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Social Cues in Animated Pedagogical Agents for Second Language Learners: the Application of The Embodiment Principle in Video Design

Sahar M. Alyahya
University of South Florida

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Social Cues in Animated Pedagogical Agents for Second Language Learners: the Application of
The Embodiment Principle in Video Design

by

Sahar M. Alyahya

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Language, Literacy, Ed.D., Exceptional Education, and Physical Education
College of Education
University of South Florida

Major Professor: John I. Liontas, Ph.D.
Sanghoon Park, Ph.D.
Yiping Lou, Ph.D.
Philip Smith, Ph.D.

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Dedications

To my first teachers who guided me through life so I might become the person I am today;
who installed in me the love of learning from an early age; who encouraged me to pursue my
dreams; who never stop their prayers for my success; to my parents,

Norah Alrajhi and Mohammed Alyahya

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this journey

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Table of Contents

List of Tables	iv
List of Figures	v
Abstract	vi
Chapter One: Introduction	1
Overview	1
Purpose of the Study	3
Research Questions	7
Research hypotheses	7
Significance of the Study	8
Contribution to the Field	9
Theoretical Justifications	10
Definition of Terms	12
Description of the Chapters	13
Chapter Two: Literature Review	15
Video Technology	15
Instructional videos	15
Video in English language learning	17
Pedagogical Agent	18
Grammar	23
Teaching English language grammar through videos	24
Motivation in teaching English language grammar through videos	27
Motivation	28
Motivation in language learning	28
Motivation in using video	29
Cognitive Load	31
Synthesis of the Existing Gap of Research	33
Populations	33
Video-infused features	35
Questions being investigated	36
In flipped class studies	36
In studies of two groups	37
In studies of one group	38
In literature reviews	38
Research approaches being adopted	38
Major research findings and gaps in research	40

Insights Gained from the Literature	42
Chapter Summary	44
 Chapter Three: Methodology	 45
Overview	45
Participants	46
Research Design	46
Research variables	50
Context of Inquiry	51
Video Design	52
Instructional materials	52
Instructional videos of the high-embodied agent (HEA)	52
Instructional videos of the low-embodied agent (LEA)	53
Instructional videos of the voice-only agent (VOA)	53
Intervention	53
The agent	56
Audio	59
Video background	59
Content of the video	60
Measures	61
Demographic information	61
Cognitive load	61
Motivation	63
Grammatical performance	65
Pilot Study	65
Data Collection	67
Data sources	67
Data-collection procedures	67
Data-Analysis Procedures	69
Privacy and Ethical Consideration	69
Chapter Summary	70
 Chapter Four: Results and Discussion	 71
Demographic Information	71
Results and Discussion	73
Results: RQ 1- What is the effect of applying the embodiment principle to an instructional video on second language learners' cognitive load?	73
Discussion	81
Results: RQ 2- What is the effect of applying the embodiment principle to an instructional video on second language learners' motivation?	82
Discussion	85
Results: RQ 3- What is the effect of applying the embodiment principle to an instructional video on second language learners' grammatical performance?	85
Discussion	88
Chapter Summary	88

Chapter Five: Conclusion	92
Limitations	93
Implications of the Research.....	95
Directions for Future Study	101
Final Thoughts	105
References.....	108
Appendixes	123
Appendix A: Demographic Information	124
Appendix B: The Cognitive Load Measurement	125
Appendix C: RIMMS.....	126
Appendix D: Grammar-tests	127
Appendix E: The Video Script.....	128
Appendix F: Samples of the designed High-embodied Agent (HEA) Instructional Video.....	133
Appendix G: Samples of the designed Low-embodied Agent (LEA) Instructional Video.....	136
Appendix H: Samples of the designed Voice-only Agent (VOA) Instructional Video.....	139
Appendix I: Recruitment Letter	142
Appendix J: Informed Consent Form	143
Appendix K: IRB Approval	145
Appendix L: Task Facilitation Approval	147

List of Tables

Table 1: Description of the Study Intervention.....	54
Table 2: Reliability Statistics of the Cognitive Load Questionnaire	62
Table 3: Reliability Statistics of the Motivation Survey.....	64
Table 4: The Participants’ Demographic Information	72
Table 5: Descriptive Statistics of the Cognitive Load Scores.....	74
Table 6: Summarized ANOVA Test Statistics of the Cognitive Load Scores	75
Table 7: Summarized Tukey Test Statistics of the Cognitive Load Scores	75
Table 8: Descriptive Statistics of the IL, EL, GL Scores.....	76
Table 9: Summarized ANOVA Test Statistics of the IL Scores.....	78
Table 10: Summarized ANOVA Test Statistics of the EL Scores.....	78
Table 11: Summarized Tukey Post Hoc Test Statistics of the EL Scores	78
Table 12: Summarized ANOVA Test Statistics of the GL Scores	79
Table 13: Relationship Between Research Question 1, Data Sources, Analysis Procedures, and Findings.....	80
Table 14: Descriptive Statistics of the Motivation Score	83
Table 15: Summarized ANOVA Test Statistics of the Motivation Scores.....	84
Table 16: Relationship Between Research Question 2, Data Sources, Analysis Procedures, and Findings.....	84
Table 17: Descriptive Statistics of the Grammar Scores	86
Table 18: Summarized ANOVA Test Statistics of the Grammar Scores	87
Table 19: Relationship Between Research Question 3, Data Sources, Analysis Procedures, and Findings.....	88
Table 20: Summary for The Results of Hypotheses Tested in This Study	90

List of Figures

Figure 1: Language skills studies in the last five years	5
Figure 2: PowToon Software design page	52
Figure 3: Screenshot of the third segment of the high-embodied agent video (dynamic agent).....	55
Figure 4: Screenshot of the third segment of the low-embodied agent video (static agent).....	55
Figure 5: Screenshot of the third segment of the voice-only agent video (no agent)	56
Figure 6: Families of PowToon software characters grouped by styles	57
Figure 7: Sample of the variety of poses for the character selected for this study	57
Figure 8: Samples of the agent’s size and positions in screen	58
Figure 9: The main background image used in the video	60
Figure 10: The working desk background image used in the video	60
Figure 11: Whiteboard background image used in the video	60
Figure 12: Data-Collection Procedures.....	68
Figure 13: Box plot to represent data normality	74
Figure 14: Box plot to represent data normality	77
Figure 15: Box plot to represent data normality	84
Figure 16: Box plot to represent data normality	84
Figure 17: Example of an agent writing a sentence	96
Figure 18: Example of an agent talking	97

Abstract

This study investigated the involvement of the Social Agency Theory within a multimedia learning environment to improve English language proficiency. The primary aim of this study is to find the effects of designing language learning instructional videos following the embodiment principle on language learners' motivation, cognitive load and performance in production of the target language. According to Social Agency Theory, when multimedia learning includes social cues like an on-screen agent with humanlike features (e.g., hand gestures, body movements, eye contact, and facial expressions), the quality of learning will be increased. To examine the effect of the embodiment principle, the study designed three different videos in which three different levels of the embodiment principle were applied: a high-embodied agent (HEA), a low-embodied agent (LEA), and voice-only agent (VOA). Then, a comparison of the three videos was made, which in turn served as a comparison of the effectiveness of the embodiment principle when applied to an agent in instructional videos. Participants were recruited from the preparatory year program—a college year with a concentration in English language courses that precedes the English Language and Literature program. Data on cognitive load, motivation, and grammatical performance were collected online using several instruments to answer the three research questions. A quantitative analysis of three levels of the independent variable experimental design was employed. ANOVA tests were done to the three dependent variables. The findings showed statistically significant results of the embodiment principle in reducing the cognitive load, namely, in the mean score of HEA compared to LEA groups. However, no significant results were found between HEA and VOA groups. Looking at the three components of the cognitive load, the extraneous cognitive load

was the only significant component among the three: intrinsic cognitive load, extraneous cognitive, and germane cognitive load. There was a statistically significant lower extraneous cognitive load score of HEA than the LEA. The findings did not show a significant difference among the groups' level of motivation or grammar performance. The study started from the hypothesis that learning an English language grammatical concept through a customized video, which includes a HEA, could improve learners' motivation, cognitive load, and performance. The results of this study provide new information on the extent to which such a video likely does and does not improve students' learning experiences.

Chapter One: Introduction

Overview

Over the past several decades, many new technologies have been incorporated into the educational fields to improve second/foreign language teaching and learning. Such technologies “designed to promote and enhance language teaching and learning in specific areas of language use (listening, speaking, reading, writing), including vocabulary, grammar, pragmatics, and culture” are the focus of study in Computer Assisted Language Learning (CALL), which may also frequently be referred to as Information Communication Technology (ICT), namely in scholarship coming from Europe (Liontas, 2018b, p. 3). Perhaps one of the most broadly relevant definitions of CALL comes from Levy (1997), in his book *Computer-Assisted Language Learning: Context and Conceptualization*, who presents a general definition of CALL as “the search for and study of applications of the computer in language teaching and learning” (p. 1). The application Levy (1997) referred to could be CALL technologies, electronic tools, and digital resources (Liontas, 2018b). With the rise of the field of CALL, much research had been conducted to investigate the integrated association of computers to language learning (Parmaxi & Zaphiris, 2017). However, not all research results have shown a positive effect of computer applications on learning a second/foreign language (e.g., Lai & Kritsonis, 2006; Mayer et al., 2005). The studies with findings not in support of CALL are equally helpful to language experts and CALL researchers in understanding the highly complex ways that new technologies affect second/foreign language education from different angles.

As scholars' definitions of computer assisted language learning (CALL) have suggested, the usage of CALL entails the specific use of digital resources in teaching or learning a second/foreign language (Liontas, 2018b). Stempleski (2002) investigated the role of the teacher in using video in the ELT classroom. Stempleski defined videos as "an extremely dense medium" (p. 364); her research supports that using videos in the English language classroom can be highly effective for engaging students and offering visual and auditory input for learners. Scholars' inquiries into the value of incorporating videos into second language learning are numerous and offer a wide range of findings in support of multimedia in the classroom (e.g., Alwehaibi, 2015; Yasin et al., 2017; Koç & Koç, 2018). Recent research in CALL have aimed to more deeply explore CALL, focusing on more specific areas, such as the principles of multimedia instructions, learners' motivation and cognitive load (e.g., Bravo et al. 2011). Among the wealth of CALL research from the recent decades, one of the most noteworthy developments in the direction of CALL research involves the Social Agency Theory in multimedia learning. Social Agency Theory claims that "social cues in multimedia instructional messages can prime a social response in learners (that is, a feeling of social presence) that leads to deeper cognitive processing and better learning outcomes" (Mayer, 2014c, p. 348). From the lens of this theory, understanding the role of technology in language learning necessarily includes four principles: personalization, voice, image, and embodiment. For the current study, it is the principle of embodiment that is of interest. Embodiment in second language teaching is especially useful for investigating the use of video for teaching English grammar rules to second language learners. The use of instructional videos is a key variable in the current study which serves as a supplemental material for a grammar lesson.

More details on the embodiment principle and the methodological specifics of this study are offered in later chapters. First, it is important to introduce the foundations of this dissertation

and the structure it follows. In the sections below, I clarify the purpose, research questions, significance, the contribution of the research, and the theoretical justification that guide the study, followed by explanation of key terms.

Purpose of the Study

The primary aim of this study is to find the effects of designing language learning instructional videos following the Social Agency Theory on language learners' motivation, cognitive load, and grammatical performance. This study applies the embodiment principle (Mayer, 2014c) to language learning videos in order to investigate various cognitive, behavioral, and educational outcomes. Specifically, the dependent variables will be in the participants' motivation and cognitive load, and performance in production of the target language. The intended use of the instructional videos is as self-directed supplemental materials for a grammar lesson. Therefore, motivation is considered a crucial element that must also be investigated. It is also important to note that younger generations are 'digital natives' (Solak & Cakır, 2015) – that is, they were born after the shift to using mostly digitally-mediated methods of communication – the aim of using digital motivational resource has undoubtedly become stronger.

As mentioned earlier, using video in second language education dates back at least to the 1980s (Nikitina, 2010). Over the decades, the subsequent research on videos in L2 classrooms is substantial, but a common theme across the studies and their findings is that the involvement of technology in teaching is an effective teaching method for stimulating and increasing students' motivation (Chen et al., 2015; Jamali et al., 2015; Salmi et al., 2012; Solak & Cakır, 2015).

Clearly, investigating the effect of technology on learning a second language is not new research. Furthermore, there is existing research that supports the connection of videos with students' motivation more specifically. However, our understanding of the numerous variables

involved in students' learning and the use of videos is still limited; further research is still needed to more fully grasp the most worthwhile ways to incorporate videos into language instruction. As a result, the purpose of this study is to contribute to existing research and to filling a gap in knowledge on this topic. Specifically, the study aims to investigate the use of a purposefully designed video while applying the embodiment principle in teaching English grammar rules for second/foreign language learners. Approaching the study of videos in the classroom in this manner has, to my knowledge, never been done and would therefore bring new knowledge to the field of CALL. The study investigates three types of videos: instructional videos of a high-embodied agent (HEA), instructional videos of a low-embodied agent (LEA), and instructional video of a voice-only agent (VOA). Consequently, the importance of this study is also derived from investigating an enhanced video instruction of high-embodied agents in the field of language learning, effectively adding new findings to the existing literature.

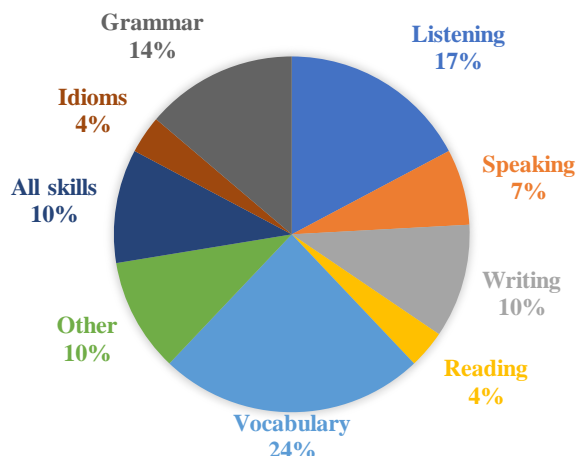
This study aims, in addition, to fill gaps in the literature in terms of theories. According to the knowledge of the researcher, none of the previous language studies discussed the theoretical base of their video design in their study. Only three articles have been found to use video as a tool in teaching a foreign language to enhance motivation (Mohammadian et al., 2018; Rajagopalan, 2017; Bozavli, 2017). Yet, none of these three articles discussed the specific design of the videos used in the study, nor the educational theories behind using videos in the classroom. The current study is, therefore, the first to investigate the use of instructional videos in teaching English grammar to language learners based on motivational and cognitive theories.

Beyond the context of videos and student motivation, the content of videos in prior research is worth discussing. The field of language learning consists of different language skills (e.g., reading, writing, listening, speaking), and the involvement of any tool or technology into language

teaching could be beneficial to certain language skills over others. For example, an instructional video could focus on students' acquiring a set of vocabulary items only, without incorporating grammatical aspects of the vocabulary words. Therefore, specifying a language skill in each study is a vital element for more meaningful results. Moreover, the current literature includes few studies on grammar teaching/learning and instructional videos. As shown in Figure 1, most studies address other skills besides grammar, and only 14% of the studies used videos to teach grammatical lessons to the learners. Furthermore, the grammar of focus in those studies focused on different areas of English grammar, none of which are the same focus as that of the current study.

Figure 1

Language skills studies in the last five years



Another gap in the literature that this study addresses concerns the source of the videos that were used in previous studies. Most of the previous studies used videos that were not designed specifically as teaching material, such as video clips of movie scenes. Some videos are designed as educational material; however, they are designed for very specific lessons, which makes them unhelpful for lessons targeting any other aspect of English learning. However, there were two articles in the reviewed literature that used originally designed videos rather than using video files

designed by others, such as a publicly accessible video posted online. Unfortunately, none of these studies provided details on the design aspects of the videos (Moranski & Henery, 2017; Zhyrun, 2016). When designing instructional material for research purposes, readers expect to be provided with methodological details about the design process, such as the conceptual base of the design, materials needed for the design construction, and information about technological requirements for designing the video. Unfortunately, none of the studies provided information about whether the video design was based on any technological or language principles. The educational background quality of the video designed and used in the language studies is thus another significant gap in the literature which this study aims to address. This study designs, plans, and produces completely original video content that specifically addresses a lesson on a certain grammatical feature. This study – situated within the theoretical base of Social Agency, as well as in the field of CALL, and using a unique methodology of specifically and originally designed instructional videos – aims to contribute to the scientific understanding of educational videos and their effects in the second language classroom and in language acquisition more generally. To sum up, the purpose of this study is to contribute to CALL literature by filling a gap in research, specifically in understanding videos in L2 learning. The study adds knowledge to the topic of instructional videos in teaching grammar and all language skills. Moreover, this study links the embodiment principle to language teaching, video technology, motivation level, and cognition load where there is no prior research that handles all five topics. After a thorough and systematic search through previous relevant studies, it is clear that grammar is the least frequently addressed skill among the studies that incorporate instructional videos. The instructional video used in this study aims to investigate a multimedia principle in teaching grammar rules. This study is the first in applying the embodiment principle to a customized instructional video for teaching grammar.

Finally, this study investigates grammar with a methodology that no other study has employed before. Ultimately, it is hoped that the findings of this dissertation will eventually make significant contributions to the field.

Research Questions

1. What is the effect of applying the embodiment principle to an instructional video on second language learners' cognitive load?
2. What is the effect of applying the embodiment principle to an instructional video on second language learners' motivation?
3. What is the effect of applying the embodiment principle to an instructional video on second language learners' grammatical performance?

Research hypotheses

Hypothesis (1) Second language learners in the three groups (the high-embodied agent, the low-embodied agent, or the voice-only agent) will show significantly different cognitive load scores as measured by the cognitive load self-rating scale questionnaire.

Hypothesis (1-1) There will be no significant differences in the intrinsic cognitive load scores measured by the three-factor solution questionnaire among second language learners who use instructional video of the high-embodied agent, who use instructional video of the low-embodied agent, and who use instructional video with a voice-only agent.

Hypothesis (1-2) Second language learners who use instructional video of the high-embodied agent will show significantly lower extraneous cognitive load scores as measured by the three-factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.

Hypothesis (1-3) Second language learners who use instructional video of the high-embodied agent will show significantly higher germane cognitive load scores as measured by the three-factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.

Hypothesis (2) Second language learners who use instructional video of the high-embodied agent will show significantly higher motivation scores as measured by the Reduced Instructional Materials Motivation Survey (RIMMS) than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.

Hypothesis (3) Second language learners who use instructional video of the high-embodied agent will show significantly higher grammatical performance scores as measured by a 12-items grammar test than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.

Significance of the Study

According to the knowledge of the researcher, in the existing research that used videos to teach grammar, the videos were originally intended for an audience other than English language learners. That is, there are little, if any, studies on using videos for grammar instruction that were designed based on instructional or language theories, concepts, or principles. Educational materials created on theoretical bases have a much higher likelihood to be successful learning materials, as justified by their design taking into consideration factors such as implication, assessment, and outcomes. Therefore, there is limited understanding in the effects of different types of videos on teaching grammar to English language learners. Addressing this limitation, this study investigates the effect of using videos designed for teaching grammar. More specifically, the study compares the learning effects of three designed videos that differ in terms of how the lesson is delivered: by

a high-embodied agent, that is, a speaker on screen with a high usage of social cues; a low-embodied agent, that is, a speaker that very little use of social cues; and voice-only agent, that is, the video has no speaker on screen, only the voice of the agent is heard. Each of the videos of this study is designed within the theoretical lens of Social Agency, which revealed new data to the literature.

As the literature review has revealed, Social Agency Theory has not been exploited much in the language field. The present study offers a novel approach of studying instructional videos by integrating the embodiment principle into designing instructional videos for second language learners, and by measuring the learners' cognitive load, motivation, and grammatical performance. The variable between the three designed videos is the social agency of the speaker in the video. The presence and absence of embodied agents in English teaching multimedia instruction are the core of this study's investigation. The results of this investigation may become a theoretical framework for future studies.

Contribution to the Field

The social cues of the animated pedagogical agent have become a topic of interest for researchers (Graesser et al., 2008). This research therefore aims to contribute to the knowledge base in the field of second language learning and instructional technology. It answers some of the gaps that have been identified in the literature. The contribution that this study makes is in testing a multimedia instructional material of English grammar that has not been tested before in motivating second language learners, reducing their cognitive load, and promoting their performance. The medium, design, and theoretical foundations of this research contributes new knowledge to the field. The first and main contribution will be in the inclusion of animated pedagogical agents in multimedia education of English language teaching.

The second contribution is in the design of the videos. Most of the previous research did not design videos for the content they are teaching but adopted videos that were designed for other purposes. The type of video used could contribute differently to delivering information to the learner. It may be more effective if researchers design instructional videos aligned with the content they are using in the study. As the author of this study found, very few researchers designed their videos, and none of them provided details about the video design process nor the elements of the video. Only one of the previous studies designed videos for teaching grammar; however, the focus of the study was not on the design of the video but in the flipped class approach that was applied (Chen, 2018). Designing a video that is aligned with the content the learner is studying could result in better outcomes. The current research includes a customized instructional video about the content of a grammar course and specifically for the participants, who are students in an English grammar course. This aspect of the study thus contributes to understanding how designing educational materials instead of using outside materials could be beneficial in teaching.

The last contribution comes from the theoretical implications, specifically the application of the embodiment principle of Social Agency Theory in teaching grammar through instructional videos. Guided by these educational principles and theories and using a new methodology of designing videos specifically for a grammar lesson, the study therefore offers a unique understanding of CALL and of instructional technology for language learning. The application of this instructional video could be a framework for future videos that aim to teach a second language.

Theoretical Justifications

To lay the foundation for this study, the research questions of this study are formed based on a theoretical concept. The theories and principles mentioned in this section form the base of this research topic. Since 2004, instructional technology experts have argued that there are two

paths to enhance meaningful learning through a multimedia learning environment. The first one seeks to reduce the cognitive load of the learner during the multimedia learning process to engage the learner in active learning cognitive processing. The second aims to increase the learners' motivation by better design of the multimedia messages which may result in active cognitive processing (Mayer et al., 2004). Researchers have presumed that when these paths enhance meaningful learning, they will consequently promote the learner's performance. Relying on this assumption, there will be differences in the dependent variables of this study, which are cognitive load, motivation, and grammar performance.

According to Social Agency Theory, "multimedia learning environments can be designed to encourage learners to operate under the assumption that their relationship with the computer is a social one, in which the conventions of human-to-human communication apply" (Atkinson et al., 2005, p. 117). In other words, when multimedia learning includes social cues like an on-screen agent with humanlike features (e.g., hand gestures, body movements, eye contact, and facial expressions), the quality of learning will be increased. Mayer (2014c) illustrates multimedia instructional message with social cues and without social cues. On the one hand, when social cues are added to multimedia instructional learning material, learners will have social responses to those cues. As a result, cognitive processing will be increased, and the quality of learners' performance will be increased as well. On the other hand, when multimedia instructional learning material lacks social cues, learners would not have any responses to social cues. The lack of responses will decrease cognitive processing which will result in a decrease in the quality of performance.

Multimedia learning is affected by different factors; therefore, when an animated pedagogical agent is involved, then the social cues of that agent could affect learning (Mayer,

2014c). The more animated pedagogical agents are human-like, the stronger activation of social responses the learners are likely to be. High social responses will increase the cognitive processing of the learner which may lead to better performance. Mayer (2014c) said, “Social cues may prime social responses in learners that lead to deeper cognitive processing during learning and hence better test performance...The *embodiment principle* is that people learn more deeply when on-screen agents display humanlike gesturing, movement, eye contact, and facial expressions” (p. 345). The focus here is on Social Agency Theory as the guiding framework of this study because of its attention to learning outcomes and because it is consistent with the interests of this investigation, namely cognitive load, motivation, and performance.

Definition of Terms

The following are terms used in this study. They are presented here along with their definitions to provide a clarification of the intended meaning:

- **Animation** – “A constructed pictorial display that changes its structure or other properties over time and so triggers the perception of a continuous change” (Lowe & Schnotz, 2014).
- **Embodiment** – When something is expressed or presented in a visible or tangible form, it is said to be embodied. Computer animations can be made to embody human communicative behaviors such as gesturing, movement, eye contact, and facial expressions. The *embodiment principle* states that people learn more deeply when on-screen agents embody these humanlike movements and behaviors (Mayer, 2014c, p. 346)
- **Experimental research** – “As a research method in the social and behavioral sciences, experiments are systematic and controlled but still involve the basic protocol of creating a test to see if what you predict will happen, does happen.” (Leavy, P., 2017, p. 94).

- **High-Embodied Agent (HEA)** – An on-screen agent who moves and presents high social cues in an educational multimedia medium. Social cues could be humanlike gesturing, movement, eye contact, and facial expressions. The term “high-embodiment” was used by Mayer (2014c) in his discussion of pedagogical agents.
- **Instructional technology** – Instructional technology refers, in this study, to educational videos; it excludes authentic videos presented for non-educational purposes.
- **Low-Embodied Agent (LEA)** – An on-screen agent presents low social cues in an educational multimedia medium. Social cues could be static humanlike gesturing, movement, eye contact, and facial expressions. The term “low-embodiment” was first used by Mayer (2014c) in his article about pedagogical agents.
- **Pedagogical Agents** – “Pedagogical agents are anthropomorphous virtual characters employed in online learning environments to serve various instructional goals” (Veletsianos & Russell, 2014). The pedagogical agent also defined as digital characters that have features of speech, gesture, movement, and human-like behaviors (Park, 2015).
- **Video** – Video is a medium of electronic communication through moving visual images. Digital videos are encoded digital data, and the technology is considered a highly important aspect of modern life (Mosdell, 2013).
- **Voice-Only Agent (VOA):** An off-screen agent who presents only his/her voice in an educational multimedia medium. The embodiment principle of the Social Agency Theory cannot be applied to the agent presentation since the agent is off-screen.

Description of the Chapters

This paper is organized into five chapters, followed by references and appendices. The current chapter has aimed to introduce the overall goals and the implications of the study. It has

given a general overview of the study, the purpose of the study, the research questions and hypotheses leading the study, the study's significance, its contribution to the fields of second language pedagogy and instructional technology, the theoretical justifications outlining the conceptual framework, as well as the definitions of key terms.

Building upon the foundational information set up in the first chapter, the second chapter presents a closer review of the related literature of scholarship concerned with video technology, pedagogical agents, grammar, motivation, and cognitive load. Chapter Two also contains a deeper synthesis of the existing gap of research and more detailed insights gained from the literature. Chapter Three presents a detailed description of the methodology, the research design, the study's participants, and the materials used to frame the study. It also includes descriptions of the context of the inquiry, video design, measures, pilot study, data collection, an overview of data analysis, and the privacy and ethical considerations of the author. Detailed analysis and discussions of the collected data and findings are presented in Chapter Four. Lastly, Chapter Five discusses the limitations of the study, the implications of the research, possible directions for future studies, and final thoughts for the overall study.

Chapter Two: Literature Review

Video Technology

Instructional videos

Under the umbrella of Computer Assisted Language Learning (CALL) is the construct of ‘digital resources’ (Liontas, 2018b), which refer to any language learning or teaching resources that come in digital form. For instance, one of the well-known digital resources that have been strongly incorporated into education is video. Videos have been employed in the field of teaching and learning a second language since the early 1980s (Nikitina, 2010). The visual and audible features provided by videos has often be compared with printed materials (Saeedi & Biri, 2016; McNulty & Lazarevic, 2012). Canning-Wilson and Wallace (2000) define video as “the selection and sequence of messages in an audio-visual context” (para. 1). Later, Stempleski added in her article “Video in the ELT classroom: The role of the teacher,” that video is “an extremely dense medium” (2002, p. 364). She describes videos in terms of what they are able to provides to English language teaching classrooms.

Mayer’s theory of multimedia learning supports the involvement of technology in teaching. Learners learn through multiple channels, and therefore in the event that learning involves more than one channel, then learners are more likely to learn more (Mayer, 2009). Video as a multimedia medium involves the audio and visual sensory of the human body. Unlike printed materials, videos deliver information via multiple channels. Moreover, university students are now considered ‘digital natives’ as Prensky (2001) named them. Digital natives are those who were born recently enough to have never known the world before digital technology. This term is fitting as a

characteristic of the target generation. As members of that category, the participants of this study are more likely than not to have an attachment to and preference for technology-assisted learning, and their relationship with technology is likely to be stronger than that of previous generations. Therefore, it is rational to posit that transferring knowledge through technological channels may be more effective than the traditional channels used for the previous generation.

Integrating video into the course materials involves the dynamic media hypothesis (Mayer et al., 2005) derived from the cognitive theory of multimedia learning (Mayer, 2001, 2005) and the cognitive load (Paas et al., 2003; Sweller, 1994, 2004). The hypothesis claims that less initial cognitive effort is needed when animations and narrations are used as learning materials comparing to paper-based materials that do not include these features. The pictures or figures of this study are presented as animations that could move in the screen, so the learners do not have to construct a dynamic image in their minds. They do not have to read texts since the lesson will be in spoken form, which is noteworthy considering this study's hypotheses start from the belief that removing the task of reading may reduce the cognitive effort.

Instructional videos in teaching language could either be designed to transfer more than one point of a lesson or designed to transfer one language point as the aim of this study. It is important to note that the results of prior research support the usage of short length of instructional videos over using the longer ones (Chen, 2018). Furthermore, Richards and Renandya (2004) claims that short videos (3-5 minutes) are better to be used throughout the teaching course. They believe that longer videos could reduce the chance of observing and noting the information. In accordance with these research findings, instructional videos are used in this study as a supplemental tool in delivering the course content, specifically using short videos of 9:20 minutes of length which present visual and audio elements and focus on one specific language point.

Video in English language learning

The involvement of video in teaching and learning languages is crucial for the audiovisual features that videos can provide (Saeedi & Biri, 2016). In addition to audiovisual features, videos also comprise facilities like play control and captions that increase their value (Pujola, 2002). These features have gained greater importance nowadays since, as discussed above, most of the learners are digital natives (McNulty & Lazarevic, 2012; Prensky, 2001). Typically, before introducing any new technology into language learning, studies are conducted to investigate the effectiveness of the technology on teaching and learning. Studies investigating the involvement of technology to promote self-language learning skills have been found to result in high English proficiency levels (Al-Kathiri, 2015; Al-Okaily, 2013; Al-Shehri, 2011). However, that is not to say that employing educational technology always yields positive results. Namely, factors that contribute to varying attitudes that language learners have toward videos remain unclarified, as well as, therefore, arguments for or against the use of videos and their effectiveness (Saeedi & Biri, 2016).

As mentioned before, videos have been employed in the field of second/foreign language teaching and learning since the 1980s (Nikitina, 2010). Videos, then, have had a long history as part of the multimedia materials that could be used in language learning, making them a prevalent target for educational research. Harmer (2001), for instance, has classified videos that can be used in English as a foreign language classroom into three kinds: off-air program videos, real-world videos, and language learning videos. He recommended that teachers use language-learning videos especially if they are associated with the coursebook since they are designed for educational purposes and therefore are more easily comprehensible for language learners.

Chen, 2018, author of “Video resources in a flipped language classroom: An experience of using videos to flip a mandarin teaching module,” suggested using more advanced technology to engage students into language learning. As an example, Chen discussed 3D visual environment, which is an example of action-based information learning. An example of a previous application of sensory and action learning environments that Chen highlighted was Second Life and digital video games. Similarly, Saeedi and Biri (2016) used short videos, specifically excerpts of television show episodes, to teach language. They conducted a study of short-lesson videos to teach English grammar. They called the short-videos ‘shorter segments’ (Saeedi & Biri, 2016, p. 26). Although the above literature shows applications of video use in ESL/EFL teaching, one promising topic that deals with the learners’ cognitive load and motivation nonetheless remain to be studied in the ESL grammar teaching and technology field.

Pedagogical Agent

Pedagogical agents are digital characters that have features of speech, gesture, movement, and human-like behaviors (Park, 2015). Digital agents playing a pedagogical role have recently become very popular in educational contexts (Gulz, & Haake, 2006). The presentation of an agent can be modeled by the human body, animal, or object (Gulz, & Haake, 2006); however, in any form, the agent has a humanlike visual appearance. Some of the crucial advantages of recruiting pedagogical agents include the cognitive support and the social enrichment that they provide to the learner (Baylor, 1999).

Gulz and Haake (2006) support the embodiment principle through their Identification Argument, in which they argue that social elements are important in student-instructor interactor. Similarly, Frechette and Moreno (2010) claim that the inclusion of agents in learning environments enhances learning because the agents function in personifying the environment. This is important

because under the right environment, learners' feelings of social interaction with the agent may lead to considering the agent as a real person (Blascovich et al., 2002). Accordingly, attempting to closely imitate the interaction of real-life to digital agent characteristics can become highly valuable in terms of students' motivation and therefore their learning. Social Agency Theory claims that students give forth more effort to learn when they feel that the instructor is engaged with them in partnership (Mayer, 2014c). With the added benefits of including agents to multimedia learning, the presence of animated pedagogical agents has also been attributed with a "persona effect" (Lester et al., 1997).

There are other theories worth mentioning that have also argued about the use of animated pedagogical agents in learning. For example, the Social Presence Theory discusses the relationship between the presence of an agent and the learner's perceptions. The theory claims that the presence of an agent may increase the learner's motivation, which in turn is likely to encourage the learner to give more effort in learning (Moreno, 2001). According to the theory, the more realistic the learners consider the agent in a virtual environment, the more positive and satisfying the experiences they have (Gunawardena & Zittle, 1997). The Confluent Education Theory argues for the use of an agent in virtual learning as well. The theory predicts that facial expressions may benefit learning in raising motivation, interests, and social presence (Brown, 1971; Shapiro, 1998). Thus, this theory aligns with and supports the Social Presence and the Social Action theories.

In contrast, other researchers claim that on-screen agent can hamper learning (e.g., Moreno, 2001). In this perspective, it is believed that the agent may be additional, unnecessary material to the lesson, which could reduce working-memory capacity and cause unwanted interference. It is possible that educators or instructional designers may see additional materials to be interesting when adding them to the learning materials; for example, adding an interesting video related to the

lesson or adding an agent to the design of a lesson. However, in some situations, according to the Seductive Details Theory, interesting but irrelevant materials can certainly distract learners from the core material (Moreno & Flowerday, 2006; Moreno, 2001). The embodiment principle supports the use of an agent with additional human-like features than a static agent; however, it has been suggested that very strong features may lead to social anxiety which could result in negative effective reactions (Garau et al., 2005).

The pedagogical agent has been a variable in prior academic learning research; namely, Park (2015) studied the effects of Social Cue Principles on cognitive load, situational interest, motivation, and achievement. In his study, Park presents four design principles based on social cues to reduce unnecessary cognitive load and to foster generative cognitive processing. Participants were 127 undergraduate students randomly assigned to each group. There were six conditions of the treatment which was on computer literacy. Conditions were divided based on the agent's image (on-screen vs. off-screen) and agent's narration (human voice, on-screen text, no-narration). Results did not find any effect of the presence or absence of the agent image. However, the agent's narration was found to affect learners' cognitive load, situational interest, and motivation. Lower cognitive load was reported in the human voice condition compared to the on-screen text and no narration. Higher situational interest was reported in the human voice condition compared to the on-screen text and no narration. Cognitive load and situational interest were found to be negatively correlated. The human voice condition raised the relevance and confidence elements of motivation significantly higher than other conditions. Finally, a recall test and a comprehension test did not show any different results among the study conditions (Park, 2015).

In 2012, Mayer and DaPra experimented with the embodiment principle of an animated pedagogical agent in academic learning. The experiment consisted of three groups who learned

how solar panels work. Participants learned through a computer-based presentation containing 11 slides and lasting less than 4 minutes. An animated pedagogical agent presented the content on the left side of each slide. The different presentations of the agent represented the different groups of the experiment. For the first group, the high-embodiment group, the agent used humanlike gesturing, movement, eye contact, and facial expressions. For the second group, low-embodiment group, an agent was on-screen but was not engaged in the actions of the high-embodied agent. For the third group, the no agent group, learners learned through the same slides and narration, but with no presentation of an agent. The experiment used the Animated Persona Instrument (API) questionnaire, a retention question sheet, and five transfer question sheets. Participants were 88 college students randomly assigned to which learning model. The API results revealed a significant outperform of the high-embodiment group over the low-embodiment group. However, there was no significant difference between the low-embodiment group and the no agent group. The retention test scores did not reflect any significant differences between groups. Concerning the transfer test score, the post hoc tests showed that the high-embodiment group outscored each of the other groups, but the difference was not significant (Mayer & DaPra, 2012).

In 2010, Frechette and Moreno conducted a study to examine the agents' instructional value. Their fundamental question asked: How do the presence and nonverbal communication of APAs affect students' learning and perceptions about their experiences? The design of the study was between-subjects experimental research design. Participants randomly assigned to learn from one of the study conditions. Adobe Flash software was used to develop the material and computers were used to deliver the instrument. A custom agent was designed and added to virtual learning materials. The study was one session and participants were exposed to an agent for 12 minutes. The study included five conditions: group (S) a static agent; group (D) an agent with hand and arm

gestures; group (D) an agent with facial expressions; group (DE) an agent with both deictic movements and facial expressions; and a controlled group without an agent. After taking the treatment, participants took a survey, a recall test, a comprehension test, and a transfer test. Data was collected in a controlled lab setting. Results showed that the presence of an agent does not affect learners' perception. It also found that materials including an agent with a facial expression could decrease the comprehension score as compared to materials with a static agent or without an agent. This research found that the presence of an agent may have little impact on the outcomes (Frechette & Moreno, 2010).

Animated pedagogical agents' level of embodiment in a learning environment was investigated in a study that designed a parrot who took the role of a pedagogical agent in a single session experiment (Lusk & Atkinson, 2007). The pedagogical agent in that study was part of a software illustrating how to solve multi-step proportional word problems. The study followed the Cognitive Load Theory as its theoretical base. The study included three versions of animated agents. The agent in the fully embodied version appeared with features of speaking and moving in modes of communication like locomotion, gaze, and gesture. The agent in the minimally embodied version only provided spoken words without any communication cues. The third version was the voice-only version and the agent was off-screen, but the learners could hear the same verbal instructions used in the other versions. The presentation of the content of the tutorial was in two different formats, animated and static. In the animated format, the text appeared simultaneously with the oral explanation. In the static format, the text appeared all together. Considering the above configurations, the study included six groups. The procedure took place in a computer lab and the duration was 120 minutes for the whole process. Regarding the pedagogical agent's level of embodiment, the results of the study revealed no significant performance on practice problem-

solving, subjective ratings of cognitive load, or instructional time. However, on perceived worked example understanding, the results were statically significant (Lusk & Atkinson, 2007).

Grammar

This research involves the study of grammar which considers the grammatical sequences and ruling out the ungrammatical sequences of a language structure. However, there is more than one type of grammar. The concept of grammar used in this research refers to what George Yule called “linguistic etiquette” (2004, p.87), that is, the grammar that identifies what is ‘proper’ or ‘best’ to be used as rules for language structure. The exact grammatical point that this research focuses on is the use of conjunctions. Conjunctions are words (e.g., *and*, *but*, *although*, *if*) that function to “connect and indicate relationships between, events and things (we swam although it was very cold)” (Yule, 2004, p. 88). The conjunctions used in this research are *because* and *even though*. The content of this study illustrates the proper use of *because* and *even though* as parts of speech in the English language, and it teaches students the difference between these conjunctions which are similar and therefore commonly confused.

The notion of grammar has a long history; in fact, two millenniums ago, a Greek grammarian, Dionysius Thrax, said that speaking a language or speaking about a language cannot be without grammar (Fromkin et al., 2007). Language experts have almost always considered it crucial to teach the grammar of a language to second/foreign language learners, the prescribed rules of syntactic constructions (Hinkel, 2018).

The need for grammar teaching is also supported by Pienemann’s (1984) teachability hypothesis. Pienemann believes that second language learners learn through stages that form a sequence. Furthermore, Lightbown (2000) linked Pienemann’s hypothesis to grammar learning and claimed that learning the grammar of a second language will be more effective if the learner

is ready to move to the next stage of language proficiency (Lightbown, 2000). These approaches support the explicit teaching of language instructions.

The current research applies Social Agency Theory which claims that the use of social cues in an instructional message would increase the quality of learning (Mayer, 2014b). The presence of a pedagogical agent with features of personalized voice narration and embodiment would increase interest and motivation for the learner. Consequently, interest and motivation would generate cognitive processing which would result in increased learning (Park, 2015). Based on the above assumptions and on the previous literature, the third hypothesis predicted higher grammar scores for participants in the HEA group than the LEA and VOA group.

Teaching English language grammar through videos

Video applications in second/foreign language teaching were found in flipped-classes research where videos were used as pre-class preparation material (Al-Harbi & Alshumaimeri, 2016; Chen, 2018). “The flipped classroom is an educational strategy that enables teachers to support students’ self-learning by providing them with interesting e-learning materials utilizing online communication to free class time for more student-centered activities” (Al-Harbi & Alshumaimeri, 2016, p. 71). The main focus of these studies, however, was not on the video design and language learning itself, but the validity of the flipped class approach when videos are used as preparation material before class.

Chen, in 2018, designed videos that explain grammar rules to second language learners of English and tested them in the flipped classes approach. In his study, he taught the grammar lessons in an explicit manner, as recommended by prior research (e.g., Webb & Doman, 2016). However, the main focus of the study was not on video design and language learning; the use of videos in the flipped class approach. Chen used three types of videos in the study: Grammar Videos (GVs),

Vocabulary Videos (VVs), and Text Explanation Videos (TEVs). The lengths of the videos were not provided, and part of the data collection was asking participants if they were skipping the videos or not. The result of Chen's study that is of the most interest to the current one is that none of the participants skipped watching the GVs, whereas 15% of watching the VVs and TEVs were skipped. Chen said, "Participants gave most prominence to GVs. It suggests that using video to teach grammar rules is thought to be beneficial and needed" (Chen, 2018, p. 73). Moreover, participants watched the videos for pre-class preparation as well as for revision, consolidation, and clarification. Therefore, it is shown that participants not only enjoyed the pre-class preparation of a flipped class, but also additional advantages of videos (Chen, 2018).

Another study by Koç and Koç (2018) aimed to find the effect of media on the learning and retention of formulaic sequences. The participants were undergraduate English language learners enrolling in an English Language Teaching program in Turkey. The study followed the mixed methods approach and there were two groups, experimental and controlled. The experimental group watched in-class video-clips of an American television drama that contained formulaic sequence sentences. The controlled group followed the same syllabus of the experimental group but without the integration of videos. The results of the post-test showed higher scores of the experimental group although the difference between the two groups was not significant. However, the retention test was significant showing better results for the experimental group. The interviews also revealed the positive attitudes of the participants toward integrating videos in teaching formulaic sequence sentences (Koç & Koç, 2018).

Al-Harbi and Alshumaimeri (2016) used instructional YouTube videos corresponding to the material of the grammar class of the participants. The researchers found that the experimental group who watched videos about the grammar rules before class scored higher than the controlled

group who did not watch the videos. The difference between the two groups was not significant, but the result from the questionnaire and interviews supported the positive attitude and perceptions of the participants. The researchers, however, did not design the videos or relate them to educational or technological theories but adopted them directly from YouTube after the class teacher approved the validity of the videos in terms of topic and students' proficiency level (Al-Harbi & Alshumaimeri, 2016).

Videos were also used in a prior study as a means of providing authentic English animated situation comedy to the learners (Saeedi & Biri, 2016). Saeedi and Biri conducted a study using video technology to teach the grammar of the English language. They followed the mixed methods approach in their study. The study included two groups, an experimental and a controlled group. The experimental group watched videos while the controlled group used traditional teaching. The study used 12 shortened episodes of "The Looney Tunes Show". The videos were presented in 6 sessions. Since the researchers aimed to teach the grammatical structure of using the conditional mood in sentences, a subtitle of the conditional sentence appeared on the screen each time a conditional sentence is used. The findings of the pre-tests and post-tests showed significantly higher scores of the experimental group compared to the controlled group. The study found it effective to use animated situation comedy videos to teach grammatical structures in EFL classes. Moreover, the results of the interviews with the participants showed that their attitudes toward the videos were all positive (Saeedi & Biri, 2016).

In 2015, Jarrad Merlo and Paul Gruba designed video tutorials to explain grammatical concepts to English as Foreign Language students. Their study paid great attention to the design of the video comparing to all other studies of video and grammar teaching. The purpose-built video they design contained a video recording of an instructor teaching the concept supported with a

presentation of PowerPoint slides. The video was 12 minutes long and taught the past tense of English verbs. They found that video-based tutorials can lead to improving learners' grammatical competence (Merlo & Gruba, 2015).

Motivation in teaching English language grammar through videos

Videos have been used in the educational domain to fulfill a variety of purposes. Many studies targeted learners' motivation when integrating video clips to language teaching (e.g., Bravo et al., 2011). Since younger generations are *digital natives* (Solak & Cakır, 2015), the aim of using digital motivational resources has become increasingly stronger over the past decade. Bozavli (2017) used videos in teaching French vocabulary to foreign language learners. Bozavli was interested in finding out the effect of providing an audiovisual method to second language learners instead of the conventional method, and she found that using videos could result in a higher level of students' motivation. These studies and others support the positive impact of videos in motivating second/foreign language learners (Oura, 2001) as video fulfills some strategies of maintaining and protecting motivation in language learning (Dörnyei, 2001).

Prior research of instructional videos in language teaching sometimes considered participants' motivation of learning when videos are used, and several of these studies also recorded motivation as part of the findings (Saeedi & Biri, 2016; Kelly & Safford, 2009; Bravo et al., 2011; Cakır, 2006). However, there was no study found in the literature that investigated the learners' motivation while learning grammar through videos that are based on motivational or technological theories. Therefore, this is an area of research that needs further research.

Motivation

Motivation in language learning

Instructional videos have been used in education for many reasons, and one of which is motivation (Harmer, 2001). Getting students to be motivated while learning has been a topic of interest for researchers and educators (Tremblay & Gardner, 1995; Reeve & Lee, 2016; Dörnyei et al., 2016). Wentzel and Brophy (2014) defined motivation as “a theoretical construct used to explain the initiation, direction, intensity, persistence, and quality of behavior, especially goal-directed behavior” (p. 2). Gardner defined motivation as “a combination of effort plus desire to achieve the goal of learning the language plus favorable attitudes towards learning the language” (as cited in Keblawi, 2009). Mayer defined motivation in multimedia learning as “the internal state that initiates, maintains, and energizes the learner’s effort to engage in learning processes” (2014a, p. 171).

Of all the descriptions of motivation in language learning, one of the current leading perspectives of the construct comes from Dörnyei, a professor who is known for his work on second-language acquisition and the psychology of the language learner. He classified students’ motivation in learning a second/foreign language into four categories naming them the Motivational Teaching Practice. Dörnyei’s Motivational Teaching Practice includes “classroom condition, the learner’s initial motivation, the maintenance of motivation, the positive self-evaluation” (Dörnyei, 2001, p. 27). The video used in his 2001 study aimed to promote learning as a motivational medium to language learners.

In 2001, Dörnyei provided four categories of students’ motivation in learning a second/foreign language. The four categories include the classroom condition, the learner’s initial motivation, the maintenance of motivation, the positive self-evaluation (p. 27).

Prior second/foreign English language research found the improvement in students' motivation when videos are involved in the learning process (Kelly & Safford, 2009; Bravo et al., 2011; Cakir, 2006). Consequently, motivation could lead to better achievement in language learning where it is accepted to be a key factor in influencing the success of second/foreign language learning. As a result, and from an educational point of view, the value of the learner's motivation is gained from its influence on the learner's academic achievement. Motivation in education has been widely studied, and one of the most influential models of motivation in language learning is Gardner's *Socio-educational Model* (as cited in Keblawi, 2009). In 1985, Gardner defined motivation as "a combination of effort plus desire to achieve the goal of learning the language plus favorable attitudes towards learning the language" (as cited in Keblawi, 2009). "People can be motivated because they value activity or because there is strong external coercion" (Ryan & Deci, 2000, p. 69). Learner's motivation is what encourages him/her to reach their desired goal.

Therefore, there are some tools that enhance the motivation of language learners. In learning grammar, memorizing rules can often cause learners to become bored with the material and lose motivation. Yolageldili and Arikan (2011) said, "When grammar is taught in a way that is too dependent on rules and memorization, young learners lose their interest and motivation" (p. 21). Grammar rules can be learned from different mediums, like instructional videos, which may not only maintain learners' interest and motivation, but even increase it.

Motivation in using video

Several researchers have found the involvement of technology in teaching to be useful for stimulating students' motivation (Saeedi & Biri, 2016; Chen et al., 2015; Jamali et al., 2015; Salmi et al., 2012; Solak & Cakır, 2015). Mayer defined motivation in multimedia learning as "The

internal state that initiates, maintains, and energizes the learner's effort to engage in learning processes" (2014a, p. 171). Consequently, we can understand that video is part of CALL applications and video is a factor that may increase the motivation of digital-native students. Moreover, video is a two-in-one tool as it may not only motivate students but also support cognitive learning theories. As mentioned earlier, one of the definitions of the video is "the selection and sequence of messages in an audio-visual context" (Canning-Wilson & Wallace, 2000, para. 1). Based on this definition, it can be assured that videos are computer-based animations and narration which eventually are implementations of multimedia. Integrating videos in learning relates to the cognitive theory of multimedia learning (Mayer et al., 2005) to the discussion. Since videos include audio-visual animations and narration, then it is necessary that some principles of the multimedia design are applied.

Using pedagogical agents in multimedia instruction is key to foster motivation (Kim & Baylor, 2006; Kim & Wei, 2011; Kramer & Bente, 2010; Lusk & Atkinson, 2007). The social presence of the facilitator (agent) provides personalized voice narration and embodiment to the learning material, which, in turn, increases the level of interest and motivation (Park, 2015). Accordingly, the second hypothesis of this study predicts higher scores of motivation for the HEA group than the LEA and VOA groups. Pedagogical agents create a feeling of human-to-human interaction which increases learner's engagement (Lin et al., 2008; Lusk & Atkinson, 2007; Sklar & Richards, 2010; Woo, 2008). This engagement is formed by the harmony between verbal communication with nonverbal cues that appeared in the human-like movements, voice, and gestures. Other studies revealed that agents may increase learning motivation when it looks competent (Kim & Baylor, 2006; Kim et al., 2006). Although several studies support the use of pedagogical agents in promoting motivation, other studies did not find any contribution of agents

to motivation or interest (Frechette & Moreno, 2010; Domagk, 2010; Choi & Clark, 2006). The debate on the benefit of pedagogical agents in education is still ongoing. The literature needs more evidence to better investigate the learners' motivation with the presence of a pedagogical agent.

Cognitive Load

Cognitive Load Theory (CLT) (Sweller, 1994, 2004) tries to explain how the capacity of the human brain's memory works when performing tasks. The notion of cognitive load refers generally to the limitation of memory; more specifically, it is the amount of information the brain can process at a given moment (Baddeley, 1992). CLT focuses on short-term storage, also called working memory, that is, the information that can be temporarily held in memory during cognitive processing. CLT assumes that there is a limited capacity of working memory. The theory consequently assumes that learning will be hampered if that capacity is overloaded (Zhang, 2013). Understanding various levels of task difficulty is the main issue for which the CLT is usually applied. The theory claims that when cognitive load level is high, learning performance will be negatively impacted (Zhang, 2013).

In the learning process, the cognitive load is divided into three categories: intrinsic cognitive load; extraneous cognitive load; and germane cognitive load. John Sweller (2010) describes how working memory is allocated in learners' brains in order to deal with each of the three types of cognitive load: intrinsic cognitive load is concerned with the "intrinsic complexity of information;" extraneous cognitive load deals with the design of instruction; and germane cognitive load is for the acquisition of knowledge (p. 123). As further explained by other researchers, the intrinsic cognitive load is the working memory load that is impacted by the nature of the learning task. Extraneous cognitive load is the working memory load that is influenced by unrelated material and schema formation. Germane cognitive load is the working memory load

that is influenced by the core of the material that is related to the schema formation (Veletsianos & Russell, 2014). The main principle of the CLT is the ability to increase the germane cognitive load and decrease the extraneous cognitive load (Kester et al., 2006; Van Merriënboer & Ayres, 2005).

The CLT theory, which divides the learning process through working memory into three paths, is significant to this study because the students' ability to process multimodal information is part of the study's focus. Foreign language learning efficiency can be improved by analyzing the structure of the cognitive load in the web-based learning environment (Zhang, 2013). To analyze the structure of cognitive load, cognitive load measurements could be used. "Proper measurement of the different types of cognitive load can help us understand why the effectiveness and efficiency of learning environments may differ as a function of instructional formats and learner characteristics" (Leppink et al., 2013). To improve the quality of learning, the capacity of working memory should be fully used, and the unrelated cognitive load should be decreased as possible (Zhang, 2013).

Based on the CLT theory, there are some cognitive advantages of using videos. Those advantages form the hypothesis of dynamic media (Mayer et al., 2005). The dynamic hypothesis claims that there are two advantages of dynamic media in learning. The first one concerns animations and narrations in videos, which "require less initial cognitive effort to receive the message than do paper-based illustrations and text" (p. 257). The second advantage is that research suggests that computer animations and narrations are found by learners to be "more interesting, entertaining, and motivating than the paper-based illustrations and text" (Mayer et al., 2005, p. 256). The reason for this is that in using computer-based animations, the learners are more likely to "exert more effort in making sense of the material—that is, learners may be motivated to engage

in germane (or essential) processing” (p. 257). Consequently, the dynamic hypothesis is useful to the theoretical lens of this study because animation and narration, which are found in the videos used in this study, are likely interesting to the learners, and - besides the fact that they require less cognitive effort – they are therefore likely also to motivate the learner.

Lastly, research of cognitive load has argued for the effects of pedagogical agents on the limited capacity of working memory during the learning process. It should be noted that although recruiting agents to instructional material has been proven to be beneficial (e.g., Mayer & DaPra, 2012; Park, 2015), it is also possible that they could increase the cognitive load. That is, the addition of pedagogical agents, being an under-researched element in cognitive load theory, may or may not cause a “split attention” situation. In other words, prior research suggests that it may be possible that learners’ attention could be divided between the agent and other elements or information (Woo, 2008; Clark & Choi, 2005).

Synthesis of the Existing Gap of Research

Populations

The previous studies that handled instructional videos as a learning method for language learning covered a variety of populations. Those populations included students from different domains; universities, k-12 schools, language institutes. The most interesting finding that was found by the author, after searching the existing literature, is that almost all prior studies that investigated instructional videos in language learning were conducted in a foreign language situation. Examples of the prior studies, which all were in foreign language situations, are Moranski and Henery (2017), and Alwehaibi (2015). As a result, considering that all participants of prior studies were foreign language learners, in applying the same theoretical and methodological frameworks to a study in a second language situation, it should be noted that the

current study will likely have different findings. This issue has two implications. For one, this study is original and, to a certain extent, is paving a new empirical pathway for future studies. Secondly, it also potentially addresses a problematic gap in how researchers can approach second language learning.

Studies that looked at videos in teaching grammar, in particular, have had the same gap of lacking understanding in the second language situation. All studies were conducted in foreign language situations (Chen, 2018; Al-Harbi & Alshumaimeri, 2016; Saeedi & Biri, 2016; Merlo & Gruba, 2015; Yolageldili & Arikan, 2011; Secules et al., 1992). The age of participants in most prior studies was adult learners, except two studies that focused on K-12 learners (Al-Harbi & Alshumaimeri, 2016; Saeedi & Biri, 2016). Moreover, researchers in this topic found that participants of studies that include technology and student-centered methods were from higher education only; no studies on younger participants on this topic presently exist in published literature (Al-Harbi & Alshumaimeri, 2016).

The sample size of studies that focused on grammar range between 4 and 62 participants. Merlo and Gruba's (2015) study included the highest number of participants (sixty-two) while Yolageldili and Arikan's study (2011) included the lowest number of participants (four). The studies were conducted worldwide, and the participants' first languages vary accordingly. Most of the studies used English as the target language (Al-Harbi & Alshumaimeri, 2016; Saeedi & Biri, 2016; Merlo & Gruba, 2015; Yolageldili & Arikan, 2011). It is clear from prior literature that the English language is easily the most targeted language for researchers who investigated videos in grammar teaching.

It has been shown in this section that videos as an educational tool have been studied and may be implemented in higher education than K-12 education. English was the target language of

most prior studies. The mean average of prior studies' participants is 33. In sum, the literature has revealed that in prior studies on second language situations, the diversity of participants in terms of their language, age, and proficiency level, among other variables, there is not much variation, but a study like the current one remains to be done.

Video-infused features

The flexibility of watching videos at any time was the main feature behind using videos in some studies (Chen, 2018; Al-Harbi & Alshumaimeri, 2016). Since Chen, Al-Harbi, and Alshumaimeri used videos in flipped classrooms, videos were the material that participants should watch and learn from before coming into class. Videos today can be shared online and played in almost all smart devices like computers, smartphones, and tablets. Chen (2018) and Al-Harbi and Alshumaimeri (2016) all argued that this feature would make videos a perfect fit to be used in this situation, which, in turn, would contribute to enhancing the performance of the participants. Moreover, they believed that watching a consistent video with the content of the lesson before class time could save valuable time for students to practice what they have learned in class.

The audiovisual features that the video has provide multiple channels for transferring information to the learner (Mayer, 2009). This feature has brought many researchers to use videos for the aim of enhancing learners' grammatical skills (Saeedi & Biri, 2016; Merlo and Gruba, 2015; Yolageldili & Arikan, 2011). Furthermore, the video could be a medium for learning tutorials. Since videos can include instructional input, Yolageldili and Arikan (2011) used videos to design tutorials for learners as instructional digital materials.

Some researchers of the previous related studies of micro-videos and grammar teaching believed in the features of video that might promote language learning. Chen (2018), who used videos in grammar flipped classrooms, referred to the prior research that showed a positive impact

of videos on language learning. The results of prior research inspired Chen to investigate the use of video in a flipped language classroom. Saeedi and Biri (2016) thought of the influence of English animated sitcom presented to high school foreign language learners of grammar. They presented parts of the sitcom through micro-videos pointing out the grammar structures used. They found that video provides an authentic and interesting presentation of grammar rules to language learners. Moreover, Yolageldili and Arikan (2011) considered the different learning styles of learners. They believed that video could meet their students' learning styles and enhance their performance of grammar.

Questions being investigated

In flipped class studies. Videos in teaching grammar were investigated within some studies that aimed to focus on the flipped class approach. Therefore, the inquiries of those studied were focused more on the flipped class approach than the use of video as a teaching tool. For instance, Chen (2018), who used video resources in flipped language classrooms, investigated two research questions using a mixed-methods approach. The study questions were investigating the participants' perceptions of videos as learning materials in a flipped class and what could be adopted from the experience. The implications focused on what might help in self-study for a flipped class (Chen, 2018). Similarly, another mixed-methods study investigated the academic impact of flipped classrooms between controlled and experimental groups in which videos were the pre-class material. The qualitative part of the study looked for the students' perceptions, attitudes, and future suggestions for using flipped classes in learning a foreign language. The videos used in this study were adopted from YouTube, and they were explaining English grammar rules (Al-Harbi & Alshumaimeri, 2016). As shown in the examples above,

studies that aimed to use video in flipped class are not found to include a focus on investigating the design of video and learners' motivation in learning grammar. In other words, for these studies, the focus was on the flipped class method where a video is a tool in implementing the method.

In studies of two groups. Studies that focused on a comparison between two groups, experimental and controlled, usually share the same type of questions. These studies, in essence, look at the effectiveness of video in each group and compared between them – although, sometimes other aspects were included in the analysis, such as the participants' attitude.

Although there are similarities in the type of questions, the settings and contents vary among studies. Saeedi and Biri (2016), for example, used videos to teach English conditional structures. They compared experimental and controlled groups. Videos were presented in the experimental group classes along with the textbook, whereas the controlled group used only the textbook. Saeedi and Biri were investigating the effectiveness of animated situation comedy videos in learning conditional sentences. Their investigation also covered the participants' attitudes toward the used videos (Saeedi & Biri, 2016). Another worthwhile mention for this topic, a 1992 study (Secules et al.) had been investigating the use of video versus the traditional method in teaching vocabulary, grammar, and idiomatic structure. This study aimed to find out if videos would enhance students' vocabulary, grammar, and idiomatic structure better than the traditional curriculum. This question was derived from the ability of video to present contextualized presentation compared to the systematic initial presentation of the traditional curriculum. Both examples were looking for whether the experimental group would have better enhancement because of the implementation of video than the controlled group.

In studies of one group. In addition to the studies that compared between two groups, other studies included one group only. Usually, studies that have one group of participants include multiple sessions of data collection to reach the answers to their questions. Merlo and Gruba (2015) investigated the effect of purpose-built grammar videos on the competence of language learners. They conducted pre-test, post-test, and delayed post-test, and then compared the results of the tests. The study includes an experimental group only without a controlled group. Another study used one group experiment is by Ilin et al. (2013). They wanted to know the effect of the video when used in a grammar course. They also investigated the learners' opinions about the grammar teacher model before and after learning through video. The participants' pedagogical situation was learning English for specific purposes.

In literature reviews. Reviews of literature on the topic of video and grammar teaching varied in questions in prior literature. For instance, Arikan (2014) reviewed online grammar teaching materials found in popular foreign language learning websites. He aimed to find the nature of the materials in terms of being traditional or communicative materials. He looked at the potential grammar learning and teaching from the available materials on young learners. Reviews of the topic are limited to these reviews which means that the area needs further reviews.

Research approaches being adopted

The mixed-method approach has been used very often in previous studies. For example, Chen (2018) adopted the mixed methods research approach to find out the students' perception toward video materials as pre-class preparation in a flipped foreign language class. Data were collected through questionnaires, surveys, and online video view records. The questionnaire

included open-ended and close-ended questions. The author was able to answer the research questions from the data collected. However, results might not be representative because participants were limited to nine students (Chen, 2018). Similar research that was conducted in a recent study (Al-Harbi & Alshumaimeri, 2016) used instructional YouTube videos of grammar rules as pre-class materials in flipped classrooms. The study adopted a mixed-methods approach and data were collected through a proficiency placement test, post-test, questionnaire, and semi-structured interviews. In the same year of 2016, Saeedi and Biri conducted a study using videos to teach grammar. The study used the same approach as the study mentioned above, that is, a mixed methods approach. For the quantitative analysis, the researchers applied a pre-test and post-test in order to find out the students' performance development. For the qualitative aspect of the study, they also conducted interviews to find out students' attitudes towards the use of videos for teaching a grammar lesson (Saeedi & Biri, 2016).

Other studies adopted the quantitative method only. Merlo and Gruba (2015), for example, used quantitative methods to investigate their questions regarding the effect of the purpose-built grammar video on the competence of language learners. Their study included one experimental group who took one session treatment and three tests before and after the treatment; pre-test, post-test, and delayed post-test. Similarly, Secules et al. (1992) investigated the effects of videos on foreign language learning in an experimental study they conducted. They assigned two groups of college students – the first, the control group, were students studying in the spring semester. The experimental group was the following semesters' group of students taking the same course. The controlled and experimental groups were in different semesters and different students. However, tests found that the two groups were equivalent.

In addition to these original research studies mentioned above, there are two additional publications noteworthy for this literature review. These publications did not conduct studies but reviewed the available literature. A meta-analysis by Arikan (2014) looked at the online grammar materials from a communicative language teaching perspective. Not all the materials included in the review were video materials, but videos were part of the materials found. Arikan (2014) signed an inclusion criterion for him to collect data and analyze it. For example, he included only free access materials. He excluded materials that were very similar to pen-and-paper materials.

Major research findings and gaps in research

There is plenty of variables to decipher amongst any review of literature in second language studies, and this study is no different. However, the review thus far has made it clear that overall, most of these reviewed studies that are relevant to the current topic do reveal positive findings toward the involvement of videos in teaching grammar. For example, Chen (2018) found that videos that explain grammar rules are preferred more by learners than vocabulary or text explanation videos. Participants watched the grammar videos without skipping and refer to them before exams for revision purposes. In 2016, Al-Harbi and Alshumaimeri found a positive perception and attitude toward using videos that explain grammar rules before class in flipped classroom studies. They did not find statistical significance between experimental and controlled groups; however, the experimental group that watched the videos before class scored significantly higher than the controlled group (Al-Harbi & Alshumaimeri, 2016). Another study that used controlled and experimental groups in teaching grammar through videos found significant differences between the two groups (Saeedi & Biri, 2016). The experimental group which included videos in teaching grammar scored higher than the controlled group. Similar to the above study, participants revealed a positive attitude toward using videos in learning grammar.

Although most of the previous studies reported positive effects of videos on learning grammar, they have some limitations that must be addressed. Limitations of studies prevent generalizing results. For example, Merlo and Gruba (2015) investigated the competence of participants in learning grammar after taking a purpose-built grammar video tutorial. The study did not look for the participants' performance or attitude. It did not include a controlled group to compare with and find the difference in the effectiveness of the tool. Another example is Ilin et al.'s (2013) study which aimed to find the effect of the video when used as instructional material in teaching grammar to English for specific purposes students. The study found that the use of video for grammar teaching motivates English for Specific Purpose (ESP) students and save learning time. Although the study showed positive results of using video in a grammar course, the sample size of the study was only four participants. Moreover, the study did not provide details about the videos designed. Information provided about the videos limited to the length of teaching and the total length of the videos; teaching last for one month and videos were 24 hours in total. However, each video's length, that is, the number of minutes of the videos, was unknown. In addition, the study covered the ESP situations only.

Reviews of prior research and materials has shown crucial findings as well. Firstly, access to a variety of unlimited audiovisual effective and efficient language materials is much easier today (Tschirner, 2001). However, Arikan (2014), who reviewed the online grammar teaching materials, warned instructors of the grammar digital materials available online. He said, "Teachers should be careful about the nature of such online materials for they will inevitably create boredom on students' part while continuing the rule-based tradition of grammar teaching alive. This, in return, will make young learners' dissatisfaction with online materials the result of which may be refraining from using them all together" (2014, p.22).

After reviewing the literature for this research, I found an absence of studies in some narrow areas in the literature. Only one study (Merlo & Gruba, 2015) found designed customized videos, 12 minutes long, to teach grammar based on educational principles. According to my knowledge after reviewing the literature, there is no study found in the related literature that is conducted in the second language learning situation. In conclusion, the knowledge base of the field of the instructional video, cognitive load, and motivation of grammar learner is still in need of research to collaborate in filling its gaps.

Insights Gained from the Literature

After an extensive review of existing scholarship related to the theories, methods, and analytical approaches of the current study, the primary insight gained here is that, of the most relevant prior research on using videos in teaching grammar, existing studies have not paid great attention to cognition or motivational aspects in the video design or learning process. Considering the theoretical aspects of learning and teaching are what stabilize the bases of any educational work, it seems therefore that designing educational videos that teach language grammar can and should be done based on a theory that is related to the content of the videos or design principles.

When implying instructional video, it is necessary to consider a design base of the videos. The base could be an instructional technological base like Mayer's Principles of Multimedia Instructions (2014b). When designing any educational material, designers can use Mayer's principles to guide their design. Mayer's principles could result in a design that presents more appropriate multimedia instruction for the learner (2014b). The selection of which principle to follow depends on the content of teaching. Instructional videos could follow language principles. For example, if instructional videos are designed for teaching or supplementing idiomatic lesson, Lontas's Principles and Practices of Understanding Idiomaticity could easily be used for more

effective learning outcomes (Liontas, 2018a). Those principles are designed for second language teaching and learning situations (and more specifically, they are aligned with idiom-learning activities and task-based digital projects which make them suitable to be followed not only for this study but for others beyond the scope of the current study.)

Lastly, the review carried out in this chapter has revealed that when the instructions of the video are directed by a digital agent, then principles of pedagogical agents best to be followed. For example, the social cues theory includes four principles of multimedia design – the personalization, voice, image, and embodiment principles. Such theories and principles help in forming a clear pedagogical base of instructional materials used in teaching and learning. The current study is shaped significantly thanks to prior researchers and their published knowledge on related variables.

Based on the above literature and the sub-categories of the cognitive load, the first research question of this study investigated four hypotheses. Hypothesis 1 predicted that applying the embodiment principle will result in different cognitive load scores. This prediction was based on the literature above, specifically Mayer's (2014c) illustration (see Theoretical Justification) of the presence and absence of social cues in multimedia instructional messages, as well as the level of social responses and cognitive processing of the learner. Consequently, the HEA video includes a dynamic agent which may activate the social responses of the learner which would lead to increase in active cognitive processing more than the LEA video. This is due to the fact that the LEA video includes a static agent whereas the VOA's agent is off-screen.

Hypothesis 1-1 did not predict any differences between groups since it investigated the intrinsic load which is the complexity of information. It should be noted that the three videos used in the current study were identical in terms of the content and design. The only difference was in the appearance of the pedagogical agent. Hypothesis 1-2 investigated the extraneous load

which concerns the design of the instructions. Based on the embodiment principle, an instructional message with a pedagogical agent of high humanlike features is considered a better design than an instructional message with a pedagogical agent of low humanlike features or no agent. According to Mayer (2014b), instructional message that results in high extraneous load is a poor design. Consequently, it was predicted that the HEA group will result in lower extraneous load. Hypothesis 1-3 predicted higher germane load scores in the HEA group. According to the Social Agency Theory, instructional messages with social cues result in deeper learning. The HEA group with high social cues would lead to deeper learning which involves high germane load.

Chapter Summary

This chapter presented a detailed review of previous studies in the literature related to the current study. To summarize, in the field of foreign language teaching and learning, the embodiment as one of the digital agents' features in the multimedia environment was found to be vague, and further research is necessary to examine the appropriate presentation of the agent in language learning multimedia environment. Secondly, this chapter has offered an in-depth synthesis the theories, methods, and analytical approaches used in existing scholarship and how the current study addresses prevailing gaps in the scientific study of language learning. To contribute to investigating the topic, this study linked the embodiment principle to language teaching, video technology, motivation level, and cognition load where there is no prior study found combined the five topics. Finally, this chapter has presented what insights were gained from the review in regard to the implications of the current study, its possible limitations, and its contributions for studying the employment of pedagogical agents in instructional videos for teaching grammar.

Chapter Three: Methodology

Overview

The term “methodology” combines in its meaning the theory and the methods which work together in developing a specific plan for the research procedure (Leavy, 2017). As a result, before discussing the methodological aspects of the research, this chapter also covers a more detailed description of some of the theoretical aspects mentioned in chapter two.

The primary purpose of this study was to find the effects of pedagogical agents’ embodiment level on the learners’ cognitive load, motivation, and grammatical performance. A quantitative analysis of three levels of the independent variable experimental design was employed. Three levels of the embodiment – high-embodied agent (HEA), low-embodied agent (LEA), and voice-only agent (VOA) – were designed for pedagogical agents’ presentation in three instructional videos. Data on cognitive load, motivation, and grammatical performance were collected using several instruments to answer the three research questions:

- 1) What is the effect of applying the embodiment principle to an instructional video on second language learners’ cognitive load?
- 2) What is the effect of applying the embodiment principle to an instructional video on second language learners’ motivation?
- 3) What is the effect of applying the embodiment principle to an instructional video on second language learners’ grammatical performance?

The findings of this study demonstrate the appropriate level of embodiment of an agent’s presentation in instructional videos designed for English language learning (ELL) students

learning a grammatical concept. This chapter begins with a description of participants, then the research design and variables, followed by the context of inquiry, and then a description of the video design. Finally, measures, a pilot study, the data collection, and an overview of data analysis procedure, privacy, and ethical consideration are presented in this chapter.

Participants

The Saudi English language students at the college level who are learning English as a foreign language in Saudi Arabia was the target population for this study. The sampling frame was all college students enrolling in a university and majoring in the English language. For this research sample, participants were recruited from Imam Mohammad Ibn Saud Islamic University (IMSIU), a large public university located in the central region of Saudi Arabia. This university offers an English Language and Literature undergraduate program. Applicants to this program take a language proficiency test and the acceptance to the program depends upon the applicants' performance in the test. Applicants who score high are placed in level one of the undergraduate program. Those who score average are placed in the preparatory year program—a college year with a concentration in English language courses precedes the English Language and Literature program. Students who score below average are excluded from the program. According to the university criteria, the preparatory year students' English proficiency is intermediate. In the preparatory year, students take a variety of courses about different language skills, one of them is the Grammar course. Participants of this research are preparatory year students of the English Language and Literature program who were enrolling in the Grammar course.

Imam Mohammad Ibn Saud Islamic University, who provides this study's participants, supports researchers who are conducting a field study and obtaining scientific and statistical data and facilitates their tasks. Facilitating Researcher Task application was a requirement before

gathering data. The Task Facilitation approval letter is attached in the appendix (L). In terms of human subject protection, the federal and state agencies and programs for the conduct of research at USF require researchers of social and behavioral research permission to conduct their research. The University of South Florida Institutional Research Board (IRB) reviewed and approved this research. The IRB approval letter is attached in the Appendix (K).

This study aimed to include 54 participants as a minimum number of participants. The number of participants was calculated by G*Power software. Dörnyei (2007) gives examples concerning sample size for the various types of quantitative studies. For comparative and experimental procedures – at least 15 participants in each group. Thus, the minimum number of participants according to Dörnyei is 45 participants. During the semester of Spring 2020, the IMSIU had 520 students in the preparatory year and all of them are enrolled in the Grammar course. The students' first language was Arabic. The English language proficiency level of the students was intermediate. The proficiency level of the participants was determined by the language proficiency test in the university place before enrolling in the program.

A total number of 108 students from the Grammar course were recruited for gathering this study's data. Since the research sample is 520 students and responses received from 108 students, then the response rate is 20.76% of students in the Grammar course. The results of the demographic data collected from participants are presented in chapter 4. The demographic information includes age, gender, English proficiency self-rated level, and their preferred learning style.

Research Design

This study is experimental research followed by quantitative method design. Patricia Leavy (2017) defined quantitative research as follows:

“Quantitative research is characterized by deductive approaches to the research process aimed at proving, disproving, or lending credence to existing theories. This type of research involves measuring variables and testing relationships between variables to reveal patterns, correlations, or causal relationships. Researchers may employ linear methods of data collection and analysis that result in statistical data. The values underlying quantitative research include neutrality, objectivity, and the acquisition of a sizeable scope of knowledge (e.g., a statistical overview from a large sample). This approach is generally appropriate when your primary purpose is to explain or evaluate” (p. 9).

Experimental research is one of the quantitative research methods forms, and it is considered the oldest form of quantitative research (Leavy, 2017). In 2002, Shadish et al. (p. 2) defined the word *experiment* in research as “taking a deliberate action followed by systematic observation”. In the field of social and behavioral science, the term *experiments* is further explained by Leavy (2017): “As a research method in the social and behavioral sciences, experiments are systematic and controlled but still involve the basic protocol of creating a test to see if what you predict will happen, does happen” (Leavy, 2017, p. 94). Experimental research, therefore, depends on the hypothesis. The experimental role is to test the hypothesis then prove it or deny it. The researcher selects study subjects, does treatment to them, then observes if there are any changes that occur (Babbie, 2013).

This experimental study involves treatment with the use of tests and surveys as the primary method of measuring data. Similar previous studies followed a quantitative research approach and were able to bring new data to the literature (e.g., Lusk & Atkinson, 2007; Mayer & DaPra, 2012).

The quantitative data collected for the current study provides the study with statistics that aim to answer the research questions.

The research questions are aligned with the research experimental approach, which is based on causal logic. In other words, “The experiment is the most powerful quantitative method for establishing a cause-and-effect relationship between two or more variables” (Gall et al., 2007, p. 379). Three research questions were formed to investigate the validity of six hypotheses. The first research question examined the difference between the agent presentation of three levels, which were the high-embodied agent, low-embodied agent and voice-only agent (as an independent variable); and the learners’ cognitive load (as a dependent variable). The cognitive process involves three kinds of sub-processes, extraneous processing, essential processing, and generative processing.

The first research question included an independent variable of 3 levels which were the HEA, LEA, and VOA was examined in detail by measuring the cognitive load level and the three kinds of the cognitive process which formed the first four research hypotheses.

The second research question examined the difference between the agent presentation of three levels the HEA, LEA, and VOA (as an independent variable) and the learners’ motivation (as a dependent variable). The second research question tested hypothesis number two of this study.

The third research question examined the difference between the agent presentation of three levels which are the HEA, LEA, and VOA (as an independent variable) and the learners’ performance (as a dependent variable). This question tested the academic outcome after applying the embodiment principle on the pedagogical agent. It investigates hypothesis number three.

Research variables

There are dependent and independent variables in this study. The study is comparing three embodiment levels of the pedagogical agent presentation in instructional videos which form three groups of participants for the study – two experimental (HEA and LEA), and one controlled (VOA). The three embodiment levels of the pedagogical agent presentation in the instructional videos form the independent variable of the study. The cognitive load process, level of motivation, and performance score were measured, all of which form the dependent variables.

Independent Variables—Three presentations of the pedagogical agent were the three levels of the independent variable of this research. One instructional video included in its design a high-embodied agent HEA (experimental). The other instructional video included a low-embodied agent LEA (experimental). The third included only the voice of the agent VOA (controlled). The appearance of the agent on-screen is the only difference among the groups. All other elements of the three videos are the same, including content.

Dependent Variables— The dependent variables are the cognitive load, the levels of motivation, and the performance scores. The questionnaire for measuring cognitive load includes questions for the three subdivisions of cognitive load analysis, which are germane, extraneous, and intrinsic. The cognitive load (total) is a dependent variable, and the three subcomponents (germane, extraneous, and intrinsic) are three different variables as well. These questionnaires were filled by the participants after the treatment. Levels of motivation were measured by the outcome of the surveys which participants took after the treatment. Performance tests indicated if there was a difference in the participants' understanding of the grammar material of the video. The participants' performance scores were measured by a grammar test after the treatment.

Context of Inquiry

This research study was conducted in 2020 during the Coronavirus (Covid-19) pandemic. The academic sector in Saudi Arabia turned to work remotely and the educational process resumed online. Therefore, the setting of conducting this study was changed. Instead of conducting the study in a computer lab in the university with the attendance of the researcher and participants, a link was sent online to the participants to participate from home. An email was sent by the grammar course instructor to the students' emails. The email includes an invitation to participate in the study and a link at the end of the email. The link takes the participants directly to the study website. Participants had the choice to do the study at any time and any place using either computers or mobile devices.

Participants were undergraduate students enrolling in the Grammar course at the university. They watched a tutorial followed by a grammar test and two questionnaires, all in one session. Participants took the intervention presented in the tutorial before taking the corresponding grammar lesson of their course. The rationale was to control the course lesson in their curriculum from effecting the study results. It is important to mention that participants received the same link; however, they were randomly selected to which video they were watching. They were divided equally between the three videos.

To participate in the study, participants had to have a computer device, a monitor, a mouse, and an audio player, or a smart mobile device to take the assessments and participate in the questionnaires. If using a computer, participants used the mouse to play and pause the video and to control its volume. A keyboard was used to access the study page online.

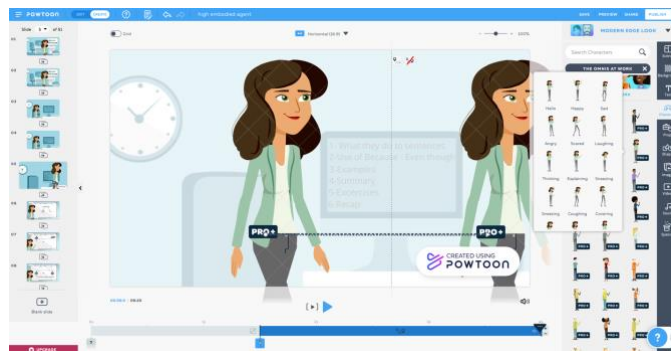
Video Design

Instructional materials

The instructional videos were designed by the researcher using PowToon online software. PowToon is a website that provides online video design software. Using the software, users can create animated video integrated with audio. In this study, the agent's role was instructing and explaining the learning material to learners. The audio was an animated pedagogical agent talking. A screenshot of the software page while designing the video is presented in Figure 2. The study included three videos and the agent's features of appearance were different in each of the three videos (HEA, LEA, and VOA). However, all other elements of the videos were identical. Each participant watched one type of video to learn a grammatical concept. Since the videos were designed by the researcher, they were reviewed by experts in the fields of the Second Language and Instructional Technology to ensure their validity.

Figure 2

PowToon Software design page



Instructional videos of the high-embodied agent (HEA). The first experimental group video included a high-embodied agent. The high-embodied agent is an animated dynamic pedagogical agent that appeared in most of the screens, and this agent was given more detailed features of a human that were not given to the low-embodied agent. Specifically, the high-

embodied agent presenting the material (Figure 3) was animated to speak and move in a manner closer to how a human would speak and move with the features of gesturing, movement, eye contact, and facial expressions (Mayer, 2014c). The learner was able to see these features. The only options participants were able to choose while watching the video was pausing and playing the video. The video included motions and sounds.

Instructional videos of the low-embodied agent (LEA). The video for the second experimental group included a low-embodied agent. The low-embodied agent is a pedagogical agent that is animated, but more static than the high-embodied agent. Like the high-embodied agent, this agent also appeared in most of the screens. The video was identical to the first experimental group video apart from this low-embodied agent lacking the humanlike features given to the high-embodied agent (Figure 4). Like the first experimental group, the only controls participants can choose from while watching the video was pausing and playing the video. The video included motions and sounds.

Instructional videos of the voice-only agent (VOA). The third video was for the control group. It included only an off-screen agent, meaning the agent's voice was the only feature included in this video. The video was identical to the two experimental groups' videos except for the fact that this video was without the presence of an agent on screen (Figure 5). Again, keeping all other variables constant, the only options participants had while watching the video was to pause and play the video. The video included motions and sounds.

Intervention

The following table presents an overview of the intervention of the study. The study's intervention mainly relies on the differences in appearance and movements of the pedagogical

agents that were added to instructional videos that taught a concept of English grammar. A definition of each intervention is provided in the ‘Definition’ column. The ‘Design Principle’ column reveals which instructional principle was followed in designing the video agent. Finally, examples are provided from the current research instrument and supported by screenshots.

Table 1

Description of the Study Intervention

Study Intervention	Definition	Design Principles	Design examples
High-embodied agent video HEA (screenshots of the video are shown in Appendix F)	An instructional video that includes an on-screen agent of a high level of embodiment. The agent is moving her body and her lips while talking. The agent has some combination of real person features like gesturing, movement, and facial expressions.	The Embodiment Principle (high-embodied agent) (Mayer, 2014c)	Figure 4 shows the third segment of the video (divided into 24 parts of the second) in which an on-screen agent stands in the middle of the screen greetings with her lips moving, her hands waving, her eyes blinking and the whole body is moving naturally while talking.
Low-embodied agent video LEA (screenshots of the video are shown in Appendix G)	An instructional video that includes on-screen agents but with a low level of embodiment, mainly of the agent’s static image on the screen. The agent displays fewer features of a real person than the high-embodied agent in the first video. The low-embodied agent’s gesturing, movement, and facial expressions are rare or not presented.	The Embodiment Principle (low-embodied agent) (Mayer, 2014c)	Figure 5 shows the third segment of the video in which an on-screen agent stands static in the middle of the screen greetings without moving any part of her body. The hand switches once from one position to the other statically without motion.
Voice-only agent VOA video (screenshots of the video are shown in Appendix H)	An instructional video that does not display an on-screen agent. Only the agent’s voice is included.	The Embodiment Principle (Mayer, 2014c) Embodiment is not applied	Figure 6 shows the third segment of the video in which an off-screen agent was greeting the audience by presenting her voice-only.

Figure 3

Screenshot of the third segment of the high-embodied agent video (dynamic agent)

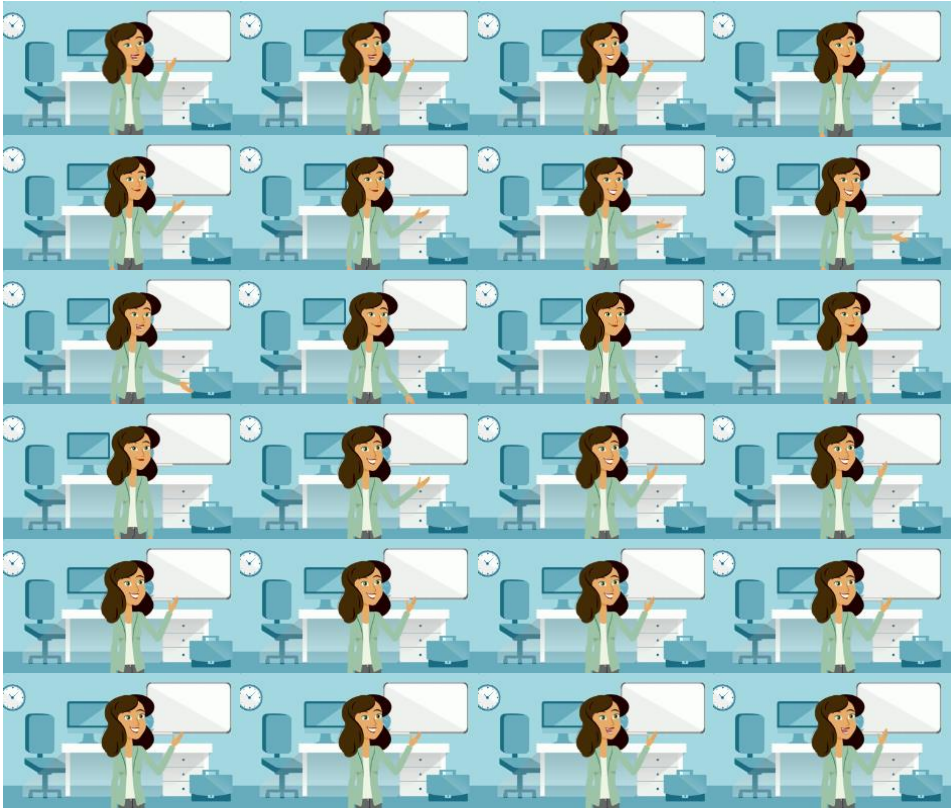


Figure 4

Screenshot of the third segment of the low-embodied agent video (static agent)



Figure 5

Screenshot of the third segment of the voice-only agent video (no agent)



The agent

The software used in designing the pedagogical agent for this dissertation video was PowToon online software. Animated characters in PowToon are predesigned and can be used directly in the software videos. A PowToon character was a good fit for designing the video of this dissertation in which the same character can be presented with animation (dynamic) or without (static). This feature served the design of the research groups (HEA, LWA, and VOA). The PowToon software contains a large selection of characters with a variety of styles grouped in families (see Figure 6).

The character of this dissertation was selected from The *Omnis at Work family* for two reasons. First, the characters of this family represent the workforce. Members of this family represent the educational sector with outfits that make them appropriate to represent pedagogical agents. Second, characters of this family can be presented in 44 different poses (Hello, Happy, Sad, Angry, Scared, Laughing, Thinking, Explaining, Sneezing, Sneezing2, Coughing, Covering, Typing, Sitting, Standing, Walking, Running, Talking, Phone, Texting, Applauding, Showing, Holding, Chilling, Stretching, Sleeping, Dozing, Crying, Confused, Talking2, Phone2, Texting2, Confused2, Pointing, Shrug, Dancing, Crunches, Squats, Yoga, Meditating, High Five, Selfie,

Working, and Working2). The range of poses of this character is notable because other characters have far fewer poses. A screenshot shows some of the variety of poses in the software presented in Figure 7.

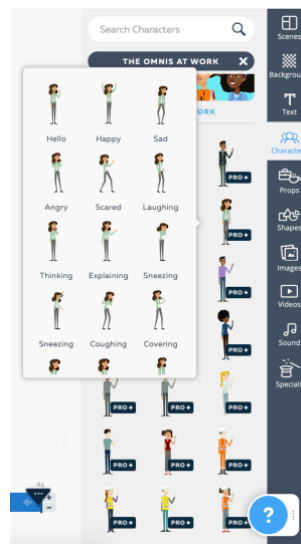
Figure 6

Families of PowToon software characters grouped by styles



Figure 7

Sample of the variety of poses for the character selected for this study



The *Omnis at Work* family has 28 characters with a variety of looks. The 28 characters were filtered, and one was selected and recruited to be the pedagogical agent of this dissertation's video. Other criteria that the researcher considered in filtering the characters of this family included gender, outfit, and ethnicity. All male characters were excluded since the audio recorded for the video belonged to a female. Outfits that represented other jobs than teaching were excluded. Characters wearing outfits with colors that did not match with the selected background of the video were also excluded, which was simply a choice of the researcher in valuing aesthetic appeal. The character selected to present the pedagogical agent of this dissertation is provided in Figure 7 and 8.

The role of the pedagogical agent in this video was as a guide and facilitator in transferring the desired content. The agent's size and position varied between scenes; participants sometimes saw only the upper torso of the agents' body, which was presented on different sides of the screen. Size and position variations were identical across the two-agent conditions (HEA, LEA). The agent was present for 6 minutes and 42 seconds of instruction (see Figure 8).

Figure 8

Samples of the agent's size and positions in screen



Audio

The audio of the video was the animated pedagogical agent's voice. The voice was a recording of a real human voice. The researcher carefully selected who would provide the agent's voice for this study, and the decision was based on a number of factors, those factors being: The voice belongs to someone who has a Ph.D. in Applied Linguistics; she is a native speaker of American English; and she has experience teaching foreign languages, ESL, and linguistics courses.

Lastly, Audacity Software was used to record and edit the audio clips. Audacity produced MP3 files that were integrated with the PowToon videos. No background music or environmental sounds were added to the video in order not to violate the coherence principle (Mayer, 2014b).

Video background

The coherence principle (Mayer, 2014b) was considered when designing the video background image. One main background image was used in the whole video (Figure 9). Two other backgrounds (Figures 10 and 11) were focus scenes from the main background. A total of three images only were used as backgrounds in the whole video in order to avoid extraneous overload (Mayer & Fiorella, 2014). Moreover, the backgrounds contain only three colors: white, gray, and shades of sky color. The main background image was selected from predesigned images in the software. The selected image has features that were not in other images including: theme, colors, and presentation elements. The theme of the image reflected an educational environment. The colors in the image were very few in order to save the audience from potentially being disturbed (Mayer, 2014b). The image contains a monitor and a board that was usable for presenting information in the video. Overall, the dimensions of the image were easily suitable for a humanlike agent to be added within.

Figure 9

The main background image used in the video



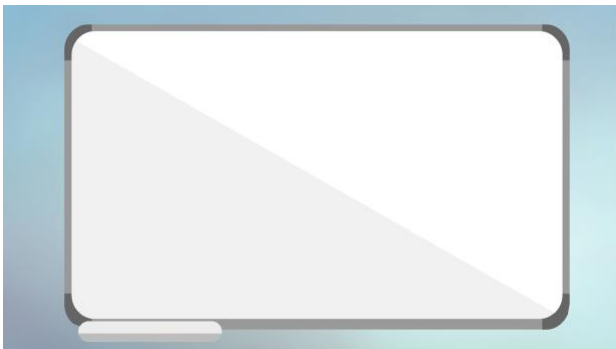
Figure 10

The working desk background image used in the video



Figure 11

Whiteboard background image used in the video



Content of the video

The content of the instructional materials used in this study contained a grammatical concept as part of a grammar lesson. To encourage participants to engage in and take this study seriously, the content of the multimedia instructional videos used in this study was adopted from the participants' grammar course syllabus. The participants were having the same grammar lesson as part of their course syllabus. Participants were notified that the content of this study

corresponded to what they were taking in their grammar course. The grammatical concept was from the participants' textbook which was published by an organization specializing in creating and publishing ESL materials. The grammatical concept was about expressing contrast using *because* and *even though*.

Measures

Demographic information

The questionnaire created for this study was used to collect data about the participants' demographic information. It included questions about the participants' gender, age, preferred learning style (e.g., visual, auditory, or kinesthetic), and how they self-rated their English proficiency level. It was the first task the participants carried out after they agreed to participate. The questionnaire was in the Arabic language to ensure the accuracy of the answers. It was a multiple-choice questionnaire and the estimated time to complete this survey was less than one minute. The demographic information questionnaire is provided in Appendix A.

Cognitive load

The cognitive load questionnaire was developed by (Leppink et al., 2013) to measure three types of cognitive load: intrinsic load (IL), extraneous load (EL), and germane load (GL). This questionnaire was used in the current study to measure the cognitive load of the participants concerning its three types. It is a 10-item multiple-choice questionnaire divided among the three types of cognitive load. Items 1, 2, and 3 all deal with the IL; items 4, 5, and 6 all deal with the EL, and items 7, 8, 9, and 10 all deal with the GL.

To reach an ideal situation in using an instrument, the data of the instrument scores should be reliable and valid (Creswell, 2014). According to AERA, APA, NCME, "Validity is the

development of sound evidence to demonstrate that the test interpretation (of scores about the concept or construct that the test is assumed to measure) matches its proposed use” (as cited in Creswell, 2014, p. 159). To validate the instrument, the 10-item questionnaire was examined in four studies. All four studies were conducted in the same Dutch university. The Cronbach’s alpha of 56 Ph.D. student participants revealed values of 0.81 for IL items; 0.75 for EL items; and 0.82 for GL items (Leppink et al., 2013). The questionnaire had been used in many previous studies, thereby assuring its validity (Gimino, 2002; Paas et al., 1994). The current study checked the internal consistency reliability of the cognitive load questionnaire responses by running a new Cronbach’s alpha statistic. The alpha coefficient for the total 10-items was 0.86, which is considered a high level of reliability. The new Cronbach’s alpha of the cognitive load subcomponents revealed values of 0.89 for IL items; 0.84 for EL items; and 0.97 for GL items. Leppink et al. (2013) provided evidence for the validity of the questionnaire in four studies based on its being reviewed by an expert panel of four specialized in the fields of Second Language Acquisition and Instructional Technology.

Table 2

Reliability Statistics of the Cognitive Load Questionnaire

Cronbach’s Alpha	N of Items
.860	10

The questionnaire answering format was a Likert-type scale and modified into an electronic delivery system. Participants were asked to respond to each statement by choosing from 0 to 10 in which 0 meaning not at all the case and 10 meaning completely the case. The questionnaire was translated into Arabic by a certified translation center. The translation accuracy was verified by applying the back-translation technique (Dörnyei & Taguchi, 2009). A bilingual instructor who

majored in SLL at the Saudi university participated in the back-translation task. The instructor translated the Arabic version of the questionnaire back to English and then the two texts were compared. The two texts – i.e., the original version, and the back-translated version – corresponded to each other, therefore indicating that the Arabic translation was accurate. Data collected from the cognitive load questionnaire answered the first research question. The cognitive load questionnaire is attached in Appendix (B).

Motivation

Reduced Instructional Materials Motivation Survey (RIMMS) (Loorbach et al., 2015) was used. This survey was used to measure participants' motivational reactions to the multimedia instructional video they learned from. The original Instructional Materials Motivation Survey (IMMS) was developed by John Keller in 2010 including 36-items (Keller, 2010). Then reduced to 12-items (RIMMS) by Nicole Loorbach, Oscar Peters, Joyce Karreman, and Michael Steehouder (2015). The survey includes four subscales, attention, relevance, confidence, and satisfaction, and each can be scored independently (Keller, 2010). Also, a total score of all items in the survey can be scored as well. The survey answering format was a Likert-type scale. Participants were asked to respond to each statement by choosing from the five following answers: (1) Not true, (2) Slightly true, (3) Moderately true, (4) Mostly true, (5) Very true. It can be used in different platforms; print-based self-directed learning, computer-based instruction, or online course that are primarily self-directed (Keller, 2010). The survey was modified into an electronic delivery system. Results of previous structural equation modeling indicated that the reduced version is preferred over the original one (Loorbach et al., 2015). Moreover, the reduced version is preferred in this study as well since it is shorter and the participants are doing all the study

procedures in one session. The reduced version reduced the tasks load on participants to complete their participation in this study. The estimated time to complete the survey is five minutes.

An extensive validation study was conducted to examine the RIMMS. Loorbach et al. (2015) reported Cronbach's alpha coefficient, an index of internal consistency reliability, for RIMMS as 0.70. the participants were 59, age-range 60-70. According to Creswell, “Reliability means that scores from an instrument are stable and consistent” (2014, p.159). A new Cronbach’s Alpha was run to measure the internal consistency and reliability of the survey after collecting the data. The alpha coefficient for the 12 items was 0.94 which is considered a high level of reliability.

Table 3

Reliability Statistics of the Motivation Survey

Cronbach’s Alpha	N of Items
.940	12

The survey has been tested previously proving its validity in measuring instructional materials used in teaching and learning (Loorbach et al., 2015). A panel with two experts in the field of Second Language Acquisition and Instructional Technology reviewed this survey. The RIMMS contains 12 items and the response scale ranges from 1 to 5. This indicates that the minimum score of the survey is 12, the maximum is 60 and the midpoint is 36. Scores of this survey cannot be designated a high or low since there are no norms for the survey. Results are to be compared with a pretest or with more than one group (Keller, 2010). The survey was translated into Arabic by a certified translation center. The translation accuracy was verified by applying the back-translation technique (Dörnyei & Taguchi, 2009). A bilingual instructor who majored in SLL at the Saudi university participated in the back-translation task. The instructor translated the Arabic version of the questionnaire back to English and then the two texts were compared. The two texts,

the original version, and the back-translated version corresponded to each other which was an indication that the Arabic translation was accurate. Data collected from the RIMMS answered the second research question. The RIMMS survey is attached in Appendix (C).

Grammatical performance

Participants' grammatical performance scores were measured by a grammar multiple-choice test (see Appendix D). The participants took the test after being exposed to the treatment. The test included questions testing the participants' knowledge about the grammatical concept taught to them in the instructional video. The test includes 12 items that were adopted from a grammar learning textbook (Azar & Hagen, 2009). All questions were developed to test the same lesson in the video. Before participating in the study, students had not yet reached the content of the video in their course. In other words, the grammar taught to them in the video was new material that they had not before seen in the course. The lesson was the last in the grammar course syllabus.

The test aims to measure the difference between the students' knowledge of the material after using each instrument and then to compare the results across each group. Each item of the test responses weighed one point and was classified into three groups according to the three videos. The validity of the 12-items of the test is based on the authors of the textbook who are experts in the field of teaching a second language. Moreover, the test was shown to two experts from the field of Second Language Acquisition and Instructional Technology. Data collected from the test answered the third research question.

Pilot Study

For the pilot study, the same experiment of the dissertation was conducted before the actual dissertation experiment. In March 2020, 10 participants from different academic backgrounds were

recruited for it. The demographic data indicated that they were 9 females and 1 male; 1 of them was 17 years old or younger, 3 of them were 18-22 years old, 6 of them were 23 years old or older. All of the pilot study participants were Saudi and spoke Arabic as a mother language, except for one participant who was bilingual from birth speaking both English and Arabic as mother tongues. Two participants were specializing in the English language; two more in instructional technology; one in teaching grammar; and the rest represented various other backgrounds. The pilot study participants received the study link and went through the study steps in which they evaluated the tutorial and tested the flow of the study.

The main purpose of the pilot study was to test the study's procedure. The pilot study ensured all logistics worked well including randomizing participants through videos, transitioning through the steps of the study, the functionality of the video, and the efficiency of the data collection instruments. It was also assessed whether the video length and language used in the data collection instrument were appropriate to participants' level. Participants reported that they did not encounter problems. The Grammar language teacher, who was the actual study participants' teacher, was one of the pilot study participants and she suggested shortening the video length. Overall, participants reported that they enjoyed taking the pilot study and watching the instructional video. In the end, there was flawless function of all of the study's design aspects, which included the link, the videos, the participants' randomization, the data storage, the tests, and the questionnaire. The pilot study was satisfactory to propose the success of larger study, which is detailed in the next two chapters.

Data Collection

Data sources

The data was collected in this study from three sources. The sources are: (1) a cognitive load questionnaire, (2) a motivation survey, and (3) a grammar test. Participants' answers provided quantitative data. The grammar test measured the gained academic knowledge after taking one of the three videos. The motivation survey measured the participants' motivation. Finally, the cognitive load survey measured the participants' cognitive load of three kinds (extraneous, essential, and generative). The three data sources work together in answering the research questions as well as in offering deeper insights into the larger issue of second language instructional technology.

Data-collection procedures

It is important to mention here that the data collection procedure was changed due to the COVID-19 pandemic which caused universities in Saudi Arabia to switch all classes into virtual meetings. Conducting this study with a face-to-face meeting in a university computer lab was impossible during Spring or Summer 2020. Therefore, the implementation was modified to online participation instead of face-to-face attendance in a computer lab. In both cases, the study was planned to be inducted electronically in which participants took the study session on their own personal computer devices. Nonetheless, the only difference was that participants took the study at home instead of a computer lab at the university.

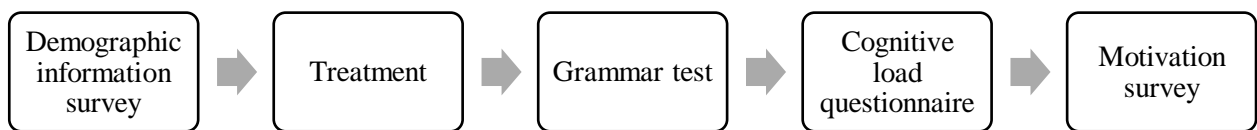
Data collection was in April 2020 and it took 5 days to be completed. The grammar instructors in the university sent invitation emails to students to participate in the study. Three days later the principle investigator asked the Grammar instructors to email students again urging them to participate in the study. The emails included a link that directed students who agreed to

participate to the study page. A total of 108 students participated in the study out of 520, as a 20.7% response rate.

The study consisted of one online session of 25-30 minutes including the instructional video, a test, a questionnaire, and a survey. After agreeing in participating in the study, the participants answered some brief questions to gather demographic information. The participants then were randomly assigned to watch one of the three instructional videos, which served as the research intervention; HEA video, LEA video, VOA video. The randomization was done electronically through Qualtrics software. Assigning students into groups for each video was done sequentially. Then, the videos played for 9 minutes and 20 seconds. After watching the instructional video, participants answered a grammar test, a cognitive load questionnaire, and a motivation survey. Below, Figure 12 presents a chart of the study procedure. All tests, surveys, and questionnaires were identical for all participants (see Appendixes B, C, and D).

Figure 12

Data-Collection Procedures



While carrying out the test for the study, participants were not permitted to go back to the previous step. For example, while doing the grammar test, participants could not go back to the video and watch it. Tests had to be done without interfering with the material. The decision to limit participants' ability to navigate back to the video afterwards was made in order to ensure that the

test results revealed what the participants gained from the treatment as it occurred with the varying three agent types. The estimated time to complete the whole procedure was thirty minutes.

Data-analysis procedures

To answer the first research question, four One-Way ANOVA tests and two Post Hoc tests needed to be conducted to find out the difference between the three kinds of cognitive load and the HEA, LEA, and VOA groups. The second research question required a One-Way ANOVA to find the difference between motivation and the HEA, LEA, and VOA groups. For the third research question, the differences between the three groups' performance and the HEA, LEA, and VOA groups were investigated using the One-Way ANOVA test. SPSS Software was used in the data analysis procedure.

Privacy and Ethical Consideration

As a requirement from the federal and state agencies and programs in the United States for the conduct of research at the University of South Florida (USF), an IRB approval from USF was obtained (see Appendix K). All participants were informed of the study's objectives and accepted their participation. Each participant agreed on Online Informed Consent before participation (see Appendix J). Potentially identifying information of the research participants was not collected. Participants knew before starting the study that their identifiable information would not be collected which gave them the confidence to share their experience. All electronic data were saved and stored on the principal investigator's password-protected computer. No one looked at the data collected documents except the researcher and the research team.

Chapter Summary

This chapter has described in full the research tools, framework, and the data collection and analytical procedures of the current study. This chapter has outlined how the study attempts to explore the effects of designing digital agents as facilitators in language learning instructional videos following Social Agency Theory on language learners' levels of cognitive load, motivation, and grammatical performance.

A quantitative research approach has been designed to achieve the purpose of this study and examine the research questions. A short video was designed and used as a medium for the treatment. The treatment was applying the embodiment principle in a pedagogical agent. Thus, three agents were designed, high-embodied agent (HEA), low-embodied agent (LEA), and voice-only agent (VOA), and each video presents one type of agent. Outcomes of the cognitive load were measured by a self-rating scale developed by Paas and Van Merriënboer (1994). Motivation outcome was measured by the RIMMS (Loorbach et al., 2015). A grammar multiple-choice test was implemented to measure grammar performance scores. The embodiment principle effect was tested by comparing scores among each group using One-Way ANOVA tests and Post Hoc tests. Data analysis of results is presented and discussed in the following chapter.

Chapter Four: Results And Discussion

The current study investigated the impact of the embodiment principle in pedagogical agents when it is applied to a specific application of Second Language Learning (SLL) instruction. Firstly, it sought to discover the influence of the embodiment principle on second language learners' cognitive load. Secondly, it investigated the impact of the embodiment principle on second language learners' level of motivation. Lastly, it examined the effect of the embodiment principle on second language learners' grammatical performance. The current chapter presents the findings of the study based on the data collection and analyses previously discussed. The organization of the results correspond with the three research questions. The software used for data analysis was SPSS software version 26. After presenting the results, this chapter includes a discussion of noteworthy findings in terms of how they contribute to knowledge presented by prior relevant literature.

Demographic Information

In the stages of data collection, some of the metadata collected for the study included demographic information of the study's participants. Participants filled out a brief survey about their age, gender, self-rated proficiency of English, and their preferred learning style. The questionnaire shows that the participants' age has a variation of 97.23%, ranging between 18 to 22 years old, with the remaining 2.78% falling in the category of 23 years old or above. What this shows is that the majority of participants were within the regular age range of most undergraduate students; that is, the participant group is representative of groups to which the findings of this study

may be applicable for educators or other researchers. As for their gender, 77.78% of participants were females, whereas 22.22% were males. females form the majority of participants. The survey included a self-rated English proficiency item. The answer to this item was a multiple choice of beginner, intermediate, and advance. Based on the answers, 70.37% of the participants considered themselves as intermediate. A quarter of participants (25%) assessed themselves as advanced in English, and only 4.63% rated themselves as advanced in their proficiency of English. Lastly, participants were asked to choose their preferred learning style. The choices were visual learning, auditory learning, kinesthetic learning, or nothing specific. The results of this question revealed that ‘nothing specific’ was selected by 61.11% of participants; visual learning type was selected by 21.30%; auditory learning type was selected by 12.96%; and the kinesthetic learning type was selected 4.63%. Consequently, apart from the participants who chose ‘nothing specific,’ the most preferable type of learning was the visual learning type.

Table 4

The Participants’ Demographic Information

Group	Number of Participants ^a	Age		Gender		Preferred learning style			
		18-22	23-above	Male	Female	V	A	K	N
HEA	38 35.2%	36 94.7%	2 5.3%	8 21.1%	30 78.9%	8 21%	4 10.5%	2 5.3%	24 63.2%
LEA	36 33.3%	36 100%	0 0%	10 27.8%	26 72.2%	6 16.7%	7 19.4%	2 5.6%	21 58.3%
VOA	34 31.5%	33 97.1%	1 2.9%	6 17.6%	28 82.4%	9 26.5%	3 8.8%	1 2.9%	21 61.8%

Note. HEA = high-embodied agent. LEA = low-embodied agent. VOA = voice-only agent. V = Visual, A = Auditory, K = Kinesthetic, N = Nothing specific.

^a Total *n* = 108.

Results and Discussion

Results: RQ 1- What is the effect of applying the embodiment principle to an instructional video on second language learners' cognitive load?

The first research question aims to examine the extent of influence of the embodiment principle being applied to an instructional video on the cognitive load of second language learners. A 10-item questionnaire was used as the measurement tool for the cognitive load dependent variable. Based on the used measurement tool, a total score of a cognitive load was collected as a sum of its three components: intrinsic load (IL), extraneous load (EL), and germane load (GL). A series of four tests of one-way ANOVA was conducted on the dependent variable "Cognitive Load" as well as on the three components "IN, EX, and GE scores."

Before proceeding to the ANOVA test, it should be noted that assumptions were tested to check if the data collected give a valid result. Cognitive load, as a dependent variable, measured at the interval level (i.e., they are continuous). The cognitive load was measured from 0 to 10. The independent variable was divided into three categorical, independent groups (HEA, LEA, VOA). Moreover, there was no relationship between the observations in each group or between the groups themselves; that is, there were different participants in each group with no participant being in more than one group (Table 5). Participants were randomly assigned to each group. Skewness and kurtosis were examined for all three groups (HEA, LEA, VOA). The scores in all groups are nearly zero, which indicates that the data are normally distributed. Figure 13 represents the data normality using Boxplot. The homogeneity of variances was assessed using Levene's Test. The *p-value* associated with the Levene's statistics is .57, which is greater than .05. This indicates that the assumption of homogeneity of variances has been met.

Figure 13

Box plot to represent data normality

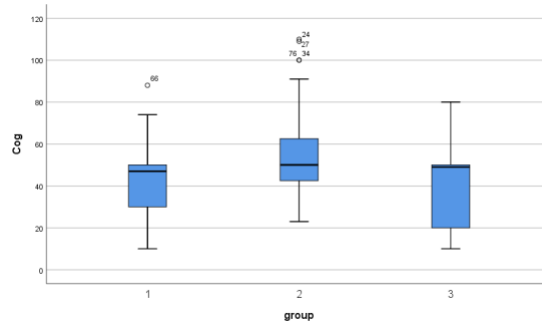


Table 5

Descriptive Statistics of the Cognitive Load Scores

Group	N	Mean	Std. Error	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
HEA	38	42.4474	3.11051	36.1449	48.7499
LEA	36	55.1944	3.89277	47.2917	63.0972
VOA	34	40.2059	3.54064	33.0024	47.4094
Total	108	45.9907	2.10956	41.8088	50.1727

Note. HEA = high-embodied agent. LEA = low-embodied agent. VOA = voice-only agent.

Based on the ANOVA test, there was a statistically significant effect of applying the embodiment principle to an instructional video on learners’ cognitive load. The p value associated with the $F(2,105) = 5.24$ is .007, which is below .05. This result was followed by the Tukey Post Hoc test to find the specific differences among the three groups. The score from the LEA group was significantly higher than the score from the HEA group, $p = .029$. The means showed that learners’ CL in the LEA group was higher than learners’ CL in the HEA, ($M = 55.19$, $SE = 3.89$) vs. ($M = 42.44$, $SE = 3.11$), respectively. In addition, the score from the LEA group was significantly higher than the score from the VOA group, $p = .010$. The means showed that learners’ CL in the LEA group was higher than learners’ CL in the VOA: ($M = 55.19$, $SE = 3.89$) vs. ($M =$

40.20, $SE = 3.54$). However, the score from the HEA group was not statistically significant with the score from the VOA group, $p = .895$. The LEA condition showed the highest total CL score with a mean of 55.19. The HEA condition showed the second highest total CL score with a mean of 42.44. The VOA condition showed the lowest total CL score with a mean of 40.20.

Table 6

Summarized ANOVA Test Statistics of the Cognitive Load Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4664.398	2	2332.199	5.237	.007
Within Groups	46762.592	105	445.358		
Total	51426.991	107			

Table 7

Summarized Tukey Test Statistics of the Cognitive Load Scores

(I) group_n	(J) group_n	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HEA	LEA	-12.74708*	4.90826	.029	-24.4160	-1.0782
	VOA	2.24149	4.98184	.895	-9.6024	14.0853
LEA	HEA	12.74708*	4.90826	.029	1.0782	24.4160
	VOA	14.98856*	5.04676	.010	2.9904	26.9868
VOA	HEA	-2.24149	4.98184	.895	-14.0853	9.6024
	LEA	-14.98856*	5.04676	.010	-26.9868	-2.9904

Note. HEA = high-embodied agent; LEA = low-embodied agent; VOA = voice-only agent.

Next, assumptions for the three components of Cognitive Load were tested. Intrinsic load (IL), extraneous load (EL), and germane load (GL), as dependent variables, were measured at the interval level (i.e., they are continuous). The independent variable was divided into three categorical, independent groups (HEA, LEA, VOA). There is no relationship between the

observations in each group or between the groups themselves. Moreover, there were different participants in each group with no participant being in more than one group; participants were randomly assigned to each group. Skewness and kurtosis were examined for all three groups (HEA, LEA, VOA). The scores of skewness and kurtosis do not violate the normality assumption. Figure 14 represents the data normality using Boxplot. The homogeneity of variances was assessed using Levene's Test. The p values associated with Levene's statistics for the IL, EL, and GL are greater than .05, which indicates the assumptions of homogeneity of variances were met.

Table 8

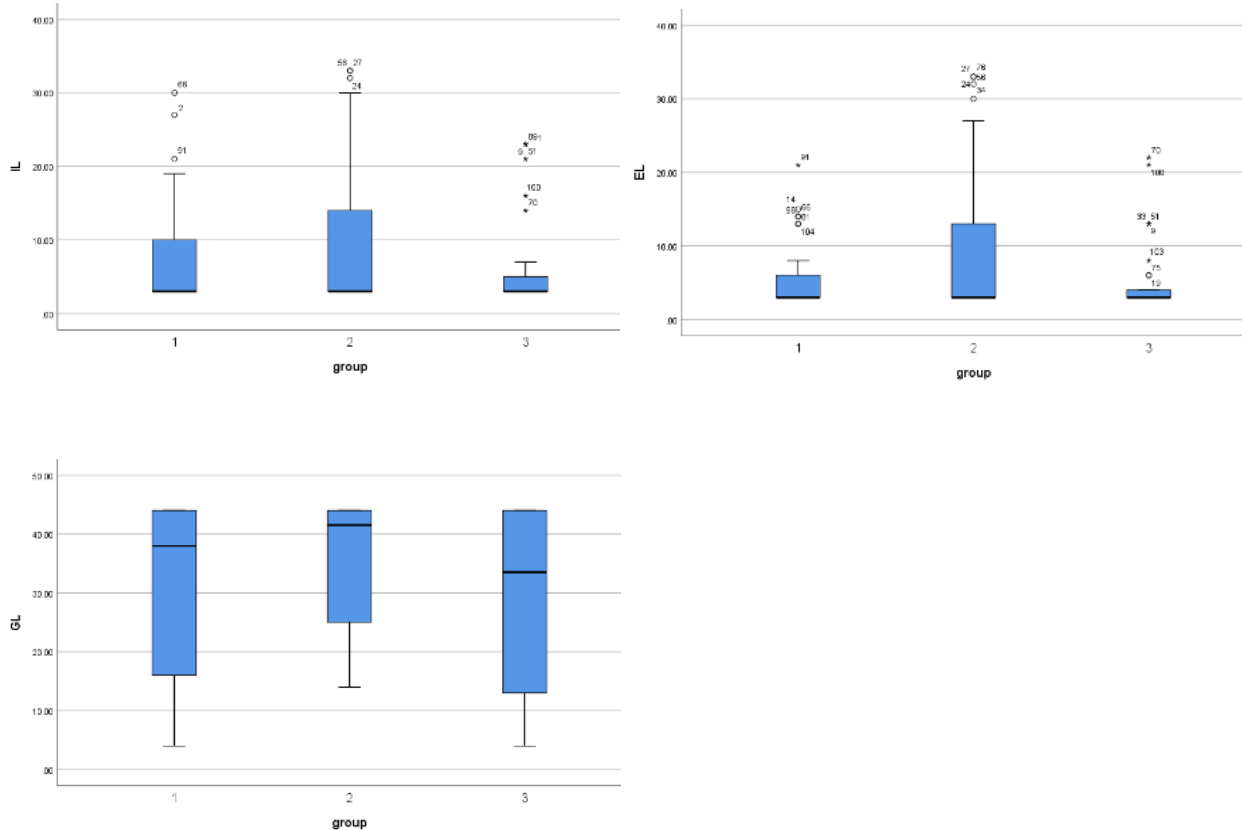
Descriptive Statistics of the IL, EL, GL Scores

Group	N	Mean	Std. Error	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
IL					
HEA	38	7.4211	1.20845	4.9725	9.8696
LEA	36	9.7778	1.68000	6.3672	13.1884
VOA	34	6.3529	1.14063	4.0323	8.6736
EL					
HEA	38	5.3158	.73628	3.8239	6.8076
LEA	36	9.4444	1.77793	5.8351	13.0538
VOA	34	5.3529	.86616	3.5907	7.1152
GL					
HEA	38	29.7105	2.48950	24.6663	34.7547
LEA	36	35.9722	1.69335	32.5345	39.4099
VOA	34	28.5000	2.77667	22.8508	34.1492

Note. IL = Intrinsic load; EL = extraneous load; GL = germane load; HEA = high-embodied agent; LEA = low-embodied agent; VOA = voice-only agent.

Figure 14

Box plot to represent data normality



For examining the three components of cognitive load (CL), an ANOVA test was done to each component. First, the ANOVA test of IL showed no significant difference: with the f value being $F(2,105) = 1.61$ ($p > .05$). Second, the ANOVA test of EL showed a significant difference among groups, with the f value of $F(2,105) = 3.81$ ($p < .05$). In order to determine which group was different, a Tukey Post Hoc test was performed. The results of the Tukey test indicate that there is a statistically significant higher extraneous cognitive load score of LEA condition than the HEA condition ($p = .044$). No other significant differences were found for the extraneous cognitive

load variable. The highest EL was in the LEA condition ($p = 9.44$). Third, the ANOVA test of GL showed no significant difference, f value is $F(2,105) = 2.87$ ($p > .05$).

Table 9

Summarized ANOVA Test Statistics of the IL Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	216.935	2	108.468	1.611	.205
Within Groups	7069.250	105	67.326		
Total	7286.185	107			

Table 10

Summarized ANOVA Test Statistics of the EL Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	405.654	2	202.827	3.812	.025
Within Groups	5586.864	105	53.208		
Total	5992.519	107			

Table 11

Summarized Tukey Post Hoc Test Statistics of the EL Scores

(I) group_n	(J) group_n	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HEA	LEA	-4.12865*	1.69653	.044	-8.1620	-.0953
	VOA	-.03715	1.72197	1.000	-4.1310	4.0567
LEA	HEA	4.12865*	1.69653	.044	.0953	8.1620
	VOA	4.09150	1.74441	.054	-.0557	8.2387
VOA	HEA	.03715	1.72197	1.000	-4.0567	4.1310
	LEA	-4.09150	1.74441	.054	-8.2387	.0557

Table 12*Summarized ANOVA Test Statistics of the GL Scores*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1146.962	2	573.481	2.871	.061
Within Groups	20977.288	105	199.784		
Total	22124.250	107			

Hypotheses regarding the first research question:

H 1: Second language learners in the three groups (the high-embodied agent, the low-embodied agent, or the voice-only agent) will show significantly different **cognitive load** scores as measured by the cognitive load self-rating scale questionnaire.

Based on the statistical analyses, there was a statistically significant difference in cognitive load between the three groups means. The p value associate with the $F(2,105) = 5.24$ is .007, which is less than nominal value .05 indicating a significant difference. This result supported the first hypothesis indicating that the embodiment principle affects the learner’s cognitive load.

H 1-1: There will be no significant differences in the **intrinsic** cognitive load scores measured by the three-factor solution questionnaire among second language learners who use instructional video of the high-embodied agent, who use instructional video of the low-embodied agent, and who use instructional video with a voice-only agent.

There was no statistically significant difference in the intrinsic cognitive load scores among the three groups. The p value associated with the $F(2,105) = 1.61$ is .205, which was above .05. Thus, this hypothesis is supported by this study.

H 1-2: Second language learners who use instructional video of the high-embodied agent will show significantly lower **extraneous** cognitive load scores as measured by the three-

factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.

Based on the statistical analyses, there was a statistically significant difference in extraneous cognitive load scores between the three groups. The f value was $F(2,105) = 3.81$ ($p < .05$). This result indicates that the embodiment principle affects the learner’s extraneous cognitive load. To examine hypothesis 1-2, a Tukey test was conducted to compare results among groups. Results indicated that there was a statistically significant lower extraneous cognitive load score of HEA video than the LEA video ($p = .044$). Therefore, this result partially supports hypothesis 1-2. That is to say, there were no significant differences between the HEA and VOA video groups ($p = 1.000$).

H 1-3: Second language learners who use instructional video of the high-embodied agent will show significantly higher **germane** cognitive load scores as measured by the three-factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.

The effect of the embodiment principle was not statistically significant on the germane cognitive load. The HEA scores of GE load was not significantly different than the LEA and VOA groups ($p > .05$). Thus, the hypothesis is not supported statistically.

Table 13

Relationship Between Research Question 1, Data Sources, Analysis Procedures, and Findings

Research Question	Data Sources	Analysis Procedures	Findings
What is the effect of applying the embodiment principle to an instructional video on second language learners’ cognitive load?	10-items CL questionnaire	One-way ANOVA	<ul style="list-style-type: none"> Statistically significant difference in CL between the three groups Statistically significant lower EL score of HEA than LEA

Note. CL = Cognitive Load.

Discussion

The agent's role in the video is that of a narrator of specific content. The agent was not necessarily a planned part of the learning content. Therefore, in terms of learners' cognitive load, the existence of an agent in the learning process could be critical. The results of the total cognitive load showed that the LEA group had the highest mean among groups. The existence of a static agent raised the load of the cognitive process of the learner. This result indicates that instructional videos of a static agent (LEA) result in statistically significant higher extraneous cognitive load scores than instructional videos of a dynamic agent (HEA) or voice-only agent (VOA).

Looking at the three components of the cognitive load, the EL was the only significant component among the three: IL, EL, and GL. When irrelevant items are added to a video and the extraneous cognitive load was increased, those items "serve to distract the learner" (Mayer et al., 2020, p. 849). The on-screen static agent in the LEA group significantly increased the EL of learners. This indicates that the static agent may distract the learners causing an increase in their EL which in turn limits the cognitive capacity available to engage in deeper learning.

Mayer (2014b) claims that an instructional design that results in an increase of the EL is typically caused by a poor design. According to Mayer's claim and the results of the current study, an instructional video using a high-embodied agent (dynamic), or an instructional video with a voice-only agent (off-screen), prove to be better designs than an instructional video that uses a low-embodied agent (static).

The result of the first question is consistent with the embodiment principle, in which the agent's body movements could affect the learner's cognitive processing (Mayer 2009, 2014c). This finding supports previous research which found that agents did not cause a distraction to learners when an agent was not essential to the instruction (Frechette & Moreno, 2010; Yee et

al., 2007). Park (2015) conducted an ANOVA test on cognitive load scores of three groups that differed in presenting narration. In one group, narration was a human voice; for the other groups, there was on-screen text narration, or there was no narration. Findings revealed a statistically significant lower cognitive load in the human voice group compared to the other two groups. Park's study results in support of the embodiment principle that is consistent with the current study. In contrast, the findings of no significant difference between HEA and VOA cognitive load in the current study do not necessarily contradict, but rather refine the results of Woo's (2008) and Clark & Choi's (2005) studies, both of which found an increase in cognitive load when an agent is presented in the instruction, but did not explore variation in types of agents like the current study has done. Moreover, a previous systematic literature review on the effectiveness of applying pedagogical agents into learning did not uncover a clear result of whether pedagogical agents impose extraneous cognitive load (Schroeder & Adesope, 2014). The current study revealed two significantly different levels of extraneous cognitive load mainly between LEA (which had the higher score of EL) and, HEA and VOA (which had the lower scores of EL). The two conditions – off-screen agent and dynamic agent – revealed a lower extraneous cognitive load than the static agent condition.

Results: RQ 2- What is the effect of applying the embodiment principle to an instructional video on second language learners' motivation?

The second research question aimed to examine the influences of the embodiment principle in its application to an instructional video on the motivation of second language learners. RIMMS was used as the measurement tool for the motivation dependent variable. A one-way ANOVA test was conducted to find if there was any significant effect.

Assumptions were tested before conducting the ANOVA test. Motivation, as a dependent variable, was measured at the interval level (i.e., they are continuous). The motivation was measured from 1 to 5. The independent variable was divided into three categories or independent groups: HEA, LEA, VOA. There was no relationship between the observations in each group or between the groups themselves. Moreover, there were different participants in each group with no participant being in more than one group. Participants were randomly assigned to each group. Skewness and kurtosis were examined for all three groups (HEA, LEA, VOA). The scores in all groups were nearly 0 which indicates that the data are normally distributed. Figure 15 represents the data normality using Boxplot. The homogeneity of variances was assessed using Levene's Test. The p value associated with Levene's statistics is .17, which is greater than .05, thus indicating that the assumption of homogeneity of variances has been met. The ANOVA test indicates that there was no significant effect on the motivation variable. The f value is $F(2,105) = 2.26$ ($p > .05$). This result indicates that the embodiment principle had no statistically significant effect on the learners' motivation.

Table 14

Descriptive Statistics of the Motivation Score

Group	N	Mean	Std. Error	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
HEA	38	46.5789	2.05218	42.4208	50.7371
LEA	36	51.0278	1.56423	47.8522	54.2033
VOA	34	45.4706	2.16981	41.0561	49.8851
Total	108	47.7130	1.13559	45.4618	49.9641

Figure 15

Box plot to represent data normality

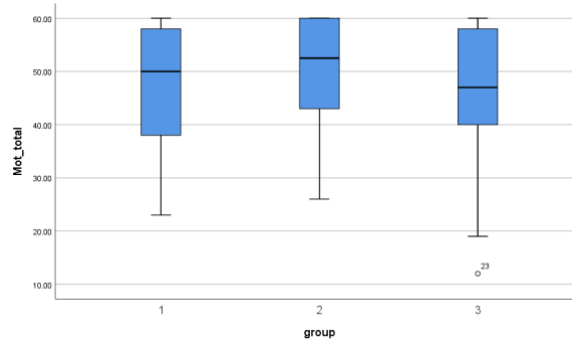


Table 15

Summarized ANOVA Test Statistics of the Motivation Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	615.396	2	307.698	2.261	.109
Within Groups	14286.706	105	136.064		
Total	14902.102	107			

H 2: Second language learners who use instructional video of the high-embodied agent will show significantly higher **motivation** scores as measured by the Reduced Instructional Materials Motivation Survey (RIMMS) than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.

There was no statistically significant difference in motivation among the three groups ($p > .05$).

The result of the ANOVA test did not support the hypothesis.

Table 16

Relationship Between Research Question 2, Data Sources, Analysis Procedures, and Findings

Research Question	Data Sources	Analysis Procedures	Findings
What is the effect of applying the embodiment principle to an instructional video on second language learners' motivation?	RIMMS	One-way ANOVA	No effect was found on motivation

Note. RIMMS = Reduced Instructional Materials Motivation Survey

Discussion

The results suggest that pedagogical agents in the three treatments are not effective in improving students' motivation for the learning material. This finding is consistent with previous research which has found that agents' appearance does not affect learners' overall motivation. Frechette and Moreno (2010), Domagk (2010), and Choi and Clark (2006) found no statistical difference in the motivation between groups that differ in the use of pedagogical agents. In contrast, Park (2015) conducted a MANOVA test on motivation scores of three groups which did show variation across narration presentation types. In a systematic review of literature regarding the implementation of pedagogical agents in learning environments, twenty-five out of fifty studies found significant results concerning agents' appearance on students behavior including motivation (Martha & Santoso, 2019). The current findings did not reveal a statistically significant difference between the groups, cf. Park (2015), whose findings regarding the embodiment principle offer conflicting results.

Results: RQ 3- What is the effect of applying the embodiment principle to an instructional video on second language learners' grammatical performance?

For measuring the participants' grammatical performance, a grammar test was conducted after watching the instructional video of the embodiment principle intervention. A one-way ANOVA was applied to the scores of the grammar test. However, before proceeding to the ANOVA test, assumptions were tested. Grammar performance, as a dependent variable, was measured at the interval level (that is, they are continuous). Grammar scores were measured from 0 to 12. The independent variable was divided into three categorical, independent groups (HEA, LEA, VOA). There is no relationship between the observations in each group or between the groups themselves. Moreover, there were different participants in each group with no participant

being in more than one group; participants were randomly assigned to each group. Skewness and kurtosis were examined for all three groups (HEA, LEA, VOA). Scores in the HEA and LEA groups were nearly 0, which indicates that the data are normally distributed. However, the VOA group was not normally distributed. In this case, the violation of normality was considered acceptable due to ANOVA's robustness (Field, 2013). Figure 18 represents the data's normality using Boxplot.

The homogeneity of variances was assessed using Levene's Test. The p value associated with the Levene's statistics is 0.85, which is greater than 0.05 and, therefore, indicates that the assumption of homogeneity of variances has been met. The result of the ANOVA test on the grammar scores of the three groups was not statistically significant. The p value associated with the $F(2,105) = 0.28$ was .76, which is more than the nominal value of .05, therefore, indicating that there is no significant difference. In other words, there was no statistically significant effect of the embodiment principle on the learners' grammar performance ($p > .05$).

Table 17

Descriptive Statistics of the Grammar Scores

Group	N	Mean	Std. Error	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
HEA	38	11.18	.277	10.62	11.75
LEA	36	11.00	.258	10.48	11.52
VOA	34	10.88	.329	10.21	11.55
Total	108	11.03	.16	10.69	11.35

Figure 16

Box plot to represent data normality

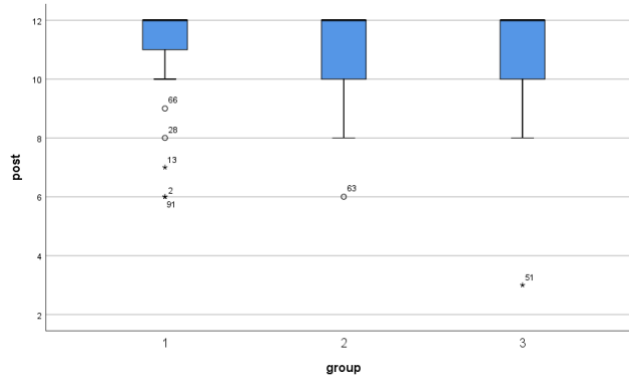


Table 18

Summarized ANOVA Test Statistics of the Grammar Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.677	2	.838	.281	.756
Within Groups	313.240	105	2.983		
Total	314.917	107			

H 3: Second language learners who use instructional video of the high-embodied agent will show significantly higher grammatical performance scores as measured by a 12-items grammar test than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.

There was no statistically significant effect among the three groups (HEA, LEA, VOA) in their grammatical performance scores ($p > .05$). Thus, this hypothesis is not supported here.

Table 19*Relationship Between Research Question 3, Data Sources, Analysis Procedures, and Findings*

Research Question	Data Sources	Analysis Procedures	Findings
What is the effect of applying the embodiment principle to an instructional video on second language learners' grammatical performance?	Grammar test	One-way ANOVA	No effect was found on grammatical performance

Discussion

Results revealed no significant effect of the embodiment principle on the performance of students' grammatical assessment. Participants' performance was consistent with their motivation in which both recorded no significant difference between groups. However, the cognitive load in the HEA showed significantly lower EL than LEA. Consequently, the reduced level of EL in the HEA condition assumes a better outcome (Zhang, 2013). Results show that learners' EL level does not affect their grammar performance. Therefore, this study is consistent with Park's (2015) study, which involved the application of the embodiment principle into six conditions treatments and revealed no significant effect of the principle on achievement. In contrast, a previous systematic review related to the design of pedagogical agents and their impact on learning environment found that implementing pedagogical agents had a positive impact on learning outcomes. The review included 50 studies, of which 76% revealed a significantly positive impact on learners' achievements by implementing pedagogical agents (Martha & Santoso, 2019).

Chapter Summary

This chapter discussed the analysis and findings of the data collected in order to answer three research questions that were previously unaddressed in the field. The study and its three unique research questions were analyzed using quantitative research methods. Research question 1

focused on the impact of the embodiment principle that was applied to a pedagogical agent in an instructional video on second language learners' cognitive load (CL). The researcher investigated whether the treatment affects the learners' CL or not. The questionnaire findings showed statistically significant results of the embodiment principle in reducing the CL, namely, in the mean score of HEA and VOA compared to LEA groups. However, no significant results were found between HEA and VOA groups. Table 20 includes a summary of the result of hypotheses 1, 1-1, 1-2 and 1-3.

Research question 2 inquired whether or not the embodiment principle that had been applied to a pedagogical agent in an instructional video impacts second language learners' motivation. The findings did not show a significant difference among the groups' level of motivation. This finding suggests that the embodiment principle has limitations in affecting second language learners' motivation, specifically when applied to a pedagogical agent in an instructional video environment. Table 20 includes a summary of the results of hypothesis 2.

Research question 3 investigated the impact of the embodiment principle that had been applied to a pedagogical agent in an instructional video on second language learners' grammatical performance. Findings indicated that the difference in scores of grammar performance across the three groups was not significant. This finding indicates that applying the embodiment principle to a pedagogical agent in an instructional video environment does not affect second language learners' grammatical performance. Table 20 includes a summary of the result of hypothesis 3.

Table 20*Summary for The Results of Hypotheses Tested in This Study*

Hypotheses	Results
H1: Second language learners in the three groups (the high-embodied agent, the low-embodied agent, or the voice-only agent) will show significantly different cognitive load scores as measured by the cognitive load self-rating scale questionnaire.	Supported
H1-1: There will be no significant differences in the intrinsic cognitive load scores measured by the three-factor solution questionnaire among second language learners who use instructional video of the high-embodied agent, who use instructional video of the low-embodied agent, and who use instructional video with a voice-only agent.	Supported
H1-2: Second language learners who use instructional video of the high-embodied agent will show significantly lower extraneous cognitive load scores as measured by the three-factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.	Partially Supported
H1-3: Second language learners who use instructional video of the high-embodied agent will show significantly higher germane cognitive load scores as measured by the three-factor solution questionnaire than second language learners who use instructional video of the low-embodied agent or instructional videos with a voice-only agent.	Not supported
H2: Second language learners who use instructional video of the high-embodied agent will show significantly higher motivation scores as measured by the Reduced Instructional Materials Motivation Survey (RIMMS) than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.	Not supported
H3: Second language learners who use instructional video of the high-embodied agent will show significantly higher grammatical performance scores as measured by a 12-items grammar test than second language learners who use instructional video of the low-embodied agent or instructional video with a voice-only agent.	Not supported

In sum, the study provides new evidence which show that learners who use LEA instruction score higher cognitive load (total) when compared to HEA and VOA. Additionally, the results of the study do not support whether the embodiment principle does or does not affect students' motivation or grammar performance. This chapter has described the data collected, presented the findings, and discussed the results. The next chapter concludes this study and presents the

limitations of the current study, the pedagogical implications, and some key directions for further research.

Chapter Five: Conclusion

Learning English grammar in an online learning environment can be boring and complicated. In an effort to remedy students' low engagement and motivation in language courses, pedagogical agents have been used in instructional materials to facilitate learning. However, the numerous elements of what a pedagogical agent does or does not provide in L2 instruction remain an understudied factor in the scholarship of fields like SLA and instructional technology. In an effort to further scientific understanding of how animated instructional agents in video instruction may increase the motivation, cognitive workload, and/or understanding of new L2 material, the current study aimed to provide supplemental learning material of a grammar concept, guided by an animated pedagogical agent, in a way that has not been studied previously.

The study started from the hypothesis that learning an English language grammatical concept through a customized video, which includes a high-embodied agent (HEA), could improve learners' motivation, cognitive load, and performance. The results of this study provide new information on the extent to which such a video likely does and does not improve students' learning experiences. Accordingly, the current chapter presents (1) limitations of the study, (2) detailed implications for HEA instructions in teaching and learning the English language within a multimedia environment and technology-based instruction, (3) future research directions, and (4) final thoughts of the study.

Limitations

No study is without limitations, and to appreciate the results of an empirical study also means to value the study's limitations. The most noteworthy limitations of the current study are presented herein.

First, the language of the original versions of the cognitive load and motivation variables surveys were in English. Participants were English language learners and, therefore, it is worth noting here that participants may have misunderstood the true meaning of the English survey items. In an attempt to bypass this limitation, the surveys were translated into the participants' first language, Arabic. The translation was done by first applying the back-translation technique (Dörnyei & Taguchi, 2009) to verify their accuracy. It could nonetheless be argued that doing so results in a new limitation; that is, the survey may not be identical to the English version. This limitation may be of consideration if the current study were to be referenced in future studies.

The achievement test could be another limitation of this study. Although it was adopted from a grammar book, and it was meant to test the students' knowledge of the grammar covered in the lesson, the participants' scores in the achievement test were high. The reason behind the high scores could be because the students already know the content, or because the questions were too easy. The format of the questions was multiple choice, which means it is possible for students to guess the right answers regardless of the certainty of their answer choice. Using different achievement tests in future research may result in different findings.

The setting of the study presents another potential limitation. Data was meant to be collected in a computer lab at the university. However, because of the Coronavirus (COVID-19) pandemic, the education sector including all universities in Saudi Arabia converted into a virtual system. Therefore, the requirement of attending a computer lab session to participate in this study

was modified into online participation. Thus, controlling the setting in a computer lab is likely to have resulted in a different data set. In terms of validation, the intended face-to-face setting may have equally resulted in increased validity in comparison to having to control the participants' activity online.

The sample size was affected also by the conversion to the online method of data collection. Again, it is possible that had the data been collected in the university, the grammar course students would have been invited to participate in person during their class period. The possibility of recruiting them could have been much higher. In online invitations, for instance, it is likely that some students may miss the invitation email. In such cases, participants would have fewer chances to partake in the study. In such cases, a much smaller sample size is expected. Although the number of participants was sufficient to conduct the present study, a larger sample size would provide even more robust results and details about the impact of the embodiment principle on an instructional video for language learning. Further research is thus needed to more fully understand the hypotheses that have guided the current study to this point.

Moreover, the conversion of the study to be conducted online affected the delivery method of the treatment. The study treatment (video) and questionnaires were designed to be taken through a computer device in a computer lab. Since the study was conducted online, the format of delivering the study had to be modified for both mobile and computer to facilitate participation. Furthermore, the online application of the study allowed participants to take the study at different times and locations. Therefore, participants' involvement in the study probably varied in time and place more than originally intended, which again may have affected the controlled timing and location as an extraneous variable.

Regarding the external validity, since the study was conducted using participants of one university in Saudi Arabia, the results cannot be generalized to include all Saudi language learners until similar studies are conducted in different contexts and considerable empirical evidence is collected. The results also cannot be generalized to include all language learners but only the intermediate students of English at the collegiate level. Additional research using similar theories, methods, and contexts applied in the current study are likely to contribute to furthering and strengthening our understanding of virtual agents, the embodiment principal, motivation, and cognitive load, and, furthermore, how each of these constructs may intersect in the language acquisition process of ESL students.

Implications of the Research

The current study applies the embodiment principle to a pedagogical agent in language learning videos for the purpose of investigating participants' cognitive load, motivation, and performance while using the target language. The principal claims that students learn more deeply when a pedagogical agent displays humanlike features. The findings revealed lower extraneous load in the HEA and VOA than the LEA. This section addresses the implications of HEA in instructional videos in the second language teaching/learning domain.

Firstly, the findings of this study suggest that instructional videos could be implemented with success for all language skills: listening, speaking, reading, and writing, including grammar and vocabulary. This study may be useful for teachers and/or creators of language learning content when choosing between materials with or without pedagogical agents. As seen, instructional videos play a variety of roles as a multimedia material in language classes, and pedagogical agents in such videos that are be designed to support explaining complex points of the lesson would help in facilitating an exercise, or in presenting a summary of a lesson.

Furthermore, pedagogical agents in instructional videos can be designed to facilitate complex aspects of language lessons. For example, in a grammar lesson, agents can explain the grammar rules of the target language by dividing segments of the grammar lesson into its own short video. If the video is about the present tense, for instance, the agent could explain the structure of the present tense along with representative examples. The pedagogical agent would illustrate examples with animations. Grammar video lessons could show a comparison between present tense and past tense of the same sentence. Instructors could add such videos to the lesson as supplementary materials at the beginning of a class. They could be uploaded online for students to refer to them at home while studying.

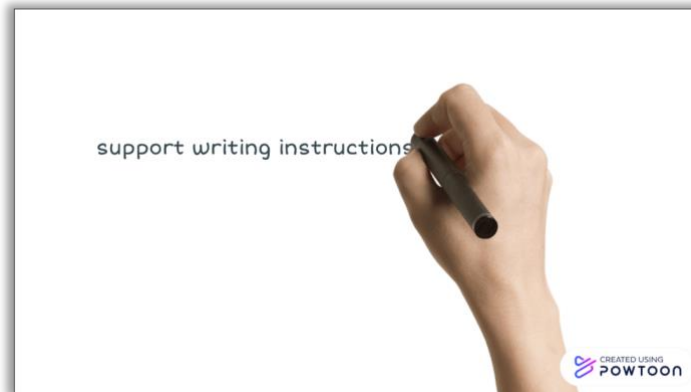
Pedagogical agents in instructional videos may be of particular use in facilitating the teaching of more complex learning content. For example, they could explain language word order in a language syntax subject. In syntax, tree diagrams are usually used to show the word position in a sentence and how the word position changes when certain aspects are changed, such as in active versus passive voice. An agent playing the role of the facilitator in the video, moving his or her body and pointing to the branch involved in the passive voice, is likely to engage students more than a video without such an agent.

The HEA instructional videos could be used for other language skills as well. For a writing course, instructional videos could be used as supporting materials in explaining writing structures. For example, HEA could present a brief explanation of writing skills along with related examples like using certain words and phrases in one or more sentences. The agent's humanlike features are not limited to promoting listening and speaking skills. They can support writing instructions like presenting a scene with the agent holding a pen and write. Presenting words in writing instead of

words popping up in the scene is a human movement that adds a social cue to instructions which may promote learning (see Figure 17).

Figure 17

Example of an agent writing a sentence



In a speaking course, instructional videos of HEA could provide the pronunciations of sounds with a focused scene on a pedagogical agent's lips while taking (see Figure 18). For example, the vowel sounds and how they are pronounced according to their positions in the word. Pedagogical agents can promote speaking learning materials by playing the role of a human who is talking to the learner. The agent can ask questions then pose for seconds to let the learner reply as if they are in real conversation. Virtual conversation between the learner and the agent offers many advantages. For instance, the HEA provides social cues that can prime the pragmatically appropriate social response of learners (Mayer, 2014c). The virtual environment is a private session between the learner and a digital agent, which may give learners a better opportunity to talk at the same time, thus simulating a sense of real social interaction. Although the agent is not a real person, learners can practice and learn social skills like eye contact with the agent while talking. Learners also can repeat the conversation as many times as they want for more practice.

Figure 18

Example of an agent talking



HEA in instructional videos could, in addition, be a useful medium for teaching reading strategies for second language learners. Agents as instructors could explain how to apply comprehension strategies while reading, for example, and how to guess the meaning of new vocabulary in the reading context. Agents' social cues appear in their movements, such as in pointing to specific words or sentences in a reading passage. In comparison, the same video explaining the strategy without an agent on-screen would lack the social cues of the agent, and, as this study and the corresponding research have shown, would likely be less engaging to the viewers of the video.

HEA could play an important role in listening skill video. The video could be part of an exercise in which the learner watches a video and then answers questions related to the video, for the purpose of practicing listening comprehension. A video that includes a talking HEA, in which the agent looks at the screen as if he or she is talking to the learner, is exemplified in Figure 18. In most listening courses, instructors provide sound clips then ask learners about them. In the suggested video, the face gestures and body movements of the agent effectively increase the social cues, which likely result in a higher quality of achieving the learning outcome.

In 2001, Alexander and Boud stated that “the online learning environment is just another physical environment: more complex than some others, but a new space for teaching and learning.” Research had been done investigating and comparing the two learning situations. Later in 2015, Reese urged the use of instructional technologies as supplemental tools for face-to-face learning: “In many circumstances, students must learn content without the assistance of face-to-face instruction and must keep track of weekly assignments through the use of virtual tools” (Reese, 2015, p. 37). Clearly, the debates of the learning situations are still ongoing and so further studies are needed, and a video is a technological tool that could potentially be used in both situations to help carry out future research. Similarly, studies on pedagogical agents’ features in instructional videos are necessary to contribute to the debate from the language-learning domain.

To reiterate, one of the main implications of the current study involves language instructors, who may find the application of HEA videos to be useful for a variety of purposes. HEA videos could be supplemental multimedia materials for any language lesson. Videos like the ones discussed here could also be used for practically any part of a language learning curriculum, and in a way that is beneficial to the students and the instructor. They could be added to the in-class instructions or as references that students refer to out of class. Instructional videos could be designed to be part of an exercise. For example, students could watch videos related to the lesson they just completed in class and answer questions while or after watching the videos. Instructional videos can be designed as summarizing material that sums up the whole lesson in a few minutes. These tools would be beneficial for students to watch them for review before exams. Moreover, designing a customized video for the purpose of teaching a specific lesson with an agent as a facilitator decrease the chances of extraneous materials that may be included in other videos. The

HEA application, usage, and benefit are not limited to what is mentioned here, but instructors and designers could use them according to the materials and situations they are dealing with.

In terms of video design, when language instructors are not skillful in video design, they could avoid designing customized video and adopt video clips from other sources that are not related to the content of the lesson. To avoid such a situation, it is suggested for language instructors to be aware of user-friendly video design applications or software like PowToon. With the development of the instructional technology domain, there are many options provided for designers to create their video and agent. Designers are not required to design the agent from scratch but use characters, images, and sounds that are already provided in the software. Some software provide dynamic characters, some provide only static characters, and some provide both dynamic and static characters.

Uploading contents or characters from the web is another feature that may facilitate designing a convenient video with the learning content. It is important, however, for anyone designing their own instructional video content to be warned of avoiding extraneous material and to include only what is needed to be presented in the video. Extra materials that are interesting but not related to the core content may harm the learning process in that they may increase the extraneous load of the learner. When designing an agent, all elements of the agent must be consistent to present an authentic environment. Elements of an agent such as age and gender should be considered to avoid confusing or distracting the learner. For example, when using a female agent image, the voice used should be a female voice. The social cue theory provides principles that can be followed in designing a pedagogical agent.

Finally, the implications of this research may be of interest to both teachers and curriculum designers of language programs. It may be of more interest, however, to the authors and publishers

of foreign language textbooks who are the industry that provides high quality learning materials (e.g., hard copies and electronic copies of course texts, classroom activities, practice exercises, assessments, games, internet resources, and more) to foreign language teachers and students across the continent, and a notable portion of these materials are in the form of video.

Directions for Future Study

Arising from the results of this study in combination with the discussion of its implications and its limitations, several issues have consequently been identified as areas of study that could be understood more fully through further investigation. This study has focused on the learners' cognitive load, motivation, and grammatical performance while applying the embodiment principle to instructional videos that teach English grammar. Further work investigating the embodiment principle from different directions may lead to a deeper understanding of the topic before us. Future research could be directed to study variables that provide further insight into the effects and functions of various methods of agent design, of video design, of research design, as well as differing learning situations (e.g., learners in a foreign language setting, learners of other languages, of other L1 backgrounds, of other ages, of other proficiency levels, to name only a few).

Concerning the design of the agent used in the current research, the agent's poses (that is, the varying positions of the agent's body) in the HEA video was predesigned in the PowToon software. The movements provided in the software were considered high-embodiment (dynamic) and the same pose without movement was considered low-embodiment (static). It may, therefore, be of interest to consider the use of other software in future research such that enables enhanced dynamic features of human agents in its design capabilities. As supported by previous research and the current study, enhanced dynamism of an agent would result in a higher level of

embodiment. Therefore, a study using a high-embodied agent designed using a different software with potentially different affordances of agent design would no doubt provide valuable insight on the extent to which the dynamism of human agents effectively leads to embodiment. Such insight on which computer programs may produce the most effective agents would no doubt be useful information for institutions, publishers, researchers, and teachers.

Future multimedia language-learning research will also need to provide details about the videos chosen for the studies, and the methodological role the video plays in these studies. Details of the studies' materials would need to include the content of the video(s), number of videos used, length of each video, source of the video(s), how the video is situated in the theoretical framework, and, where applicable, the learning and cognitive principles applied to the use of video. For future research on the use of video in L2 learning, it is highly recommended that all of these details be given attention in order to effectively understand the results. There are numerous variables of videos in L2 instruction that can easily overwhelm researchers who aim to pinpoint what the most beneficial instructional video looks like. The present study recommends that these details mentioned above are the ones that are the most crucial for researchers who want to dig deeper into the topic and contribute meaningful scholarship to the field of Computer Assisted Language Learning. Furthermore, while investigating the literature for the current study, it was difficult to find information about the videos used in prior research. For researchers who wish to refine the use of videos and instructional agents, this lack of information amongst a wealth of otherwise detailed studies signifies an urgent need to fill in those gaps. Therefore, researchers are encouraged to design their videos or adopt educational videos that were designed specifically for the same content of the language course, consequently repairing the shortage of information in the existing literature of video design for second/foreign language teaching and learning.

Naturally, there are various research designs that can be adopted in investigating the area of pedagogical agents in instructional videos and teaching grammar for second language learning. The present study adopted an experimental quantitative research method. However, it would be beneficial in achieving a more robust understanding if video agents are studied from other perspectives and for additional purposes. For example, researchers could design a case study research approach for a deeper, qualitative analysis of the topic. They could design a treatment for a longer period, for instance a semester-long study segmented into several sessions and compare the results with a controlled group. In addition to study duration, future studies could differ in terms of participants. The current research included 108 participants of L1 Arabic learners of ESL; researchers who have access to participant groups that are larger and/or of differing L1 backgrounds would offer a great many different lenses, which could result in valuable additions to the scholarship on this topic.

Comparing among the published studies on instructional videos in language learning, almost all the studies were investigated the foreign language (FL) situation. There is a considerable gap in the literature made by the shortage of studies done in the second language (SL) learning environment. Additionally, it is widely understood that there are countless differing factors between FL and SL learning environments such as different learning outcomes, the method of instruction, and the type and level of motivation, to name but a few factors. While studies on FL learning can be of some use to understanding the experiences of FL learners, it remains that the dissimilarities substantially diminish the usefulness of applying FL research findings to the SL setting. Therefore, future research focusing on the SL context may be more useful to the field at present than additional FL studies, as more attention to the SL context would attend to this current gap in the scholarship.

Due to fact that the current research was conducted in the midst of the Coronavirus pandemic (COVID-19), the research setting was converted from in computer-lab setting into an online setting. Instead of gathering all participants at the same time and place to take the study, which was the methodology originally proposed for the study, the participants' carried out their roles in the study remotely, from their homes. Students were instructed to work individually and were informed that their performance will have no effect on their class grade. Although the online setting was unavoidable for the current study, it is impossible to know to what extent, if at all, the participants interacted with one another during the study (e.g., communicating with a classmate using an electronic device). Therefore, there is a possibility that the study would have had different results if it had been conducted in the classroom since such a controlled setting would ensure that participants work individually. As a result, and under the presumption that schools return to conducting classes in the traditional face-to-face environment, a future replication of the current study could be done in which the setting is controlled within the physical classroom.

The present study used a pedagogical agent in the instructional video as a tool to motivate learners and decrease their cognitive load while learning English grammar. Considering this study is unlike any other, it could be used as a framework for future research in investigating other language skills. The embodiment principle could have different effects on learners' academic performance, differences that could be illuminated through the application of this framework to additional studies. Prior research relevant to the current study revealed an absence in investigating the embodiment principle on language learning. Further research of embodiment principle application in teaching language could contribute to the demining of instructional videos for language learning. In addition, future research on each language skill will help in knowing if there is a different effect of the embodiment principle across language skills. For instance, for

instruction on pronunciation and speaking, a video with a high-embodied agent may be found to differ in effectiveness in comparison to the same agent used in videos for teaching grammar. Moreover, the application of this framework could be tested in other languages. A comparison between the results of this research with a similar one applied to another language would add new knowledge to the literature of the fields of second language acquisition and instructional technology.

Final Thoughts

This study investigated the involvement of the embodiment principle within a multimedia learning environment to improve English language learners' cognitive load, motivation, and grammar performance. To examine the effect of the embodiment principle, the study designed three different videos in which three different levels of the embodiment principle were applied: a high-embodied agent (HEA), a low-embodied agent (LEA), and voice-only agent (VOA). Then, a comparison of the three videos was made, which in turn served as a comparison of the effectiveness of the embodiment principle when applied to an agent in instructional videos. The comparison was made in order to investigate how the embodiment of the agent intersects with other constructs related to learning. Firstly, the study examined how, if at all, the cognitive load differs across the three embodiment levels. Secondly, a measurement of student motivation was taken to explore whether the embodiment level impacts learners' motivation. Lastly, since learning is the core aim of any instructional material, learners' performance on a grammar test was also evaluated.

The results of the analyses revealed that for the participants who watched the instructional video with the high-embodied agent, the extraneous cognitive load was significantly less in comparison to the participants who watched the instructional video with the low-embodied agent. By applying the embodiment principle to instructional video agents, learners are provided with

spoken input that incorporates the kinds of paralinguistic cues (e.g., gestures, facial expressions) that occur in everyday social interactions. Therefore, this finding provides evidence that a high-level embodiment of agents effectively reinforces learners' comprehension of the spoken input, which makes the interaction feel more personalized, as verified by the reduction in cognitive load compared to the low-level embodiment. In other words, these results reveal that if an agent appears in the multimedia learning material, exposure to an agent with high-embodied features is more likely to lead to a reduction in learners' extraneous cognitive load. Further research is needed to find the cognitive load differences between bodied agents and voice-only agents. Reducing the amount of information that must be simultaneously processed in students' brains is vastly important as it means there is more working memory capacity that can be dedicated to understanding the content of the video. While the study did not show an immediate effect of this on learners' motivation, it is plausible that over a longer period of using high-embodied agents, the increased comfort afforded by the agent may indeed positively influence learners' motivation. In essence, the highlight of this study is the positive impact of high-embodied agents on learners' cognitive load compared to low-embodied agent because, as previous research has shown (Mayer, 2014c; Park, 2015), there may be ripple effects of cognitive overload in other aspects of an individual's language learning process.

Notwithstanding the implications of the finding discussed above, the current study contributes to filling a gap in the existing literature on second language acquisition and instructional technology. Specifically, this study adds to the knowledge of the field regarding video design, cognitive load, and the embodiment principle. It offers a novel theoretical and methodological framework in its combination of social cues, embodiment, video agents, cognitive load, and grammar instruction. This study provided explicit information regarding the design of

the videos; considering details of video designs were not included in previous studies, the current study is one of the first that builds a necessary understanding of the specific features in instructional videos that may be instrumental to the language learning process. Moreover, unlike prior studies that did not reference a pedagogical theory in which their videos aimed to put into practice, the starting point for the design of the videos used in this study was the embodiment principle, one of the social cues' instructional principles of The Agency Theory.

In closing, this study demonstrates that it is important to consider the many elements of multimedia that are used as a means for presenting language learning material for students of the current generation. As Prensky named the current generation 'digital natives' (Solak & Cakır, 2015), instructors are increasingly encouraged to incorporate instructional technology into their classrooms and lessons. Thus, research, like the present study, is needed if we wish to identify which digital teaching methods have the most advantageous effects in various fields and why. With this need in mind, this research explored but one specific element of digitally mediated teaching: the involvement of the embodiment principle presented as a high-embodied agent in instructional video material in the field of teaching and learning English grammar. Accordingly, the study demonstrated that when an agent is added to an instructional video, the dynamic agent is successful in reducing learners' cognitive load than static agent. The differences between the dynamic agent and off-screen agent needs further investigation. In anticipation of future research continuing to dig deeper into additional possible effects of the embodiment principle, in other settings, from other theoretical and methodological viewpoints, language classes may be supplied with multimedia certain to optimize the overall learning experience.

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Appendices

Appendix A: Demographic Information

1. Gender:
 - Male
 - Female

2. Age:
 - 17 or younger
 - 18-22 years old
 - 23 or older

3. How would you rate your English proficiency?
 - Beginner
 - Intermediate
 - advanced

4. Preferred learning style (visual, auditory, or kinesthetic)
 - Visual learning/ prefer graphs, maps, charts to learn
 - Auditory learning/ prefer listening and speaking to learn
 - Kinesthetic learning/ prefer physical and body activities to learn
 - Nothing specific/ you prefer more than one style to learn

Appendix B: The Cognitive Load Measurement

All the following questions refer to the activity (lecture, class, discussion session, skills training or study session) that just finished. Please respond to each of the questions on the following scale ('0' meaning not at all the case and '10' meaning completely the case):

0 1 2 3 4 5 6 7 8 9 10

1. The topic/topics covered in the activity was/were very complex. (Intrinsic Load - IL)
2. The activity covered formulas that I perceived as very complex. (IL)
3. The activity covered concepts and definitions that I perceived as very complex. (IL)
4. The instructions and/or explanations during the activity were very unclear. (Extraneous Load - EL)
5. The instructions and/or explanations were, in terms of learning, very ineffective. (EL)
6. The instructions and/or explanations were full of unclear language. (EL)
7. The activity really enhanced my understanding of the topic(s) covered. (Germane Load - GL)
8. The activity really enhanced my knowledge and understanding of vocabulary. (GL)
9. The activity really enhanced my understanding of the formulas covered. (GL)
10. The activity really enhanced my understanding of concepts and definitions. (GL)

Appendix C: RIMMS

Instructions

Reduced Instructional Materials Motivation Survey

There are 12 statements in this questionnaire. Please think about each statement in relation to the instructional material you have just studied and indicate how true it is. Give the answer that truly applies to you, and not what you would like to be true, or what you think others want to hear.

Think about each statement by itself and indicate how true it is. Do not be influenced by your answers to other statements.

Record your responses by clicking on the icons of the Likert-type scales and follow any additional instructions that may be provided in regard. Thank you.

- 1 = Not true
- 2 = Slightly true
- 3 = Moderately true
- 4 = Mostly true
- 5 = Very true

1. The variety of examples, exercises, illustrations, etc., helped keep my attention on the lesson.
2. The quality of the text helped to hold my attention.
3. The way the information is arranged on the video (file) helped keep my attention.
4. It is clear to me how the content of this material is related to things I already know.
5. The content and style of writing in this lesson convey the impression that its content is worth knowing.
6. The content of this lesson will be useful to me.
7. As I worked on this lesson, I was confident that I could learn the content.
8. After working on this lesson for a while, I was confident that I would be able to pass at test on it.
9. The good organization of the content helped me be confident that I would learn this material.
10. It was a pleasure to work on such a well-designed lesson.
11. I really enjoyed studying this lesson.
12. I enjoyed this lesson so much that I would like to know more about this topic.

Appendix D: Grammar-tests

Choose the correct completions.

1. Because it was a dark, cloudy day, ____.
a. I didn't put on my sunglasses b. I put on my sunglasses
2. Even though it was a dark, cloudy day, ____.
a. I put on my sunglasses b. I didn't put on my sunglasses
3. Even though Mira has a cold, ____.
a. She feels okay b. she feels tired
4. Because gas is so expensive, ____.
a. I drive my car a lot b. I avoid driving my car a lot

Circle *even though* or *because*.

1. I put on my raincoat (*even though / because*) it was a bright, sunny day.
2. I put on my raincoat (*even though / because*) it was raining.
3. (*Even though / Because*) Sue is a good student, she received a scholarship.
4. (*Even though / Because*) Ann is a good student, she didn't receive a scholarship.
5. (*Even though / Because*) I was so tired, I didn't want to walk all the way home. I took a taxi.
6. (*Even though / Because*) I was dead tired, I walked all the way home.
7. This letter was delivered (*even though / because*) it didn't have enough postage.
8. That letter was returned to the sender (*even though / because*) it didn't have enough postage.

Appendix E: The Video Script

Slide 1

Number of spoken words: 47

Number of written words on screen: 3

Supporting images: None

Time: 15 seconds

Narration: Hello, my name is Sara.

I am happy you are watching my video.

This video is an informational video on the differences between using *Because* and *Even though* in English. The content of this video is related to the grammar course you are taking in the university.

Slide 2

Number of spoken words: 65

Number of written words on screen: 14

Supporting images: None

Time: 39 seconds

Narration: In this video, we will discuss what “*Because*” and “*Even though*” do to sentences.

Then we will focus on the use of *Because* followed by *Even though*.

We will look at a number of examples and compare between *Because* and *Even though*.

We will summarize the information before we do some exercises together.

Lastly, we will do a recap at the end of this video.

Slide 3

Number of spoken words: 3

Number of written words on screen: 14

Supporting images: None

Time: 5 seconds

Narration: Let’s get started!

Slide 4

Number of spoken words: 16

Number of written words on screen: 12

Supporting images: 2 red arrows

Time: 8 seconds

Narration: Because and even though join two clauses together

A clause has a subject and a verb

Slide 5

Number of spoken words: 56

Number of written words on screen: 37
Supporting images: 4 agents/ o'clock
Time: 30 seconds
Narration: I was very tired
I went to bed early
In one sentence Because can join them as two clauses

- Because I was very tired, I went to bed early.

I was very tired
I stayed up late
Even though joins these two clauses in one sentence.

- Even though I was very tired, I stayed up late.

Slide 6

Number of spoken words: 58
Number of written words on screen: 48
Supporting images: 3 red highlight underlines
Time: 28 seconds
Narration: *Because* and *even though* can come at the beginning or in the middle of a sentence.
For example:
Even though the TV is expensive, I still bought it.
I still bought the TV, even though it is expensive.
Because that TV is expensive, I did not buy it.
I did not buy the TV because it is expensive.

Slide 7

Number of spoken words: 94
Number of written words on screen: 33
Supporting images: 3 red highlight underlines
Time: 55 seconds
Narration: Now, let's look at *Because*
Because answers the question "why?"
Because gives a reason for something
He went to bed early, WHY? He went to bed early *Because* he was very tired
For example
She uses that product it's the cheapest
She uses that product (*because*) it's the cheapest.
being the cheapest was the reason for using it. So, the cheapest was the answer for the question
(why is she using that product?) the answer comes after (*because*).
another example
A lot of people buy those shoes *because* a famous basketball player wears them.

Slide 8

Number of spoken words: 50

Number of written words on screen: 24

Supporting images: orange arrow

Time: 33 seconds

Narration: Let's take a closer look into even though

Now, which sentence expresses a surprising or opposite information?

1- Because I was very tired, I went to bed early.

2- Even though I was very tired, I stayed up late.

Think about it

Sentence 2 with even though expresses opposite information

Slide 9

Number of spoken words: 13

Number of written words on screen: 3

Supporting images: 2 agents/ 3 symbols/ a car/ a bus

Time: 9 seconds

Narration: What do I mean by opposite? opposite is like happy – sad/ big – small.

Slide 10

Number of spoken words: 43

Number of written words on screen: 33

Supporting images: 2 agents/ 2 highlight squares / I symbol/ o'clock/ car/ money bag

Time: 24 seconds

Narration: So, in this sentence, it's very tired - stayed up late

Usually when people are tired, they go to bed, but he stayed up late. So that's why he used *even though*.

another example

Even though it's expensive, many people buy that car.

Slide 11

Number of spoken words: 63

Number of written words on screen: 53

Supporting images: 4 red underlines/ 2 green highlight squares/ 2 purple highlight squares

Time: 42 seconds

Narration: let's compare between *because* and *even though* by looking at more examples

Barry's in good shape physically because he gets a lot of exercise.

Tim's in good shape physically even though he doesn't get much exercise.

another example

Joe speaks Spanish well because he lived in Mexico for a year.

Sherry didn't learn Spanish even though she lived in Mexico for a year.

Slide 12

Number of spoken words: 51

Number of written words on screen: 25

Supporting images: 2 orange arrows/ 4 symbols/ 2 underlines/ 2 highlight squares

Time: 42 seconds

Narration: In summary

So,

Even though introduces surprising or opposite information

And

Because answers the question why.

Let's look at these examples,

Even though the weather was cold, I went swimming.

Because the weather was cold, I didn't go swimming.

Because answer the question why.

Even though shows surprising or opposite information

Slide 13

Number of spoken words: 38

Number of written words on screen: 1

Supporting images: none

Time: 23 seconds

Narration: Let's try some exercises

Now, I will ask you 3 questions and try to answer them correctly.

Fill in the blanks with *Because* or *Even though*

You have 40 seconds to think before I say the correct answer

Slide 14

Number of spoken words: 98

Number of written words on screen: 48

Supporting images: o'clock/ hand and pen

Time: 2 minutes and 36 seconds

- Narration: That ad is really popular ----- It has a catchy slogan

The answer is because

Because it has a catchy slogan, it became popular. ("it became popular" shows reason)

- Energy drinks are advertised on sites popular with teens ----- Teens buy more of these drinks.

The answer is because

("Teens buy more of these drinks") shows reason

- A TV ad shows only boys playing with a popular toy ----- girls like the toy, too.

The answer is even though

"Girls like the toy, too" shows opposite information than the first part of the sentence.

Slide 15

Number of spoken words: 2
Number of written words on screen: none
Supporting images: none
Time: 5 seconds
Narration: Let's recap

Slide 16

Number of spoken words: 35
Number of written words on screen: 7
Supporting images: 2 orange arrows
Time: 20 seconds
Narration: Because answers the question why.
Even though shows surprising or opposite information
Both of them join two clauses together
And both of them can come at the beginning or in the middle of a sentence.

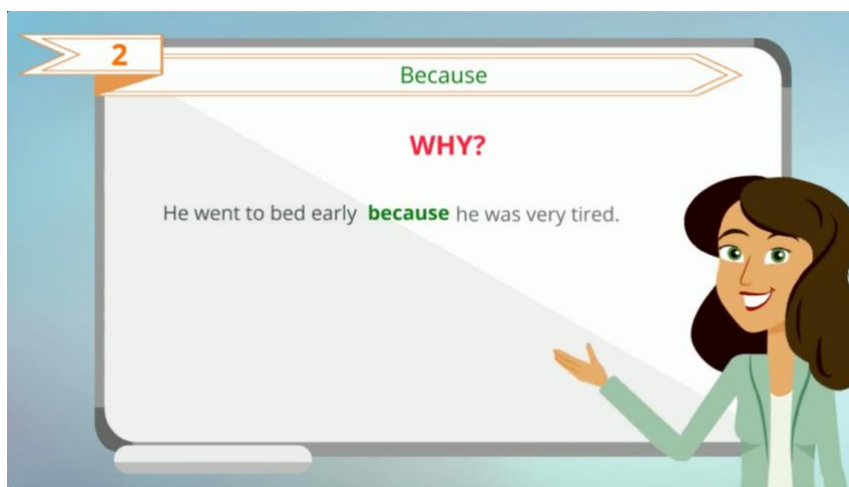
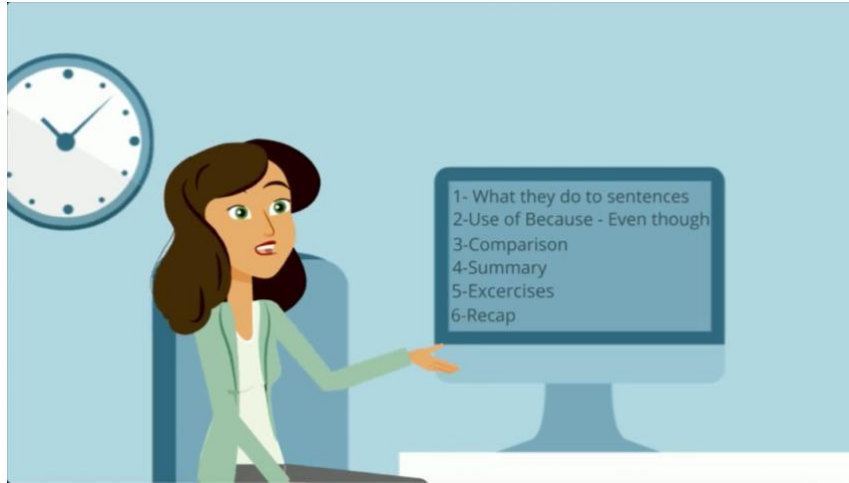
Slide 17

Number of spoken words: 32
Number of written words on screen: 3
Supporting images: none
Time: 15 seconds
Narration: You have reached the end of this video.
I hope you enjoyed my short tutorial on the use of *Because* and *Even though* and that you will use them in the future.

Slide 18

Number of spoken words: 4
Number of written words on screen: 3
Supporting images: none
Time: 7 seconds
Narration: Thank you for watching,


Appendix F: Samples of the designed High-embodied Agent (HEA) Instructional Video



3 Comparison

Even though
 Tim's in good shape physically **even though** he doesn't get much exercise.
 Sherry didn't learn Spanish **even though** she lived in Mexico for a year.


Because
 Barry's in good shape physically **because** he gets a lot of exercises.
 Joe speaks Spanish well **because** he lived in Mexico for a year.





4 Summary

Even though
 ↓
Surprising / Opposite


Because
 ↓
Why?

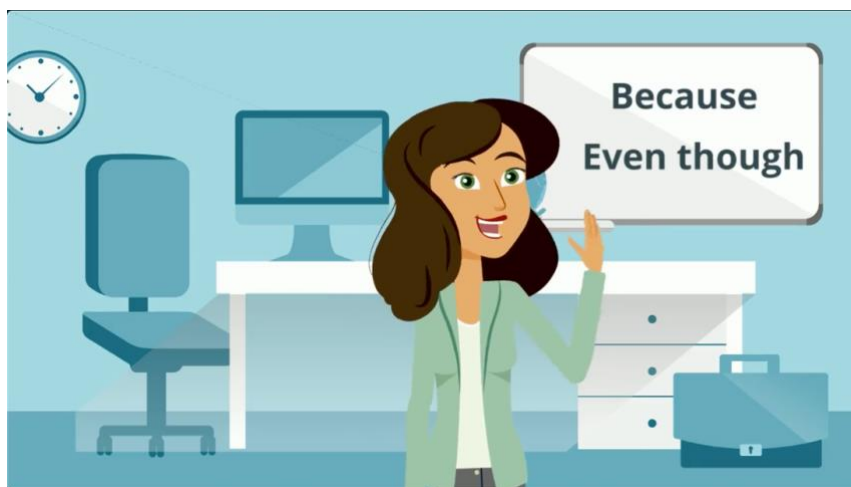
Even though the weather was cold, I went swimming. 

Because the weather was cold, I didn't go swimming. 

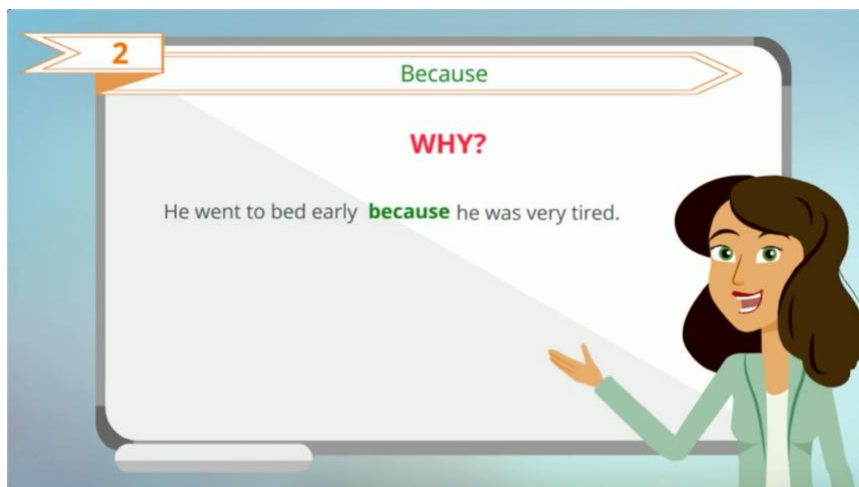
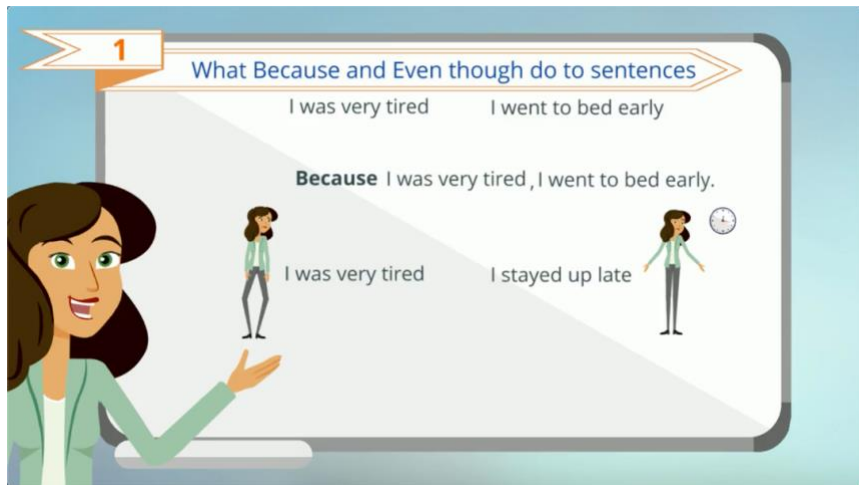
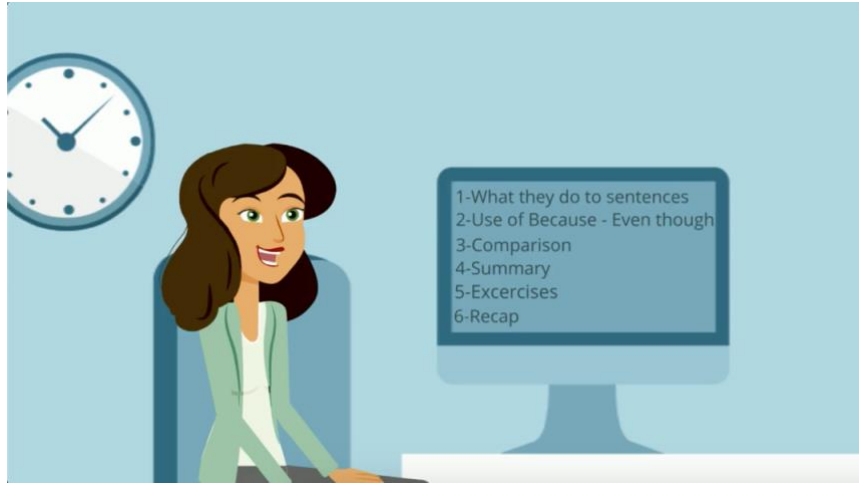


5 Exercises





Appendix G: Samples of the designed Low-embodied Agent (LEA) Instructional Video



3 Comparison

Even though
 Tim's in good shape physically **even though** he doesn't get much exercise.
 Sherry didn't learn Spanish **even though** she lived in Mexico for a year.

Because
 Barry's in good shape physically **because** he gets a lot of exercises.
 Joe speaks Spanish well **because** he lived in Mexico for a year.








4 Summary

Even though ↓ **Surprising / Opposite**


Because ↓ **Why?**

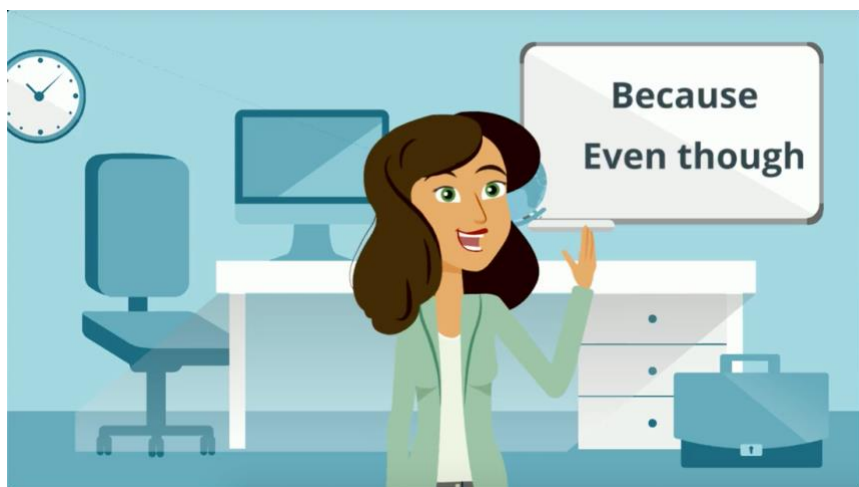
Even though the weather was cold, I went swimming.

Because the weather was cold, I didn't go swimming.

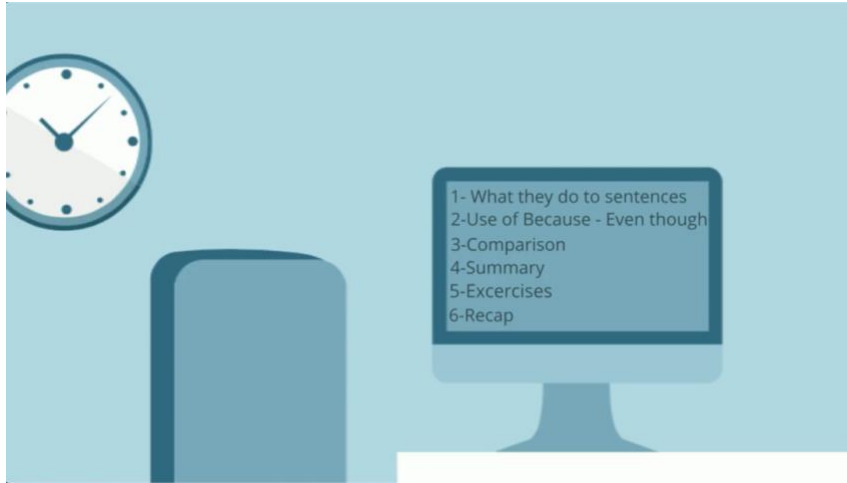






5 Exercises





Appendix H: Samples of the designed Voice-only Agent (VOA) Instructional Video



1 What Because and Even though do to sentences

I was very tired I went to bed early

Because I was very tired, I went to bed early.

I was very tired I stayed up late

Even though

2 Because

WHY?

He went to bed early **because** he was very tired.

3

Comparison

Even though

Tim's in good shape physically **even though** he doesn't get much exercise.

Sherry didn't learn Spanish **even though** she lived in Mexico for a year.

Because

Barry's in good shape physically **because** he gets a lot of exercises.

Joe speaks Spanish well **because** he lived in Mexico for a year.

4

Summary

Even though

Surprising / Opposite

Because

Why?

Even though the weather was cold, I went swimming.

Because the weather was cold, I didn't go swimming.



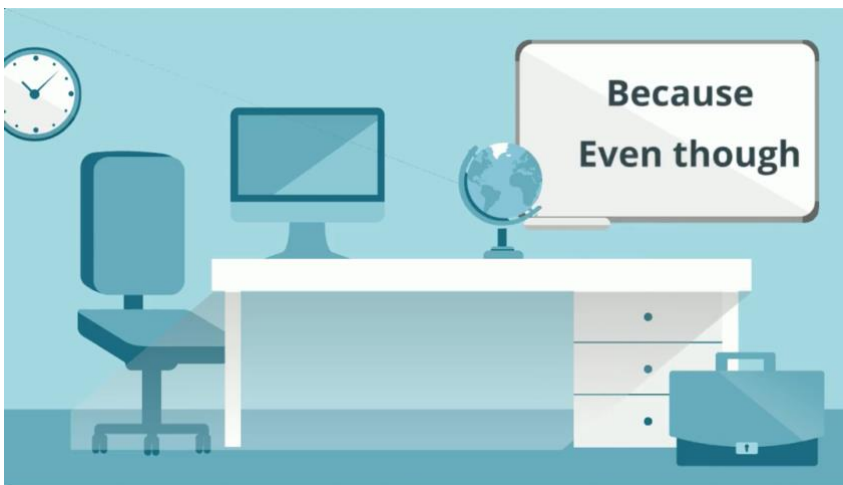
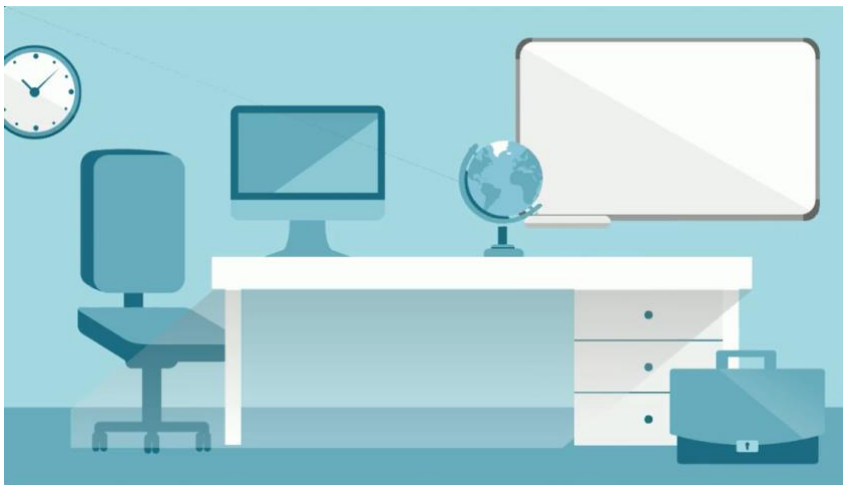
5

Exercises

6

Recap

Even though	Because
Surprising / Opposite	Why?



Appendix I: Recruitment Letter

May the peace, mercy and blessings of ALLAH (God) be upon you

IRB Study # STUDY000607

My name is Sahar Alyahya and I am researching on technology in education and second language acquisition at the University of South Florida. The purpose of this research is to measure the cognitive load, motivation and achievement after watching an instructional video. The target participants are students enrolled in the Grammar course at the College of Languages and Translation at Imam Mohammad Ibn Saud Islamic University.

Your Identity will be anonymous when participating in this study. I will not ask for your name or ID number. Your responses would not affect the course grades in which the course instructor is not a part of this research, therefore, please answer with credibility.

Your participation is optional. It will support me to gather specific data about the study. Thus, you should not share the content of this study with your colleague.

The study includes:

- 1- Watching an instructional video about one of the lessons you are taking in your Grammar course at the university.
- 2- Taking a test after watching the video and answering 2 surveys.

Participating in this study may take 30 minutes.

When starting with it you should finish it at the same time.

To participate click on (next) below.

If you have any questions, please contact the researcher at Sahar3@usf.edu

Thank you,

Appendix J: Informed Consent Form



Informed Consent to Participate in Research

Information to Consider Before Taking Part in this Research Study

Title: Social Cues in Animated Pedagogical Agents for Second Language Learners: The Application of The Embodiment Principle in Video Design

Study # STUDY000607

You are being asked to take part in a research study. The information in this document should help you to decide if you would like to participate. The sections in this Overview provide the basic information about the study. More detailed information is provided in the remainder of the document.

This study is being led by *Sahar Alyahya* who is the Principal Investigator. She is being guided in this research by *Dr. John I. Liontas*. Other approved research staff may act on behalf of the Principal Investigator. The purpose of the study is to find the effects of designing language learning instructional videos following the social agency theory on language learners' grammatical performance.

Why are you being asked to take part?

You are being asked to take part because you are an English language learner.

Study Procedures

If you take part in this study, you will be asked to watch an animated video related to your English language course then take a language test along with 2 surveys. The expected time the procedure would take is about 30-minutes and the data is collected anonymously. This study is being conducted online.

Alternatives / Voluntary Participation / Withdrawal

Your participation is voluntary. You should not feel that there is any pressure to take part in the study. You are free to participate in this research or withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study. Your decision to participate will not affect your student status or course grade.

Benefits and Risks

The potential benefits of participating in this research study include learning a grammar lesson that may add to your grammar knowledge. This research is considered to be minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

Compensation

You will receive no payment or other compensation for taking part in this study.

Privacy and Confidentiality

We must keep your study records as confidential as possible. Certain people may need to see your study records. By law, anyone who looks at your records must keep them completely confidential. The only people who will be allowed to see these records are: the principal

investigator, the advising professors, and The University of South Florida Institutional Review Board (IRB).

It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. Confidentiality will be maintained to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet. However, your participation in this online survey involves risks similar to a person's everyday use of the Internet. If you complete and submit an anonymous survey and later request your data be withdrawn, this may or may not be possible as the researcher may be unable to extract anonymous data from the database.

Contact Information

If you have any questions, concerns or complaints about this study, call *Sahar Alyahya* at 8135107922 or contact by email at Sahar3@mail.usf.edu

If you have questions about your rights, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638 or contact the IRB by email at RSCH-IRB@usf.edu.

I freely give my consent to take part in this study. I am 18 years of age or older. I understand that by proceeding with this online tutorial and its survey and tests that I am agreeing to take part in this research.

Appendix K: IRB Approval



EXEMPT DETERMINATION

April 22, 2020

Sahar Alyahya

Dear Mr. Alyahya:

On 4/21/2020, the IRB reviewed and approved the following protocol:

Application Type:	Initial Study
IRB ID:	STUDY000607
Review Type:	Exempt (2)
Title:	Social Cues in Animated Pedagogical Agents for Second Language Learners: The Application of The Embodiment Principle in Video Design
Funding:	None
Protocol:	• Protocol, Version #2, 4_21_2020.docx

The IRB determined that this protocol meets the criteria for exemption from IRB review.

In conducting this protocol, you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Please note, as per USF policy, once the exempt determination is made, the application is closed in BullsIRB. This does not limit your ability to conduct the research. Any proposed or anticipated change to the study design that was previously declared exempt from IRB oversight must be submitted to the IRB as a new study prior to initiation of the change. However, administrative changes, including changes in research personnel, do not warrant a modification or new application.

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about

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Page 1 of 2



whether these activities impact the exempt determination, please submit a new request to the IRB for a determination.

Sincerely,

Various Menzel
IRB Research Compliance Administrator

Institutional Review Boards / Research Integrity & Compliance

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Page 2 of 2

Appendix L: Task Facilitation Approval

MINISTRY OF EDUCATION
IMAM MOHAMMAD IBN SAUD
ISLAMIC UNIVERSITY
DEANSHIP OF SCIENTIFIC RESEARCH



وَرَأَى الْمُجَلِّينَ
جَامِعَةُ الإمام محمد بن سعود الإسلامية
عمادة البحث العلمي

المشروعات :

التاريخ: / / ١٤ هـ

الرقم:

Task facilitation

Fadilat / Your Excellency ----- May ALLAH save him

Imam Mohammad Ibn Saud Islamic University

May the peace, mercy and blessings of ALLAH (God) be upon you,
and after

I refer to the student's wish at College of Education - University of South Florida / Sahar Mohammed Alyahya to conduct a study entitled " Social Cues in Animated Pedagogical Agents for Second Language Learners: The Application of The Embodiment Principle in Video Design " to complete the requirements for obtaining a PhD in Education.

Since the research topic requires conducting a field study and obtaining scientific and statistical data. So I hope to facilitate her task to apply the study tool and provide him with the necessary data.

my greetings and appreciation

and

May the peace, mercy and blessings of ALLAH (God) be upon you

Dean of Scientific Research

Prof. Mohammed Ibn Mohsen Babtain



جَامِعَةُ الإمام محمد بن سعود الإسلامية

رقم المعاملة: 83536
تاريخها: 1441/08/12
أرسلها: 1441/08/12
مدون:
رقم الجهة: 033

