalinguistic information they had previously received in the treatment task, incorporate it, and produce language sequentially, instead of simultaneously, not pushing the Executive Function (EF) of WMC to its limit. In fact, it might be the case the untimed nature of the task provided the ideal conditions for all participants (regardless of their WMC) to succeed and learn the target form.

Another reason to explicate these findings might be that explicit feedback benefitted learners with high and low WMC equally, which is partially in agreement with Yilmaz (2013). He found that while recasts only worked for low WMC learners, explicit feedback worked for low and high WMC learners. Following this argument, it might be the case that explicit feedback ‘levels the playing field’ for participants across the WMC spectrum, not allowing for WMC to have any effect. In this case, and contrary to Mackey et al. (2002), all participants may have processed the input provided in the form of feedback during the treatment task in a sufficiently elaborative way such that encoding in long-term memory could occur. As a consequence, learners of all WMC capacities may have been as able to access information from long-term memory at the time of immediate posttests and delayed posttests. As claimed by Mackey et al.
(2010), not all feedback types pose the same demands on WMC, as learners may not so easily make a cognitive comparison between a recast correction and their erroneous output than between explicit/metalinguistic correction and their erroneous output.

It might have also been the case that due to the focus on one structure (vs. many), WMC resources might not have been depleted, as participants might not have been overwhelmed with the task, and they did not have to even focus on many structures or on several language aspects (grammar, vocabulary, etc.) at the same time. Potentially, once participants ‘got’ the rule during the treatment task, they did not have to keep processing at the same high level during the oral and written assessment tasks. Although the oral nature of the story retell would not allow for think aloud procedures that would ascertain how participants were processing, the written assessment task could benefit from this approach. If it was the case that the focus on just one linguistic structure did not tax participants’ WMC, and that it potentially facilitated their automatization of language production, they might have been able to focus all their WMC resources on the correct production of the target structure following the rule they had previously learnt, and not focus so much on other aspects of the language such as vocabulary, pronunciation, among others.

Findings in this dissertation are partially in agreement with some interactional studies (Goo, 2012), and partially in disagreement with other interactional studies (Ando et al., 1992; Mackey et al., 2002). Previous interactional SLA research has shown that WMC is one of the main cognitive variables affecting interaction-driven L2 learning (e.g., Goo, 2012; Li, 2013; Mackey, Adams, Stafford, & Winke, 2010; Mackey, Philp, Fujii, Egi, & Tatsumi, 2002; Mackey & Sachs, 2012; Révész, 2012) and that learners with higher WMC may exhibit more delayed
benefits from communicative instruction and feedback than their counterparts with lower WMC (Ando et al., 1992; Mackey et al., 2002), results that were not found in the present study.

Contrary to Ando et al. (1992) and Mackey et al. (2002), gain scores at delayed posttest did not correlate significantly with the WMC scores. These conflicting findings might have been due to different nature of the experimental conditions in Ando et al.’s (1992) study and the present study. While Ando et al. (1992) included 9 hours of explicit form-focused instruction, the time on task in the current study varied from 22 to 42 minutes. As for Mackey et al.’s (2002) study, only data from 7 participants were actually considered for the delayed posttest, which encourages caution when extrapolating the findings of this study. Additionally, Mackey et al. (2002) provided feedback to participants in the form of recasts, which differed to the feedback provided in the present study. Findings in this dissertation are partially in agreement with Goo (2012), as Goo (2012) found that WMC predicted the beneficial effects of recasts but failed to predict improvement in the metalinguistic group.

Findings in this study are partially in agreement with Baralt (2015), while they are in partial disagreement with Payne and Whitney (2002). This study, like Baralt (2015) found that WMC was not related to the learning of the Spanish past subjunctive. While Baralt (2015) explored text-based SCMC interaction and recasts, the current study explored three types of SMC interaction and explicit feedback. Despite their differences, both studies observed similar results. Baralt (2015) hypothesized that the lack of a relationship between WMC and learning in the text-based SCMC mode might be due to the fact that feedback was given in the written form, which allows easily for feedback contingency, easily allowing learners to compare corrections to their erroneous utterances (specifically in her less complex task). In the current dissertation, this explanation may also be plausible, as error-feedback contingency was mostly observed in all
three modes under investigation, not just the written form. However, this was also observed in the oral modes, which, although not expected, may be explained due to the explicitness of the treatment, and the non-interactive nature of the assessment tasks, as explained above.

While Payne and Whitney (2002) found that the correlation between WMC and L2 development was stronger for the FTF participants than for the text-based SCMC participants, results that emerged from this dissertation showed that WMC seemed to play a similar role in all three SCMC modes (almost no role at all). However, these two studies are different in several respects. First of all, Payne and Whitney’s (2002) study included an FTF group and a text-based SCMC group, while the present study included three SCMC groups. Moreover, this study was a very controlled, pretest-immediate posttest-delayed posttest study while Payne and Whitney (2002) was a study that took place over a 15-week semester.

Moreover, Payne and Whitney (2002) found an effect for phonological working memory capacity (PWMC), while the current study focused on the executive function (EF) of WMC (Baddeley, 2007, 2010), responsible for various attentional functions, chief among which was the updating of goals based on feedback for the current study. Finally, the way that learning was measured was markedly different in both studies. This study just focused on measuring learning of one target structure, the past subjunctive, while their study measured learning more generally using the oral proficiency interview (OPI) instrument and assessing it through two examiners using a 50-point rubric. While the nature of the OPI is interactive, both of the assessment tasks in the current dissertation were monologic in nature, which might have influenced the different results in both studies.

The hypothesis that had been put forward in previous SCMC studies including the variable of WMC (e.g., Payne & Ross, 2005; Payne and Whitney, 2002) that low-span WMC
participants may use text-based SCMC as a compensatory mechanism, and therefore thrive in this environment (when compared to oral communication environments), was not confirmed in the current investigation. The reasoning behind this hypothesis is that the slower pace of the text-based SCMC mode allows low-span learners to process input and/or feedback first, to then move on to produce output, thereby allocating their cognitive resources serially.

It was hypothesized that because of its closer proximity to FTF than text-based SCMC, video-based and/or voice-based SCMC might favor those participants with high WMC, supporting previous FTF interaction literature (e.g., Mackey et al., 2002, 2010), and that text-based SCMC might favor those participants with low WMC, following other studies (Payne & Ross, 2005; Payne & Whitney, 2002). However, this hypothesis was not confirmed, as participants across the WMC spectrum in the three SCMC modes under study performed equally well. As mentioned above, this might have been due to the fact that the task was not difficult enough for participants to put their WMC under pressure or that not having the time pressure to finish the task within a given time, even those with lower WMCs could perform well.

Ultimately, the finding that all learners, regardless of their WMC, were able to develop past subjunctive oral and written productive knowledge at immediate posttest, and that many of them were able to retain this knowledge at delayed posttest, is in itself an important finding. In this case, the lack of relationship indicates that under explicit learning conditions, leaners with varying WMCs may be able to benefit equally when it comes to developing a complex L2 grammar structure.

**Research Question 3**

*Is the amount of feedback related to oral or written gain scores of the target structure?*
This is the first study to investigate the effect of explicit feedback on different SCMC modes. While there has been previous research that has looked into implicit feedback (recasts) in different modes (Baralt, 2013; Sachs & Suh, 2007; Yilmaz & Yuksel, 2011), and research that has compared implicit versus explicit feedback (Loewen & Erlam, 2006; Monteiro, 2014; Sauro, 2009; Yilmaz, 2012), previous research has not investigated the efficacy of explicit feedback in different SCMC environments. Findings of previous investigations showed that recasts may benefit language development (Baralt, 2013; Sachs & Suh, 2007; Yilmaz & Yuksel, 2011), and that recasts were more effective in SCMC than in FTF (Yilmaz & Yuksel, 2011). Studies comparing two types of feedback have resulted in mixed findings, either showing no differences between meta-linguistic feedback and recasts (Loewen & Erlam, 2006; Monteiro, 2014; Sauro, 2009), or an edge of the explicit feedback group over recasts (Yilmaz, 2012).

The choice of feedback for the present study, as explained in the previous section, was due, in part, to the complex target form under study (Collentine, 1995; 1998; 2010) and to the fact that although implicit feedback might not obstruct communication (Long 1996), it might also go unnoticed by learners (e.g., Carroll, 2001; Panova & Lyster, 2002). In addition, there is some evidence that metalinguistic information may in fact be more effective than recasts (e.g., Lyster & Saito, 2010). Therefore, a combination of metalinguistic and explicit feedback was deemed appropriate for the learning of the Spanish past subjunctive in the current study.

The amount of metalinguistic and explicit feedback provided depended on a number of factors. First of all, every time a participant made a mistake, feedback was provided by the researcher. The first one-three times participants made a mistake, metalinguistic feedback (rule to form the past subjunctive and context of use) was provided. Although that was what was initially intended, some participants asked for clarification of the rule in later conversational
turns, so the researcher provided them with the rule two-three additional times. Only two participants, as shown in Table 28 above, needed four and five metalinguistic feedback episodes, respectively, who belonged to the video and voice conditions. After that, explicit feedback was provided (‘X is wrong, you should say Y’) every time the participant made a mistake. In order to level the playing field for participants in the three groups, after the metalinguistic feedback episodes were provided in the text-based mode, participants were instructed to close the chat so that these feedback episodes disappeared and could not be accessible for future reference.

The first finding that emerged while examining feedback was that the text-based SCMC group received a significantly smaller amount of total number of feedback episodes (both just metalinguistic and metalinguistic and explicit combined) than the voice-based SCMC group. While the difference between the text-based group and the video-based group was not statistically significant, there was a descriptive difference between both groups, with the text-based SCMC group receiving fewer feedback episodes than the video-based mode. Taking into account that the L2 development of the three groups was equivalent both at immediate posttest and delayed posttest, it seems than in fact fewer feedback episodes were needed in the text condition than in the other two conditions to successfully learn the target form.

In the case of metalinguistic feedback, this might have been due to the fact that seeing the metalinguistic feedback on the screen may have helped learners process it better/faster (even if it was not visible/accessible for the rest of the task), thus not needing additional episodes. In fact, the majority of participants, 60.9%, in the text-based condition just needed one metalinguistic feedback episode, followed by 30.4% who needed two. This contrasts with the voice-based condition, in which the majority of participants, 47.6%, received two, followed by 23.8% of
participants who received three, and with the video-based condition, in which the majority of participants, 52.4%, received two, followed by 38.1% who received just one.

When considering explicit feedback, participants in the text-based SCMC could and indeed made use of the possibility of scrolling back to visualize the explicit feedback (but not metalinguistic, as it was removed) provided by the researcher. The screen-recorded videos showed that participants in the text-based SCMC mode moved their mouse upward or scrolled up to examine formerly provided feedback, and then sent their message. Before sending their message, participants often scrolled up quickly to view a past subjunctive form (from a previous explicit feedback episode) for comparison. After seeing a correct form, they scrolled back down, typed their response, and sent the message to the researcher. It seems that the re-readability of previous messages logically leads participants to not need additional explicit feedback. In fact, while the average number of feedback episodes needed in the voice group were 9.85, followed by the video group with 7.47, text group just received an average of 6.04 (see Table 26 above for more details on the ranges).

The second result observed was that as the total number of feedback episodes increased, the linguistic gain scores at immediate and delayed posttest decreased, when all three treatment groups were analyzed together. Because feedback was provided every time a participant made a mistake, it appeared that the fewer mistakes participants made, or they faster they got the rule, the better they performed at immediate posttest and delayed posttest. These correlations were all small and significant (between -.21 and -.24). Likewise, when considering just the number of metalinguistic feedback episodes, the only correlation that was significant (albeit also small, as indicated in Table 29) was the one between number of metalinguistic feedback episodes and oral gains at immediate posttest. This finding may be explained by the fact that possibly having had a
more solid base on the subjunctive before starting the task, made participants make fewer errors and understanding or ‘getting the rule’ faster and more efficiently, therefore producing the target form on the immediate posttest more efficiently.

When exploring the association between total number of feedback episodes and linguistic gains for each of the treatment groups, different relationships emerged. There were very small and non-significant correlations in the text-based SCMC group, meaning that the linguistic gains were not associated with feedback episodes in this mode. For the voice-based SCMC group, the only small-medium correlation that was significant was between feedback and written gains at immediate posttest (-.37). For the video-based SCMC group, there were medium-large correlations that were significant (-.66 for oral delayed gains; -.54 for written delayed gains) between feedback and written and oral gains at delayed posttest. When focusing on the associations between metalinguistic feedback and linguistic gains, similar trends emerged. There were negative, medium-sized, significant correlations between number of metalinguistic feedback episodes and oral and written gains at immediate posttest for the voice group and between metalinguistic feedback and oral and written gains at delayed for the video group.

When considering the results per group, it seems that the provision of feedback was not associated to linguistic gains in the text-based mode (very small, non-significant correlations, as indicated by Table 30 and Table 32). For the voice condition, it seems that the fewer mistakes participants made during the treatment task (and therefore the fewer feedback episodes they received), the better they did on the written immediate posttest. For the video condition, it seems that, the fewer errors they made during the treatment task afforded them an advantage on the delayed posttests (with medium to large correlations, as observed on Table 30 and Table 32). Due to the abnormal distribution of scores at immediate posttests (negatively skewed as most
participants obtained high scores), and the lack of variability in number of metalinguistic feedback episodes (between 1-5, with most participants needing only or two), results of the total number of feedback episodes as they relate to delayed gains (in which more variability was observed) are considered more meaningful.

The fact that participants in the voice conditions considered the treatment task to be more difficult than participants who performed it in the other two modes may be related to this finding. Given that participants in the voice condition found it challenging to perform the task through the voice mode, without visual cues, and having to communicate in an immediate way, adding the variable of feedback in this mode might have made it more challenging for them to benefit from it. In fact, going back to the recordings of those participants who received the highest number of feedback episodes (19, 15, and 14 respectively), it seems that participants struggled to keep up with the reception of feedback and the completion of the task. Completing the task while receiving fewer feedback episodes caused less confusion/distraction to participants, allowing them to make more efficient form-meaning connections, and making them perform better in the immediate posttests.

After watching the video recordings of the three students who received the highest amount of feedback (13 episodes), it was obvious that they became nervous and sometimes even anxious as the task progressed and they kept needing more feedback episodes. It might have been the case that participants’ embarrassment that they kept making mistakes might have inhibited the learning process. Indeed, video-based participants’ responses in the exit questionnaire manifested that participants were feeling ‘watched’ or even visually ‘judged’ as the task progressed, and they kept producing erroneous forms of the target structure. In fact, one participant said: ‘the main thing was having to react instantly rather than getting some time to
think or someone to help you along’. Video-based SCMS is a richer mode of communication because of both visual and audio input, compared to text-based and voice-based modes. The fact that participants felt ‘watched’ could have increased their anxiety and inhibited delayed learning. Interestingly, it did not appear to inhibit short-term learning. Indeed, how anxiety mediates immediate and delayed learning is a fruitful area for future investigation.

The feedback descriptive findings in the current dissertation are partially in agreement with Baralt (2013) and to some extent in disagreement with Monteiro (2014), Sauro (2009) and Loewen and Erlam (2006). Firstly, Monteiro (2014) did not provide feedback consistently to participants every time they made a mistake on the video-based SCMC mode. In fact, out of 289 incorrect target forms elicited in the metalinguistic group, only 146 metalinguistic feedback episodes were provided. For the recast group, out of 279 incorrect target forms elicited, only 181 recasts were provided. In Sauro (2009)’s study, feedback was neither provided every time participants made a mistake, but was provided more often than in Monteiro’s (2014) study. The mean number of errors in the recast group was 3.23, and the mean number of recasts was 2.77. For the metalinguistic group, the mean number of errors was 4.4 and the mean number of metalinguistic episodes was 3.6. For Loewen and Erlam (2006), participants were given feedback in response to 69% or more of the total number of errors made, with an average rate of 80%. While the recast group received corrections 91% of the time, the metalinguistic group received corrections 72% of the time. Sachs and Suh (2007) also includes descriptive data of feedback in her study, with enhanced and unenhanced recasts showing very similar data (average number of unenhanced recasts 8.4 vs. average number of enhanced recasts of 7.1), while they do not specify whether feedback was provided every time participants made a mistake.
The findings in the current dissertation are partially in agreement with Baralt (2013), as her text-based SCMC group needed fewer recasts than her FTF group only when performing the less complex task. In her study, recasts were provided to an FTF group and a text-based SCMC group. Although inferential statistics were not performed, descriptive data are provided. Her two FTF groups received an average of 8.61 recasts (with a more complex task) and 9.17 recasts (with a less complex task), and her two text-based SCMC groups received an average of 8.88 recasts (with a more complex task) and 6.88 recasts (with a less complex task). Again, inferential statistics were not run to compare both modes but it can be observed than when performing the less complex task, participants in the SCMC mode needed fewer recasts than in the FTF mode (6.88 vs. 9.17). The difference between Baralt (2013) and the current dissertation is while she included recasts, the present study included explicit feedback. No comparisons could be established with Yilmaz (2012) and Yilmaz and Yuksel (2011) because they do not provide descriptive data on their feedback provision.

**Limitations and Future Research**

One important limitation of this study was the relatively low sample size. Future studies should increase the sample size in order to increase the power of the statistical tests. Sample size was relatively small and although power was high for the main effect for time, it was low for group comparisons, indicating that more participants were needed.

An important consideration for future studies including different SCMC modes is learning styles. Some participants in the exit questionnaire mentioned that they enjoyed the voice-based SCMC mode, such as this participant who liked the ‘non-threatening nature of the voice communication mode, in the sense that when you are face-to-face with a teacher, they feel more pressured to speak and you see the impatience in their face’. On the other hand, other
participants (who were assigned to the video mode) mentioned that they learned things better when they were able to read them. Following this, researching bimodal (e.g., voice and text) and even multimodal environments (e.g., video, voice, and text) for the learning of this and other target structures will be a productive line of research, following previous studies (e.g., Blake, 2005; Collentine, 2009). Once technology is advanced enough, it may be possible to have video-based SCMC with voice-recognition software providing subtitles of the utterances of the interlocutors, thereby providing L2 learners with the affordances of both modes.

As for the significant differences in time on task for the different SCMC modes under study, and considering the findings in previous studies comparing oral and written modes, evidence seems to point to the fact that the written mode takes significantly longer time than the oral mode. Future studies including other type of tasks and other target forms need to keep addressing this issue.

Importantly, the linguistic structure investigated may limit the generalization of the findings in this study. Future studies would benefit from exploring the learning of other linguistic items in task-based interaction with different types of feedback. Whether the provision of metalinguistic feedback (providing the rule of when to use the subjunctive together with how to form the past subjunctive), accompanied by subsequent explicit feedback will be effective for other grammatical structures is to be determined by future research. It will be interesting for future research to keep investigating which modes (written versus oral SCMC modes) work better for different types of learning (grammatical forms, lexis, oral fluency, pronunciation, etc.).

It may be the case that the voice-based SCMC mode entails particular advantages for learners, as this oral mode has the potential to ‘force’ learners to use just their linguistic resources to communicate in the L2, while this is not the case for the video-based or the text-
based environments. In the case of the text-based environment, while learners do need to use their linguistic resources to communicate, they do not need to express themselves orally. In the video-based environment, learners are able to get by or get their point across using visual cues or gestures. Future studies should explore the advantages that each of the modes afford for the learning or development of various L2 skills.

It is for future research to determine whether the results in the current study would replicate with different interactions, such as student-student pairings (e.g., Granena, 2016; Yilmaz & Granena, 2010) or several groups of students plus an expert interlocutor (e.g., Loewen & Erlam, 2006; Shintani & Aubrey, 2016). Although a dyad of participant-researcher seemed to result in positive learning gains, it may be more ecologically valid to explore other groupings for interaction in the traditional or the virtual classroom.

Another limitation of the current study is that only one measure of WMC was included, in part due to time restrictions during the data collection procedure. Including more than one measure of executive WMC may be able to provide a more accurate and nuanced metric for this cognitive individual variable. The present study did not find any relationship between executive WMC and language development, as measured by the oral and written productive posttests. As mentioned above, one explanation for this lack of relationship may have been the untimed nature of the assessment tasks. If this was the case, future research might want to keep including WMC as an independent variable (exploring either the executive function or phonological working memory, among others), while measuring learning through different timed and untimed tasks that might be more challenging for L2 learners and therefore test learners’ WMC under time pressure. Moreover, future studies should also investigate whether the lack of relationship between WMC and linguistic gains observed in the current study emerges in future studies.
exploring interactional (versus monologic and non-interactional) assessment tasks. Also, more empirical studies are needed to elucidate how WMC interacts with different modes and types of learning when different and larger populations of learners are included into the equation. In fact, the sample of L2 learners here showed a slightly negatively skewed distribution of WMC scores (as shown by Figure 25). It will be interesting to see whether the WMC findings of this dissertation replicate with learners that achieve more dissimilar WMC scores.

Especially striking was the difference in scores on the delayed posttests, visually shown in the bimodal distributions in figures 18 and 19. As WMC failed to explain this difference, future studies should include other cognitive variables that may help explicate why some participants scored close to zero whereas others scored close to 100% one week after the treatment. Other variables to be considered in future studies are motivation, anxiety, long-term memory, grammatical sensitivity, and learning styles.

As claimed by Mackey et al. (2010), not all feedback types pose the same demands on WMC, as learners may not so easily make a cognitive comparison between a recast correction and their erroneous output than between explicit/metalinguistic correction and their erroneous output. It would be interesting for future research to include WMC with different SCMC modes while exploring different types of feedback (explicit vs. implicit types of feedback). Also, it might be useful in the future to look into whether PSTM, typically operationalized as the ability to repeat novel phonological input (e.g., pseudowords) correctly, is a subcomponent of Baddeley’s (2000, 2003) WMC system. Although this component of WMC is usually associated with vocabulary acquisition, some studies have also found that it is related to grammar learning (e.g., Ellis & Schmidt, 1997; Ellis & Sinclair, 1996; Williams, 1999; Williams & Lovatt, 2003). Additionally, it may also be fruitful to include not only other measures of WMC, but also
measures of attentional control, or grammatical sensitivity, to explore how they may mediate between feedback and grammatical learning. Indeed, closer attention to the relationship among type of feedback, type of learning, and type of WMC is clearly warranted in future research.

Future studies should keep investigating whether WMC moderates L2 learning on different communication modes differently (Payne & Ross, 2005; Payne & Whitney, 2002). Researchers should use other types of tasks, under timed versus untimed conditions, and with provision of explicit versus implicit feedback. In fact, increasing task difficulty/complexity may result in test scores that are more normally distributed at immediate posttests (instead of most participants scoring almost perfect scores). As the answer to this issue might not be black and white, these other factors should be included in future investigations, as they may help determine who benefits the most under different circumstances and learning contexts, as echoed by previous researchers (e.g., Baralt & Gurzynski-Weiss, 2011).

Finally, it would be interesting to keep exploring the relationship between feedback and language development. Because many of the feedback studies reviewed here did not include descriptive data on their feedback provision, it was difficult to establish comparisons between the current study and previous ones. For that reason, future studies should be more transparent in their reporting of feedback descriptive data.

**Pedagogical Implications**

The current study showed no significant difference in performance between the three modes (text-based, video-based, and audio-based), while there was a significant difference in time on task between the text-based mode and the other two modes, with participants taking significantly longer in the text-based mode than in the other two modes. As for the implications of this finding, second language researchers and practitioners may want to consider both the time
on task and the learning results shown by each mode when they are trying to select which mode to use for a particular learning situation. As time is typically a constraint for both in-class activities and out-of-class homework, language practitioners may need to consider which task is more efficient for them. Given that all three modes seem to be equally effective for L2 learning of the past subjunctive, L2 instructors may want to choose the one that is more time-effective, in this case, either the video-based, or the voice-based modes. Additionally, and following trends that SCMC is becoming video-centric (Petersen & Sachs, 2016), this study empirically showed that this mode may encourage L2 grammatical learning. Whether these findings are replicated in telecollaboration environments in which participants engage in learner-learner interaction is to be confirmed by future research (see Akiyama & Cunningham, 2018 for a recent review on SCMC-based telecollaboration research).

As mentioned above, the current study has shown relatively larger gains than other studies (e.g., Baralt, 2013). The main difference between both studies was the type of feedback provided by the researcher to participants, as participants belonged to the same level of instruction (4th semester Spanish course). While Baralt (2013) provided feedback in the form of recasts, the current study provided two-three metalinguistic feedback episodes followed by explicit feedback. In terms of the implications of this finding for Spanish L2 instructors, it is important to note that the past subjunctive structure may indeed benefit from explicit and unambiguous feedback, which in this study was tailored to participants’ needs, in the sense that it was provided every time they made a mistake consistently (unlike other studies, Loewen and Erlam, 2006; Monteiro, 2014; Sauro, 2009). Following this, it seems that the explicitness and the intensity of the feedback both lead to robust gains of the Spanish past subjunctive. On the other hand, explicit feedback has been argued to be intrusive and interrupt the flow of conversations
Therefore, language practitioners should carefully consider all factors before deciding which feedback type might be more relevant for different tasks and target structures.

Given the explicitness and the intensity of the feedback (provided every time participants made a mistake), and that most of the test items targeted the use of past subjunctive, this might have raised participants’ awareness of the target structure, possibly affecting their performance on the posttests. If seems that this awareness of the target form may have benefited L2 oral and written production of this complex target form, which leads to conclude that explicitness of feedback leading to high awareness may be beneficial for L2 grammatical development (Leow, 2015).

The current dissertation confirmed the finding attested in previous research (e.g., Baralt, 2013; Payne & Whitney, 2002), that L2 development may be transferred from one mode (oral or written) to the other mode. This points to the fact that if language practitioners want to encourage correct oral production of some target forms on the part of the learners they may choose to have learners do a task in the oral or the written SCMC mode, depending on how much time they have or what means are available to them. In turn, when instructors want to improve their students’ writing of some particular grammar feature, they may consider doing so through an oral intervention, such as oral task-based interaction in the classroom.

It is also important to consider that, when any of the SCMC modes are implemented in long distance language courses, learners have the possibility of opening other programs in their computers or distracting themselves with other factors in their environment (see Monteiro, 2014). Although the experimental conditions in the current dissertation did not allow for this, because participants were made aware that their interactions were being recorded (either voice-recorded or screen-recorded), and the laboratory setting did not allow for many distractions,
other settings may not be as controlled as the ones here. Following this, and if interactions are not recorded in a real-life, long-distance language course, language practitioners may want to consider which mode does not allow learners to get distracted or open other programs. For example, the video-based SCMC mode may limit these distractions as learners may feel the pressure to stay engaged. On the other hand, the text-based SCMC mode may allow for participants to engage in other activities while the language instructor may not be able to detect it. In the case of voice-based SCMC interactions, as it happens with regular phone conversations, it may be easier for the interlocutors to get distracted and/or multitask and not being ‘present’ so much in the actual L2 interaction.

**Conclusion**

Despite its limitations, this study adds some support to the pedagogical usefulness of theoretically motivated tasks combined with feedback SCMC interactions for L2 development. In particular, this study showed that oral SCMC (video-based and voice-based) and text-based SCMC environments were able to provide intermediate-level Spanish L2 learners the possibility of establishing successful communication with an L2 instructor that leads to grammatical learning of the past subjunctive. All three SCMC modes, combined with metalinguistic and explicit feedback, were equally effective in promoting learning of the Spanish past subjunctive at immediate posttest and retaining this learning one week after the treatment. This study also added to the body of literature that states that L2 learning in one mode (written/oral) may be transferable to the other mode. Participants who carried out a task in the written mode successfully demonstrated oral production of the target form. Likewise, participants who carried out a task in the oral mode were able to successfully produce the target form in the written assessment task.
Furthermore, results of this study did not support a role for the cognitive individual difference of WMC in mediating the learning in any of these three modes. Finally, it seems that the amount of feedback received was significantly negatively correlated with written gains at immediate for the voice-based SCMC mode and with both oral and written gains at delayed for the video-based mode. The fewer mistakes participants made or the faster their rate of learning was, the more robust their gains seemed to be for these two modes either immediately after the treatment or one week after it.

These encouraging results speak for the use of SCMC-based tasks that may be integrated in traditional FTF course, which want to incorporate an online, interactional-based component to their designs, or distance language courses, which typically lack interactive speaking practice. This study is an example of how both teachers and learners can benefit from the use of technological applications when tasks are designed with the support of SLA principles. Technology in the classroom will not inherently improve learning outcomes for students so studies like this one and future studies are necessary to ensure that educators are harnessing the full potential of technology to enhance L2 learning.
APPENDIX A: PILOT SAMPLE TREATMENT TASK- STORY RETELL

Instructions:
Please read the following story carefully. You will need to retell the story in Spanish to your partner via text-chat. Don’t worry about typing accent marks. The researcher will be providing feedback to you as you complete the task. Additionally, please ask the researcher at any time during the task if you need assistance or want to know how to say a word in Spanish. The story is divided into three parts, which you will read and retell sequentially. When you are done reading each part of the story, use the following prompts to guide you in retelling it. You will have as much time as you need. Please, ask the researcher now if you have any questions. If you don’t, please start reading the first part of the story, and when you are ready, you may start typing in the chat. Please, type one bullet point at a time

Tom and his friend, Sam, meet back at Georgetown after their study-abroad experience in Madrid (Spain) last semester. While having coffee, they start remembering their experience in Madrid and talk about three events that happened while they were there and how they felt about these three experiences.

Experience 1:
This story is about their first day of classes in Madrid. First thing in the morning, they left their apartment to get coffee before heading to university. Sam was irritated that they did not find a Starbucks cafe easily. They had to walk more than 15 minutes to find one. Tom and Sam were angry that the barista did not accept a credit card as payment. After finally getting coffee, they were ready and energized to go to university. Tom was happy that public transportation was very fast and frequent in Madrid, so they made it on time to their first class. Sam was surprised that the professor, however, arrived late to class, and Tom was surprised that professors did not interact much with students during class time, which made the class kind of boring. Sam and Tom were also surprised that professors did not give homework for the next class. Once they were done with their classes of the day, Sam and Tom were happy that Spanish students invited them for coffee after class. Tom was happy that coffee cost only 1 euro in the university coffee
shop (so much cheaper than Starbucks!). Once they finished their long day of classes and they got to their new apartment in the center of Madrid, Sam was irritated that her History professor did not answer her email quickly, and both Tom and Sam were surprised that they had time in their hands to do an evening activity.

Prompts to help you retell Story 1 to your partner. Make sure you provide the equivalent of all the underlined English words.

-To be happy/ to make someone happy: alegrarse.

*Ejemplo:* She is happy- (A ella) le alegra que…// They were happy- (A ellos) les alegró que…

**PRESENT**

**PAST**

-To be angry/ to make someone angry: enfadarse/enojarse.

*Ejemplo:* I am angry- (A mi) me enoja que…// He was angry that- (A él) le enojó que…

**PRESENT**

**PAST**

-To be surprised/ to surprise someone: sorprenderse.

*Ejemplo:* He is surprised- (A él) le sorprende que…// They were surprised that- (A ellos) les sorprendió que…

**PRESENT**

**PAST**

- Sam / was irritated / they did not find a Starbucks
- Tom and Sam / were angry/ the barista did not accept credit card
- Tom / was happy/ public transportation was fast and frequent
- Sam / was surprised/ professor arrived late to class
- Tom / was surprised/ professors did not interact with students
- Sam and Tom / were surprised/ professors did not give homework
- Sam and Tom / were happy/ Spanish students invited them for coffee
- Tom / was happy/ coffee costed only 1 euro
• Sam / **was irritated**/ History professor **did not answer** her email

• Tom and Sam / **were surprised**/ they **had** free time in the evening
APPENDIX B: PILOT SAMPLE ORAL PRODUCTION TEST-
STORY RETELL TASK 1

Instructions:

Please read the following story carefully. You will need to retell the story by yourself into the microphone in Spanish. When you are done reading the story, please raise your hand and the researcher will give you some prompts to guide you in retelling the story. Don’t try to memorize the story because you will have the sentences you need to say in front of you later. Please, do not forget to give this story to the researcher once you are done reading it. You will have as much time as you need.

Story:

Amy is in the middle of final exams. Even though she is angry that all her final exams are on the same day, she is happy that the library is not very full and that her best friend always helps her with biology. During one of her study breaks, she starts remembering about the last Thanksgiving vacation she spent in Seattle with her family. It was such a relaxing vacation …!

This is part of what she remembers…

Over Thanksgiving, Amy travelled to Seattle from Washington DC to meet her cousin Sasha and the rest of the family. The day before Thanksgiving, Sasha went to the airport to pick Amy up. When she was getting off the plane, Amy was happy that someone helped her with her suitcase, but she was angry that Sasha did not arrive on time to the airport. Because Sasha was not very familiar with the area, she asked her dad for directions, as she did not like to use GPS. She was surprised that her dad gave her such bad directions. Also, she was angry that the line of cars to
get to the airport was so long. Finally, because it was a relatively small airport, Sasha arrived and found Amy all bored waiting for her.

Amy was surprised the weather was not rainy, being Seattle in November, and she was also happy the sun shined in the sky. On their way back home, they wanted to stop for food as they were very hungry, but they were surprised that they did not find any good restaurant on the road. They decided that it was a good idea to cook at home with the rest of the family. When they got home, they had some tea, and then they started cooking. Sasha’s parents were surprised that Amy cooked so well. Amy explained that in DC, she took cooking lessons because her university offered them for free. As she was cooking, the family dogs came to greet everyone. They seemed to be happy to see Amy. However, they left almost immediately, and Amy was angry that the dogs did not interact so much with her this time. However, she was very happy that Jack (her baby cousin) remembered her from the Summer. She actually only met Jack for 3 days during the Summer, because she worked a lot in her Summer internship. Jack seemed to be very happy that Amy was there and got to play with him during dinner! After they were done eating, Sasha’s parents wanted to play cards with Amy, but they were surprised that Amy fell asleep at the dinner table! She must have been truly tired from the long trip.

… wow! Amy is now back to reality. After daydreaming for a while, she finds herself back in the library. She is angry her friend does not want to stay anymore, but she is happy her biology professor answers her emails with questions quickly!
Retell Story Task 1- Prompts

Prompts to help you retell the story. **Make sure you provide the Spanish equivalent of ALL the underlined English words in the bullet points on the following page.** Please, DO NOT take notes during this task. You have 5 minutes to prepare before we start recording your voice.

-To be happy/ to make someone happy: alegrarse.

_Ejemplo:_ She _is_ happy- (A ella) le alegra que… // They _were_ happy- (A ellos) les alegró que…

**PRESENT** | **PAST**
---|---
-To be happy/ to make someone happy: alegrarse.

_Ejemplo:_ I _am_ angry- (A mi) me enoja que… // He _was_ angry that- (A él) le enojó que…

**PRESENT** | **PAST**
---|---
-To be angry/ to make someone angry: enfadarse/enojarse.

_Ejemplo:_ He _is_ surprised- (A él) le sorprende que… // They _were_ surprised that- (A ellos) les sorprendió que…

**PRESENT** | **PAST**
---|---
-To be surprised/ to surprise someone: sorprenderse.

**Vocabulary to assist you during the retell:**

-To be: ser/estar
-To help: ayudar
-To arrive: llegar
-To know: conocer
-To give: dar
-To meet: conocer
-To shine: brillar
-To be hungry: tener hambre
-To find: encontrar
-To drink: beber

-To cook: cocinar
-To offer: ofrecer
-To visit: visitar
-To interact: interactuar
-To work: trabajar
-To remember: recordar
-To play: jugar
-To fall asleep: dormirse
-To want: querer
-To answer: responder
• Amy/ **is angry**/ all her finals **are** on the same day

• Amy/ **is happy**/ the library **is** not full

• Amy/ **is happy**/ her best friend **helps** her with biology

**NOW, SHE STARTS TO REMEMBER A STORY// AHORA, ELLA EMPIEZA A RECORDAR UNA HISTORIA…**

• Amy/ **was happy**/ someone **helped** her on the plane

• Amy/ **was angry**/ Sasha **did not arrive** on time

• Sasha/ **asked** her dad for directions/ because she **did not know** the area

• Sasha/ **was surprised**/ her dad **gave** bad directions

• Sasha/ **was angry**/ line of cars **was** long

• Amy and Sasha/ **were happy**/ the airport **was** relatively small

• Amy/ **was surprised**/ the weather **was not** rainy

• Amy/ **was happy**/ the sun **shined** on the sky

• Amy and Sasha/ **decided** to stop on the road/ because they **were** very hungry

• Amy and Sasha/ **looked for** restaurants/ but it **was not** their lucky day

• Amy and Sasha/ **were surprised**/ no good restaurants **were** on their way

• Amy and Sasha/ **were happy**/ their family **prepared** tea

• Sasha’s parents/ **were surprised**/ Amy **cooked** so well

• Amy/ **took** cooking lessons/ because her university **offered** them for free

• The dogs/ **were happy**/ Amy **visited** the family

• Amy/ **was angry**/ the dogs **did not interact** with her

• Amy/ **met**/ her cousin Jack just for 3 days in Summer/ because she **worked** a lot

• Amy/ **was happy**/ Jack **remembered** her
• Jack/ was happy/ Amy played with him during dinner

• Sasha’s parents/ were surprised/ Amy fell asleep

BACK TO THE PRESENT TIME… // VUELTA AL MOMENTO ACTUAL…

• Amy/ is angry/ her friend does not want to study in the library anymore

• Amy/ is happy/ her biology professor answers her emails quickly
APPENDIX C: PILOT SAMPLE WRITTEN PRODUCTION TEST-SEMI-SPONTANEOUS PICTURE DESCRIPTION TASK

Instructions:
In the following task, you will see two pictures side by side. You will be asked to write one sentence (with a main clause & a subordinate clause) describing the two pictures you see, using the verbs in the infinitive tense in parenthesis as a guide to create your sentence. Try to be as specific and detailed as possible in your sentence.

This is Natalia:

*Scenario:* Natalia just finished her first semester at Georgetown University in Washington, D.C. Four months ago, when she arrived in D.C. from her home state, Florida, she had a difficult time assimilating to her new life, and to college life especially, and now that she has, she is reflecting on how some experiences surprised her (sorprenderse), made her happy (alegrarse), or made her angry (enojarse) last semester.

Don’t forget that we are talking about *last semester*!

Please, ask the researcher about clarification if you are not sure of what you need to do now. Use the additional piece of paper provided to write your sentences. Thank you!
| Last semester… |
| NATALIA       | HER FRIENDS                     |
| (alegrarse)   | (organizar un picnic)           |
APPENDIX D: SAMPLE TREATMENT TASK - STORY RETELL

Instructions:

01
You are going to read a fun story in English. You will need to retell the story in Spanish to the researcher via text-chat/video-chat/voice-chat. The researcher will be providing feedback to you as you complete the task. Additionally, please ask the researcher at any time during the task if you need assistance or want to know how to say a word in Spanish.

02
The story is divided into three parts. When you are done reading each part, you will see different bullet points in the following slides that will help you retell the story. In case you are doing the task through text chat, please type one bullet point at a time.

03
Please, ask the researcher now if you have any questions. If you don’t, please start reading the first part of the story, and when you are ready, you may start typing in the chat. Please, type one bullet point at a time.

Sample story:

Tom and his friend, Sam, meet back at Georgetown after their study-abroad experience in Madrid (Spain) last semester. While having coffee, they start remembering their experience in Madrid and talk about three events that happened while they were there and how they felt about these three experiences.
Experience 1:

This story is about their first day of classes in Madrid. First thing in the morning, they left their apartment to get coffee before heading to university. Sam was irritated that they did not find a Starbucks cafe easily. They had to walk more than 15 minutes to find one. Tom and Sam were angry that the barista did not accept a credit card as payment. After finally getting coffee, they were ready and energized to go to university.

Tom was happy that public transportation was very fast and frequent in Madrid, so they made it on time to their first class. Sam was surprised that the professor, however, arrived late to class, and Tom was surprised that professors did not interact much with students during class time, which made the class kind of boring. Sam and Tom were also surprised that professors did not give homework for the next class.
Once they were done with their classes of the day, Sam and Tom were happy that Spanish students invited them for coffee after class. Tom was happy that coffee cost only 1 euro in the university coffee shop (so much cheaper than Starbucks!). Once they finished their long day of classes and they got to their new apartment in the center of Madrid, Sam was irritated that her History professor did not answer her email quickly, and both Tom and Sam were surprised that they had time in their hands to do an evening activity.

Sample prompts:

- Sam / was irritated / they did not find a Starbucks (encontrar)
Tom and Sam were angry; the barista did not accept credit card (acepar)

*barista: barista
*credit card: tarjeta crédito

Tom was happy; public transportation was fast and frequent (ser)

*public transportation: transporte público
APPENDIX E: SAMPLE ORAL PRODUCTION TEST- RETELL STORY TASK 1

Instructions:

Sample story:

• Amy is in the middle of final exams. Even though she is angry that all her final exams are on the same day, she is happy that the library is not very full and that her best friend always helps her with biology. She is kind of surprised that her best friend worries about Amy’s grades for once! During one of her study breaks, Amy starts remembering about the last Thanksgiving vacation she spent in Seattle with her family. It was such a relaxing vacation...! This is part of what she remembers...
Over Thanksgiving, Amy travelled to Seattle from Washington DC to meet her cousin Sasha and the rest of the family. The day before Thanksgiving, Sasha went to the airport to pick Amy up. When she was getting off the plane, Amy was happy that someone helped her with her suitcase, but she was angry that Sasha did not arrive on time to the airport. Because Sasha was not very familiar with the area, she asked her dad for directions, as she did not like to use GPS. She was surprised that her dad gave her such bad directions. Also, she was angry that the line of cars to get to the airport was so long. Finally, because it was a relatively small airport, Sasha arrived and found Amy all bored waiting for her.

Amy was surprised the weather was not rainy, being Seattle in November, and she was also happy the sun shined in the sky. On their way back home, they wanted to stop for food as they were very hungry, but they were surprised that they did not find any good restaurant on the road. They decided that it was a good idea to cook at home with the rest of the family. When they got home, they had some tea, and then they started cooking. Sasha’s parents were surprised that Amy cooked so well. Amy explained that in DC, she took cooking lessons because her university offered them for free.
Sample prompts:

1. Amy/ is angry/ all her finals are on the same day (ser)
2. **Amy**/ is happy/ the library is not full (**estar**)  *library: **biblioteca***

3. **Amy**/ is happy/ her best friend **helps** her with biology (**ayudar**)
Handout 2

Please, DO NOT take notes as you prepare to perform this speaking test. You have 5 minutes to prepare before we start recording your voice. You may keep this page with you during completion of the task.

If you are not sure about any vocab items, improvise in Spanish or say them in English!

Take into account that you will NOT always need the SUBJUNCTIVE. Pay attention to whether people are getting happy, surprised, or angry, or no emotions are expressed!

-To be happy/ to make someone happy: alegrarse.

*Ejemplo:* She *is* happy- (A ella) le alegra que…// They *were* happy- (A ellos) les alegró que…

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-To be angry/ to make someone angry: enfadarse/enojarse.

*Ejemplo:* I *am* angry- (A mi) me enoja que…// He *was* angry that- (A él) le enojó que…

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-To be surprised/ to surprise someone: sorprenderse.

*Ejemplo:* He *is* surprised- (A él) le sorprende que…// They *were* surprised that- (A ellos) les sorprendió que…

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APPENDIX G: SEMI-SPONTANEOUS PICTURE DESCRIPTION WRITTEN TASK
(all three versions, 10 pages per version)

Instructions:

In the following task, you will see two pictures side by side. You will be asked to write one sentence (with a main clause & a subordinate clause) describing the two pictures you see, using the verbs in the infinitive tense in parenthesis as a guide to create your sentence. Try to be as specific and detailed as possible in your sentence.

This is Natalia:

Scenario: Natalia just finished her first semester at Georgetown University in Washington, D.C. Four months ago, when she arrived in D.C. from her home state, Florida, she had a difficult time assimilating to her new life, and to college life especially, and now that she has, she is reflecting on how some experiences surprised her (sorprenderse), made her happy (alegrarse), or made her angry (enojarse) last semester.

Don’t forget that we are talking about last semester!

Please, ask the researcher about clarification if you are not sure of what you need to do now. Use the additional piece of paper provided to write your sentences. Thank you!
<table>
<thead>
<tr>
<th>Last semester…</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATAILIA</td>
</tr>
<tr>
<td>(alegrarse)</td>
</tr>
<tr>
<td>HER MOTHER</td>
</tr>
<tr>
<td>(llamar por Skype)</td>
</tr>
</tbody>
</table>
Last semester…

**NATALIA**

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**FINAL EXAMS**

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
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<tr>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

*December 2016*

(enojarse)

(ser)

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Biology final exam
Spanish final exam
History final exam
Statistics final exam
Last semester on Natalia’s birthday…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER BOYFRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Natalia" /></td>
<td><img src="image2.png" alt="Boyfriend" /></td>
</tr>
</tbody>
</table>

**(sorprenderse)**

**(invitar)**
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>RESTAURANTS</th>
</tr>
</thead>
</table>
|         | • Sweetgreen
|         | • Pinstripes
|         | • Tombs
|         | • Filomena
|         | • Los Cuates
|         | • Mai Thai
|         | • Leopold’s Café
|         | • Il Canale

(sorprenderse)

(costar)
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER FAMILY</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image of Natalia" /></td>
<td><img src="image2.png" alt="Image of her family" /></td>
</tr>
</tbody>
</table>

(alegrarse) (visitar)
<table>
<thead>
<tr>
<th>Last semester…</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATALIA</strong></td>
<td><strong>HER FRIENDS</strong></td>
</tr>
</tbody>
</table>

(alegarse)  (organizar un picnic)
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER BOYFRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>(alegrarse)</td>
<td>(comprar tickets)</td>
</tr>
</tbody>
</table>
### Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER BEST FRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Natalia" /></td>
<td><img src="image2.jpg" alt="Her Best Friend" /></td>
</tr>
</tbody>
</table>

- **(enojarse)**
- **(olvidar)**

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Natalia’s birthday!
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER CELL PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>

(enojarse)  (quedarse sin batería)
Last semester...

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td>[Image]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-10 Class</td>
<td>Class</td>
<td>Class</td>
<td>Class</td>
</tr>
<tr>
<td>10-11 Recitation</td>
<td>Recitation</td>
<td>Yoga</td>
<td></td>
</tr>
<tr>
<td>11-12 Group meeting</td>
<td>Work</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>12-1 Work</td>
<td>Work</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>1-2 Class</td>
<td>Class</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>2-3 Class</td>
<td>Yoga</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>3-4 Class</td>
<td>Work</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>4-5 Meeting</td>
<td>Work</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>5-6 Class</td>
<td>Class</td>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>6-7 Class</td>
<td>Homework</td>
<td>Homework</td>
<td></td>
</tr>
<tr>
<td>7-8 Class</td>
<td>Homework</td>
<td>Work</td>
<td></td>
</tr>
</tbody>
</table>

(sorprenderse)     (estar ocupado)
<table>
<thead>
<tr>
<th>Last semester…</th>
<th>FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATALIA</strong></td>
<td><strong>FOOD</strong></td>
</tr>
<tr>
<td>![Image](172x254 to 352x509)</td>
<td>![Image](439x218 to 657x509)</td>
</tr>
<tr>
<td><strong>ENojarse</strong></td>
<td><strong>HORRIBLE</strong></td>
</tr>
<tr>
<td><strong>LEO'S DINING HALL</strong></td>
<td></td>
</tr>
</tbody>
</table>
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>THE SECRETARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>(enojarse)</td>
<td>(gritar)</td>
</tr>
</tbody>
</table>

I AM SO BUSY!!
<table>
<thead>
<tr>
<th>Last semester…</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATALIA</strong></td>
<td><strong>HER FRIENDS</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(enojarse)</th>
<th>(no invitar)</th>
</tr>
</thead>
</table>

---

---
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER BANK ACCOUNT (CUENTA BANCARIA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](156x254 to 335x509)</td>
<td>![Image](366x265 to 691x509)</td>
</tr>
</tbody>
</table>

(enojarse)  (no tener)

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---
Last semester...

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER FRIEND</th>
</tr>
</thead>
</table>

(alegarse) | (ayudar con tarea) |
Last semester...

NATALIA

HER PROFESSOR

(alegrarse)

(responder a los emails)
<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER FRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>(alegrarse)</td>
<td>(comprar café)</td>
</tr>
</tbody>
</table>
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER SPANISH PROFESSOR</th>
</tr>
</thead>
</table>

(sorprenderse)  (estar embarazada)
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(sorprenderse)</td>
<td>(participar)</td>
</tr>
</tbody>
</table>
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER BOYFRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Image of Natalia" /></td>
<td><img src="image2.jpg" alt="Image of her boyfriend" /></td>
</tr>
<tr>
<td>(sorprenderse)</td>
<td>(cocinar pizza)</td>
</tr>
</tbody>
</table>
Last semester...

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER CREDIT CARD (TARJETA DE CRÉDITO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>

(enojarse) (no funcionar)
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>THE WEATHER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Surprised Natalia" /></td>
<td><img src="image2.png" alt="Cold Natalia" /></td>
</tr>
</tbody>
</table>

(sorprenderse) (estar)
<table>
<thead>
<tr>
<th>Last semester…</th>
<th>HER COMPUTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATALIA</td>
<td></td>
</tr>
<tr>
<td>(enojarse)</td>
<td>(romperse)</td>
</tr>
</tbody>
</table>

203
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER PROFESSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(enojarse)</td>
<td>(poner una F)</td>
</tr>
</tbody>
</table>

____________________________________________________________________________________________________
_________________________________________________________________________________________
_____________
| Last semester… | | |
|----------------|----------------|
| NATALIA        | HER FRIEND    |

(alegrarse)   (invitar)
<table>
<thead>
<tr>
<th>Last semester…</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NATA LIA</td>
<td>THE LIBRARY (BIBLIOTECA)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(alegrarse)</th>
<th>(abrir)</th>
</tr>
</thead>
</table>

OPEN UNTIL 3 am
<table>
<thead>
<tr>
<th>Last semester…</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATALIA</strong></td>
<td><strong>HER FRIENDS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surprise party for Natalia!</td>
</tr>
<tr>
<td></td>
<td>(alegrarse)</td>
</tr>
<tr>
<td>Surpris e party for ___ ___</td>
<td>(planear)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Last semester...

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>...during class...</td>
<td></td>
</tr>
</tbody>
</table>

(sorprenderse) (comer)
Last semester...

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>HER FRIEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>(sorprenderse)</td>
<td>(llegar tarde)</td>
</tr>
</tbody>
</table>

10:10 am
Last semester…

<table>
<thead>
<tr>
<th>NATALIA</th>
<th>STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(sorprenderse)</td>
<td>(ser miembro)</td>
</tr>
</tbody>
</table>
REFERENCES


*Cognitive Linguistics, 19*(1), 67-106.


Smith, B. (2010). Employing eye-tracking technology in researching the effectiveness of recasts in CMC. In Francis M. Hult (Ed.), *Directions and prospects for educational linguistics* (pp. 79–98). New York: Springer.


