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Nature of L2 negotiation and co-construction of meaning in a problem-based virtual learning environment: a mixed methods study

Aurore Patricia Mroz
University of Iowa

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NATURE OF L2 NEGOTIATION AND CO-CONSTRUCTION OF MEANING IN A
PROBLEM-BASED VIRTUAL LEARNING ENVIRONMENT:
A MIXED METHODS STUDY

by

Aurore Patricia Mroz

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Teaching and Learning
in the Graduate College of
The University of Iowa

May 2012

Thesis Supervisors: Associate Professor Michael Everson
Assistant Professor Pamela Wesely

ABSTRACT

Adopting a Socio-Constructivist theoretical framework, this study investigated the French language discourse produced by a focal group of five intermediate learners of French while immersed in a virtual learning environment (VLE) and engaged in a problem-based activity. Adopting a mixed methods approach, this study analyzed both quantitative and qualitative data to examine the second language (L2) negotiation and co-construction of meaning process in this group's discourse; as well, it investigated these learners' emerging L2 critical thinking, problem solving, and technology literacy skills.

Results indicated that the discourse produced by these students was significantly impacted by the problem-based activity itself, and characterized by a progressive trend towards higher levels of L2 critical thinking, with sustained episodes of negotiation and co-construction of meaning. Most notably, the discourse analysis indicated that it was during the consensus-building phase of the problem-based activity that most instances of higher level critical thinking occurred. Moreover, the 3-D representation of learners (as avatars) and space, as well as the immediacy of synchronous chat-based interactions in the VLE had a positive social, motivational, and linguistic impact on this process. These results lend support to the claim that VLEs, with an underlying problem-based and consensus-building component, provide optimal learning opportunities for learners to develop L2 critical thinking and problem solving abilities.

Discussion is offered about the benefits of a mixed methods approach to research, as well as about the reliability and validity of Hull & Saxon's (2009) Interaction Analysis model for L2 discourse analysis. Implications for the L2 classroom as well as for future research on L2 negotiation of meaning are also provided.

Abstract Approved:

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Graduate College
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CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Aurore Patricia Mroz

has been approved by the Examining Committee
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Leslie Schrier

Lia Plakans

Stephen Alessi

To all my loved ones, on both sides of the Atlantic Ocean.

The distinctive characteristic of human learning is that it is a process of making meaning – a semiotic process; and the prototypical form of human semiotic is language. Hence the ontogenesis of language is at the same time the ontogenesis of learning.

M.A.K. Halliday
Towards a language-based theory of learning (1993, p.93)

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The writing of a dissertation, as most people know, can be a long and lonely journey. Mine was long, and sometimes painful, but certainly not lonely. In fact, it is by passing through this supreme academic challenge that I got to realize how strong a support system I had, and how lucky I should consider myself for being so well surrounded. It is thus to all these wonderful people who have been the greatest supporters a doctoral student could hope to have that I would like to dedicate these few words of deep and sincere gratitude.

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CHAPTER I

INTRODUCTION

So long as people have problems to solve and decisions to make, so long as they have things to learn and issues to resolve, there will be ample needs and opportunities to use our critical thinking skills

P. Facione
Think critically (2011, p.7)

Problem Statement

A societal need for critical thinking and problem solving
abilities

According to the American Philosophical Association (1990), critical thinking and problem solving skills are essential human abilities that stand at the very foundation of progress made in societies. As concrete examples of the impact of critical thinking and problem solving abilities on our societies, Facione (2011) pointed out that “problem solvers using critical thinking have achieved massive breakthroughs in science, technology, commerce, and the arts, such as G3 cell phone technology, cancer treatments individualized to a person’s unique DNA, global e-business, and new forms of music and architecture” (p.5).

Critical thinking and problem solving are thus not just ethereal philosophical concepts: rather, they are concrete tools of the mind enabling us to make tangible and substantial decisions to contribute to the evolution of our societies. What makes critical thinking and problem solving skills such potent tools is the intellectual empowerment that they permit, serving as “liberating forces” enhancing our chances of success in our personal and collective daily endeavors through the ability we have to “form well-reasoned and fair-minded judgment regarding what to believe and what to do” (Facione, 2011, p.6). As such, critical thinking and problem solving abilities are highly regarded and highly needed skills for the advancement of free societies, and their development should be considered a crucial topic of research.

An educational responsibility: to promote critical thinking
and problem solving

The development of critical thinking and problem solving skills is thus an essential task, and can be considered to be the primary responsibility that education should assume for the advancement of our societies. The investigation of this development of critical thinking and problem solving abilities in our students should consequently be a primary responsibility for research in education.

What is at stake is to determine the type of learning opportunities that lead to this sort of intellectual empowerment, that is, the learning tasks which lead our students to become “skeptical without being cynical, open-minded without being wishy-washy, analytical without being nitpicky, decisive without being stubborn, evaluative without being judgmental, and forceful without being opinionated” (Facione, 2011, p.9). In other words, research needs to determine what in education promotes deep meaning over surface and inert knowledge, in order for education to serve its function as promoter of critical thinking and problem solving abilities (Bakhtin, 1981; Campbell, et al., 2001; Duffy & Orrill, 2001; Vygotsky, 1978; 1987).

What we know for now is that these learning opportunities need to allow our learners to create open-ended answers (Ku, 2009), that reflect the validity of more than one perspective and highlight the quality of their arguments (Moss & Koziol, 1991), while permitting them to exercise their judgment (Fischer, et al., 2009), and making their reasoning visible (Norris, 1989). Lipman (1988) suggested that one concrete way in which to access these abilities is by looking at such learning processes as negotiation of meaning, that aim at increasing “the quantity and quality of meaning that students derive from what they read and perceived and that they express in what they write and say” (Lipman, 1988, p.43). From the point of view of educational research, this sort of processes in general, and negotiation of meaning in particular, should thus be central

topics of investigation, to contribute to inform classroom practices intended to promote the development of critical thinking and problem solving abilities.

L2 negotiation and co-construction of meaning in the study of L2 critical thinking and problem solving

L2 critical thinking and problem solving as a learning

objective

As more specifically related to Second Language (L2) education, the growth of critical thinking and problem solving skills in an L2 has indisputably become a paramount objective, as portrayed in the recent publication by the American Council for the Teaching of Foreign Languages (ACTFL) of a 21st Century Skills Map (2011). Developed as a result of a partnership among key national organizations and educators representing the wide diversity of different core academic subjects, this map has been intended to guide educators, administrators, and policymakers in the selection of fundamental educational objectives to be targeted in the L2 classroom. Specifically, this map has advocated the crucial need to integrate the learning of World Languages to twelve core interdisciplinary skills, among which L2 critical thinking and problem solving.

L2 negotiation of meaning as a research construct

To become critical thinkers and problem-solvers in an L2 is nevertheless a different process than being one in an L1: it implies becoming an “inquirer (who is able to) frame, analyze, and synthesize information as well as negotiate meaning across language and culture in order to explore problems and issues from [one’s] own and different perspectives” (ACTFL, 2011, p.9; see also Bakhtin, 1986; Can, 2009; Halliday, 1975; 1993; Wells, 2007). L2 negotiation and co-construction of meaning appears to be at the same time a promising learning opportunity and a promising research construct in

the investigation of L2 learners' emerging critical thinking and problem solving abilities, as it provides "a bird's-eye view of student interactions and critical thinking processes" (Jeong, 2003, p.28; see also Campbell, et al., 2001; Hull & Saxon, 2009; Wells, 2007). As such, L2 negotiation of meaning deserves L2 educational researchers' attention.

Current state and needs of research on L2 negotiation of meaning

L2 negotiation of meaning is not a new research subject. It has actually been an extremely popular topic, attracting researchers' attention in L2 education as well as in SLA for over two decades, notably following Long's (1983a; 1983b; 1996) Interaction Hypotheses and a Cognitivist paradigm. But a look into this Cognitivist-based research tends to reveal that the way in which L2 negotiation of meaning has been defined often bears little association with L2 critical thinking and problem solving skills. Rather, it has been predominantly defined as the correction and subsequent retention of initially deficient forms of the language by the L2 learner when s/he produces these forms while interacting with a more competent speaker of the language. Although this particular aspect of study is worthy of attention in the realm of linguistics, it can nevertheless be considered an inadequate starting point in the evaluation of L2 learners' critical thinking and problem solving skills. Indeed, several issues arise from such a focus, opening a need in research for a redefinition of the very construct of L2 negotiation of meaning.

Practicality issues

First, a significant part of this research has focused on interactions between a native speaker (NS) and a non-native speaker (NNS), or on interactions between an advanced speaker of the language and a speaker of a lower level of proficiency. In the first case, it can be supposed that access to a NS is still a rare opportunity in a traditional L2 classroom, where more often than not, the only NS, if any, happens to be the teacher. Focusing on a NS-NNS exchange in the reality of the L2 classroom thus means focusing

on teacher-student interactions, leading to a form of teacher-centeredness that many theories have tended to refute, in favor of student-centeredness and ownership of the learning process by the learners (ACTFL, 2011; Marlow & Page, 2005; Richardson, 2003; Townsend et al., 1999). For practical purposes, teachers may first and foremost need to know from research how their students can work and communicate together in the classroom in order to learn to develop these critical thinking and problem solving skills. In the second case, it can also be argued that most L2 classes tend to aggregate students of similar levels, making the possibility of interactions between advanced speakers and lower-level speakers of the language fairly uncommon. Here again, for practical purposes, research may better serve L2 practitioners by focusing on interactions between students of more homogeneous levels, as this near homogeneity of students is more representative of the reality of their everyday classroom.

From inert knowledge to deep meaning

Second, the primacy given by research to various morpho-syntactical aspects of the language when investigating L2 negotiation of meaning has revealed an approach to research that locates the process of negotiation of meaning at a surface level, thus equating L2 negotiation of meaning with surface learning, instead of considering it as a deep learning process, participating to the development of critical thinking and problem solving abilities in the L2. What is at stake here is the need to shift from a focus-on-form to a focus-on-function of the language produced by the L2 learners. The point is to move away from researching surface learning, where the “intention is to avoid failure with corresponding strategies that facilitate the memorization of facts without meaning or organization” (Ramsden, 1992, as cited in Campbell et al., 2001, p.173), and move towards researching what constitutes deep learning, where the “intention [is] to gain personal understanding, with corresponding strategies to gain meaning” (Campbell et al., 2001, p.173). This shift from research on L2 negotiation of meaning as a surface process

leading to surface learning, to research on L2 negotiation of meaning as a deep process leading to deep learning is crucial in order to contribute to the development of L2 learners' critical thinking and problem solving skills. This shift is even more important that a research centered on L2 focus-on-form has tended to feed L2 classroom practices that have also been heavily focused on form, the pedagogical implications of which are now contested, as students need to learn to use the language critically rather than simply learn *about* the language (ACTFL, 2011).

From L2 learners' deficiencies to L2 learners' abilities

Third, the notion of correction that stands at the heart of a Cognitivist definition of L2 negotiation of meaning implies a deficiency from part of the L2 learner who produces an incorrect form of the language in comparison with a tacit standard (a NS-like mastery of the linguistic forms). It can be reproached to this approach that the very notion of interlanguage (Selinker, 1972) has been founded on an approach to L2 acquisition that acknowledges the presence of imperfections in the language produced by L2 learners that nevertheless attest of the emergence of a process of acquisition of the L2.

Moreover, the validity of correction as a proof of L2 learning has been called in question, as "it cannot be guaranteed that a response that simply repeats a modified signals, namely, one that modifies the trigger utterance with a target-like model, is evidence of learning" (Bitchener, 2004, p.93). Conversely, a Socio-Constructivist approach to the study of L2 negotiation of meaning indicated that a distinction should be made between the acts of negotiation of meaning that indicate a linguistic dysfunction and those which attest that understanding is being established between two interlocutors (Jauregi, 1997; Vandergriff, 2006). In the same vein as these Socio-Constructivist studies, it can be argued that dissonances amongst L2 learners in the act of meaning negotiation should be considered as opportunistic perturbations allowing the emergence of a discourse representative of their L2 critical thinking and problem solving abilities.

Additionally, this distinction is important as it calls into question research that focuses on correction and language deficiency, in that this research tends to support L2 classroom practices that test L2 students to find out what they don't know, rather than to unveil what they are already able to do (ACTFL, 2011). It can thus be argued that L2 practitioners need to be guided by a new trend of research that demonstrates a shift from looking at L2 learners' deficiencies to investigating L2 learners' current critical abilities, notably their critical thinking and problem solving abilities in the L2.

Limitations of retention as an indicator of L2 learning

Fourth, the use of indices of retention as indicators of learning, as it has been most commonly established by a Cognitivist-based research on L2 negotiation of meaning, can also be contested, inasmuch as it can be considered to be inappropriate evidence of L2 critical thinking and problem solving skills. What these indices have calculated is the rate of retention of the corrected morpho-syntactical forms that were initially incorrectly produced by the L2 learner, and subsequently corrected, either by the more advanced speaker, or by the learner him/herself. Yet, the validity of these indices as markers of learning has been challenged, notably by Shekary & Tahririan (2006) who note that "successful uptake does not indicate that the feature has been acquired. Immediate uptake does not indicate retention, and lack of immediate uptake does not indicate that nothing is noticed" (p.564). I will thus argue that a new learning index needs to be found and utilized by research, which better determines the state of L2 learners' critical thinking and problem solving abilities.

The social nature of L2 negotiation of meaning

Finally, even though it may have been useful to explore and study negotiation of meaning from a focus-on-form perspective, as it is a topic worthy of attention in the realm of linguistics, "the research points out areas in which (this traditionally defined) negotiation does not appear to assist L2 learning, especially with respect to the learner's

need to access L2 grammatical morphology and to strive toward accurate production of L2 morphosyntax” (Pica, 1994, p.493). Research should thus admit these limitations and move toward researching other aspects of negotiation of meaning, notably “social actors as they are acting, not linguistic detail alone” (Saarenkunnas , et al., 2003, p.206), which also better align with an investigation of the social aspects involved in the L2 negotiation of meaning process in the development of L2 critical thinking and problem solving abilities.

In view of these issues, I will argue that a new definition of L2 negotiation of meaning is needed that would have the potential to guide a new trend of research focusing on the development and acquisition of L2 critical thinking and problem solving skills by L2 learners.

L2 negotiation of meaning as framed by innovative technology for learning

The needs of our learners as “digital natives”

In order for the development of L2 critical thinking and problem solving skills by L2 learners to answer the societal needs of the third millennium, it will need to be fundamentally anchored in technology-based forms of interactions, since, aside from face-to-face and sign language, communication and exchanges among people in the 21st century are never technology-free (Harrington & Levy, 2001), even more so that our students are now part of a generation of “digital natives” (Prensky, 2001, p.1).

It is thus necessary to frame the study of L2 negotiation of meaning into the context of Computer-Mediated Communication (CMC) when considering L2 critical thinking and problem solving abilities. To become efficient L2 critical thinkers in the third millennium, our learners will thus also need to learn to use technology critically for L2 learning purposes, to develop L2 technology literacy skills. In that sense, the study of L2 negotiation of meaning should be more precisely framed in the field of study on

Computer-Assisted Language Learning (CALL), as it will also need to investigate how L2 learners use technology to learn, through an L2, to become “productive global citizens (who are able to) use appropriate technologies when interpreting messages, interacting with others, and producing written, oral, and visual messages” (ACTFL, 2011, p.14). Consequently, I will argue that a study of L2 negotiation of meaning, as a research construct representative of L2 critical thinking and problem solving skills, can gain in practical implications for the future L2 classroom if it is concomitantly enriched and framed in the field of CMC and CALL, via a study on the integration of innovative forms of technology for L2 learning. In that sense, our learners’ L2 technology literacy abilities should also be investigated to better inform a research on their L2 critical thinking and problem solving skills.

Impact of technology on the L2 learning process

Within the field of research on CALL, Blake’s (2008) meta-analysis showed that the key construct predominantly under investigation has been the interactive affordances of the technological apparatus used by L2 learners in CALL. Nevertheless, I will argue that what is of significant interest in a study on L2 learners’ critical thinking and problem solving abilities is the true source of these interactions, that is to say the learners themselves, as they come in contact with others in the social process of L2 negotiation and co-construction of meaning. In that sense, many CALL researchers have advocated an ecological shift in research on CALL (Blake, 2008; Felix, 2005a; 2005b; 2005c; 2008; O’Rourke, 2005; Saarenkunnas, Kuure, & Taalas, 2003), with a need to re-orient our attention “to the complex nature of humans as sociocultural actors and (to consider) technological settings as artifacts and as mediators, rather than determiners, of action and interaction” (O’Rourke, 2005, p.435).

At a theoretical level, this shift is imperative in order to avoid decontextualizing the use of technology from its human components, by only focusing on technological

affordances: rather, we should be turning our attention to “the way in which people’s aspirations, expectations, and perceptions influence the way they execute their roles [through technology]” (Savin-Baden, 2008, p.156), to contribute to the study of emerging L2 technological literacy and L2 critical thinking and problem solving skills in L2 learners. At a practical level, this shift in research is important to help inform L2 teaching and learning best technological practices, by shifting away from considering technology as “a cool tool” and to instead work at “integrat(ing it) into instruction to enhance learning” (ACTFL, 2011, p.4). It is thus the impact of technology on the L2 learning process, as it is perceived by the learners themselves, that research should investigate.

Furthermore, Levy (2000) noted that “the language itself, the ways students learn, and the goals of our students are changing with the technology” (p.185). The use of cell phones and the emergence of texting in the 2000’s is a representative example of this impact of technology on the nature, forms, and functions of language, as texting has led to new communicative goals, based on conciseness, speed, creativity, and ownership of the language, dramatically impacting the linguistic habits of our learners (Anis, 2007). This impact of technology on L2 learning deserves our timely scrutiny, as newer and more innovative technologies emerge at a tremendous pace, and “if the language community is not to be continually ‘surprised’ by a new technology once it reached critical mass and very quickly spreads to the population as a whole” (Levy, 2000, p. 186). In that sense, a study on the impact of technology on the L2 learning process is necessary, insomuch as it can be considered to affect L2 learners’ technology literacy abilities, since the discourse they process or produce via technology is always affected to some extent, in its nature, forms, and/or functions, by the very tool for communication that serves its delivery.

VLEs as innovative technology for L2 negotiation of meaning

Amongst the vast list of groundbreaking technologies that have recently emerged with a remarkable pedagogical potential, virtual learning environments (VLEs) are of particular interest. VLEs are technological environments for learning, which rely upon the association of 3-D immersive and social technological platform, usually called a Three-Dimensional Multi-User Virtual Environment (3D-MUVE), and an underlying pedagogical project. Researchers (Barab et al., 2005; Jeffery & Collins, 2008; Omale et al., 2009; Salmon, 2009; Warburton, 2009) have considered that VLEs were especially promising in the development of forms of learning based on negotiation of meaning and complex problem solving. It is consequently legitimate to postulate that the use of VLEs in L2 learning could have a potential for the development and acquisition of both L2 critical thinking and problem solving skills, and L2 technology literacy skills. Yet, the evaluation of VLEs' impact on the learning of these skills still remains to be conducted (Salmon, 2009; Savin-Baden, 2008; So & Brush, 2008), and is thus a timely and appropriate research variable.

In sum, in view of the different societal and educational needs that we presented, it is the intent of the present study to contribute to a research in L2 education and SLA, informing the L2 classroom practices, by evaluating the emergence of L2 critical thinking and problem solving skills in L2 learners, focusing on their L2 negotiation and co-construction of meaning process, while exploring the use of a VLE and studying its impact on these students' emerging L2 technology literacy and critical thinking skills.

Purpose Statement

Objectives of the study

The primary objective of this study is to empirically and deductively assess the presence and nature of patterns emerging in the discourse collectively produced by a

group of L2 learners invested in a negotiation and co-construction of meaning task. This construct will be considered as a paradigmatic exemplification of a Vygotskian socio-constructivist epistemology, and as a process representative of L2 critical thinking and problem solving skills. L2 negotiation and co-construction of meaning will be defined as the subjective and alternatively collective and individual process by which learners produce and exchange discourse and meaning which is ‘affected, renegotiated, [arbitrated], and reconstructed as a result of conflict in social interactions’, as well as in individual perceptions (Jeong, 2003, p.28). It is as an incremental process, based on Gunawardena et al.’s (1997) and Hull & Saxon’s (2009) Interaction Analysis model, and will examine the discourse produced via chat by a group of L2 learners attempting to solve a complex problem while being immersed in a VLE.

The second objective of this study is to obtain a comprehensive and inductive understanding of these L2 learners’ L2 technology literacy skills by examining their individual experiences and perceptions, as well as the impact of the VLE in which they were immersed on their L2 negotiation and co-construction of meaning process. This construct will be considered as a phenomenon that paradigmatically exemplifies the ecological shift from the technological apparatus to the human interactions advocated by research in CALL. It will be operationalized through a qualitative study, supported by instrumental case studies and phenomenology to reveal how learners individually and subjectively perceived, experienced, documented, and expressed the impact that an immersion into a problem-based VLE may have had on their collective process of L2 negotiation and co-construction of meaning, and thus on their L2 critical thinking and problem solving abilities.

Research questions

Deriving from these new research parameters and objectives, two research questions have been guiding this study:

- RQ#1: Do significant patterns of L2 negotiation and co-construction of meaning exist in the discourse produced collectively by a group of Intermediate French II college-level learners working collaboratively to solve a complex problem as they are immersed in a virtual learning environment? If so, what is the nature of these patterns and what does it reveal in terms of these learners' L2 critical thinking and problem solving skills?
- RQ#2: How do these learners individually perceive, experience, document, and express the impact of the specific problem-based virtual learning environment in which they were immersed on their L2 collective process of negotiation and co-construction of meaning? What does this perceived technological impact reveal in terms of these learners' L2 technology literacy skills?

Conclusion

In conclusion, the present study intends to investigate L2 learners' negotiation and co-construction of meaning process, as developing in and impacted by an innovative technological environment (a VLE), representative of third millennium technologically-mediated forms of communication. This study aims at contributing to a research on our L2 learners' critical thinking and problem solving abilities, to determine how these learners can develop these paramount skills in order to become efficient agents and contributors of progress in a globalized world requiring them to interact, via technology and in an L2. Finally, this study aims at informing L2 classroom practices, whether for the promotion of learning opportunities conducive of higher mental skills, such as L2 critical thinking and problem solving, or for the efficient integration of technology in the L2 classroom, conducive to the development of L2 technology literacy skills by L2 learners.

Overview of chapters

The following chapter establishes a detailed literature review, allowing to situate the present study in a Socio-Constructivist framework, in reaction to the limitations of the predominant Cognitivist-based trend of research on L2 negotiation of meaning. It also further anchors the present study in connection with research on CALL and on emerging VLEs. Chapter III addresses the methodology selected to carry this study, namely a mixed methods approach, and details the curricular intervention that led to the data collection and data analysis processes on which this study is based. Chapter IV presents the results answering each research question, and offers an integrative interpretation of both quantitative and qualitative results. Finally, Chapter V discusses these findings, in terms of their contribution to the study of L2 negotiation and co-construction of meaning, to inform research on L2 learners' critical thinking and problem solving skills, as well as their theoretical and practical implications, in an attempt to inform L2 theory building as well as the future L2 classroom. Chapter V concludes by providing venues for future research, based on the results obtained in this study.

CHAPTER II

REVIEW OF LITERATURE

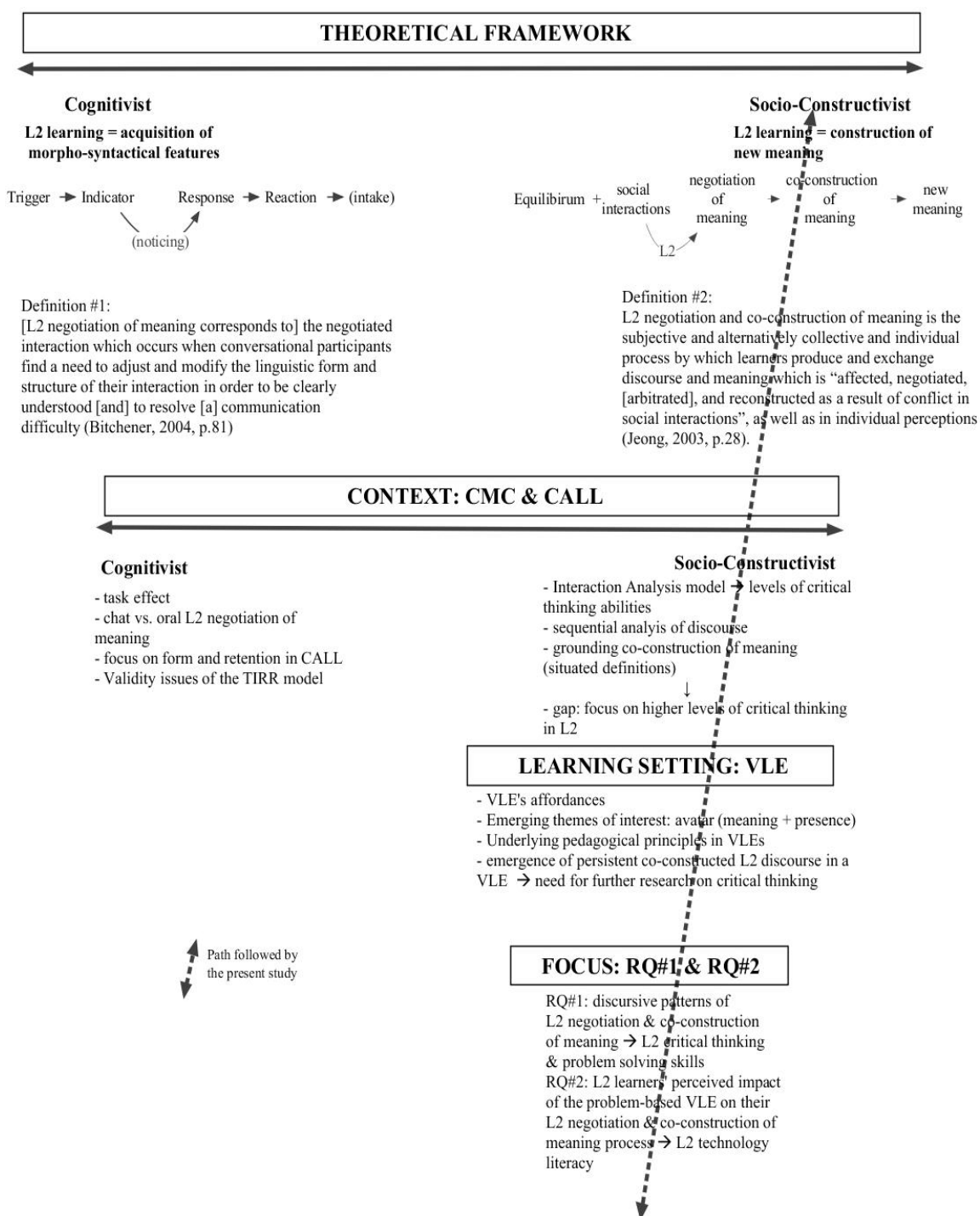
Introduction

As suggested in Chapter I, L2 negotiation and co-construction of meaning are promising constructs to include in our study of L2 learners' emergent critical thinking and problem solving abilities. With the need to integrate innovative technological tools to the teaching and learning of L2, it has been equally important to situate the study of L2 negotiation and co-construction of meaning within the field of research on Computer-Assisted Language Learning (CALL), and to notably focus on such innovative tools as Virtual Learning Environments (VLEs). As presented in Figure 2.1, this chapter will review and critically discuss the literature on L2 negotiation of meaning, with two objectives in mind: to explain why the present study has adopted an alternative definition of the construct of L2 negotiation of meaning, anchored in a Socio-Constructivist theoretical framework, and to then further situate the present study in the body of works on CALL, and more specifically on VLEs.

Fundamental to this review of literature will be the theory underlying the definition of the construct of L2 negotiation of meaning (a Socio-Constructivist theory). The first part of this chapter will intend to show that different definitions of L2 negotiation of meaning have been in competition in the literature, induced by their alignment with different theoretical frameworks.

Second, this chapter will situate the study of L2 negotiation of meaning within the field of research on computer-mediated communication (CMC) and on computer-assisted language learning (CALL). We will also demonstrate that a Cognitivist and a Socio-Constructivist trend have been in competition for the study of our central construct in CMC and CALL. Aligned with the shift in paradigm advocated by this study, we will present an alternative analytical model (Hull & Saxon's (2009) Interaction Analysis

Figure 2.1. Organization of the review of literature in the present study.



model), but we will also demonstrate that a gap in research was found for the study of L2 (rather than L1) negotiation of meaning in synchronous (rather than asynchronous) forms of CALL.

Finally, the last part of this chapter will further situate the study of L2 negotiation and co-construction of meaning within a virtual learning environment (VLE) setting, by demonstrating that an inherent affiliation exists between this innovative tool for learning and the Socio-Constructivist framework adopted in the present study. A review of the literature on VLEs will be conducted, allowing to demonstrate that a gap in research on VLEs for L2 negotiation and co-construction of meaning exists to further investigate learners' L2 critical thinking, problem-solving, and collaborative abilities.

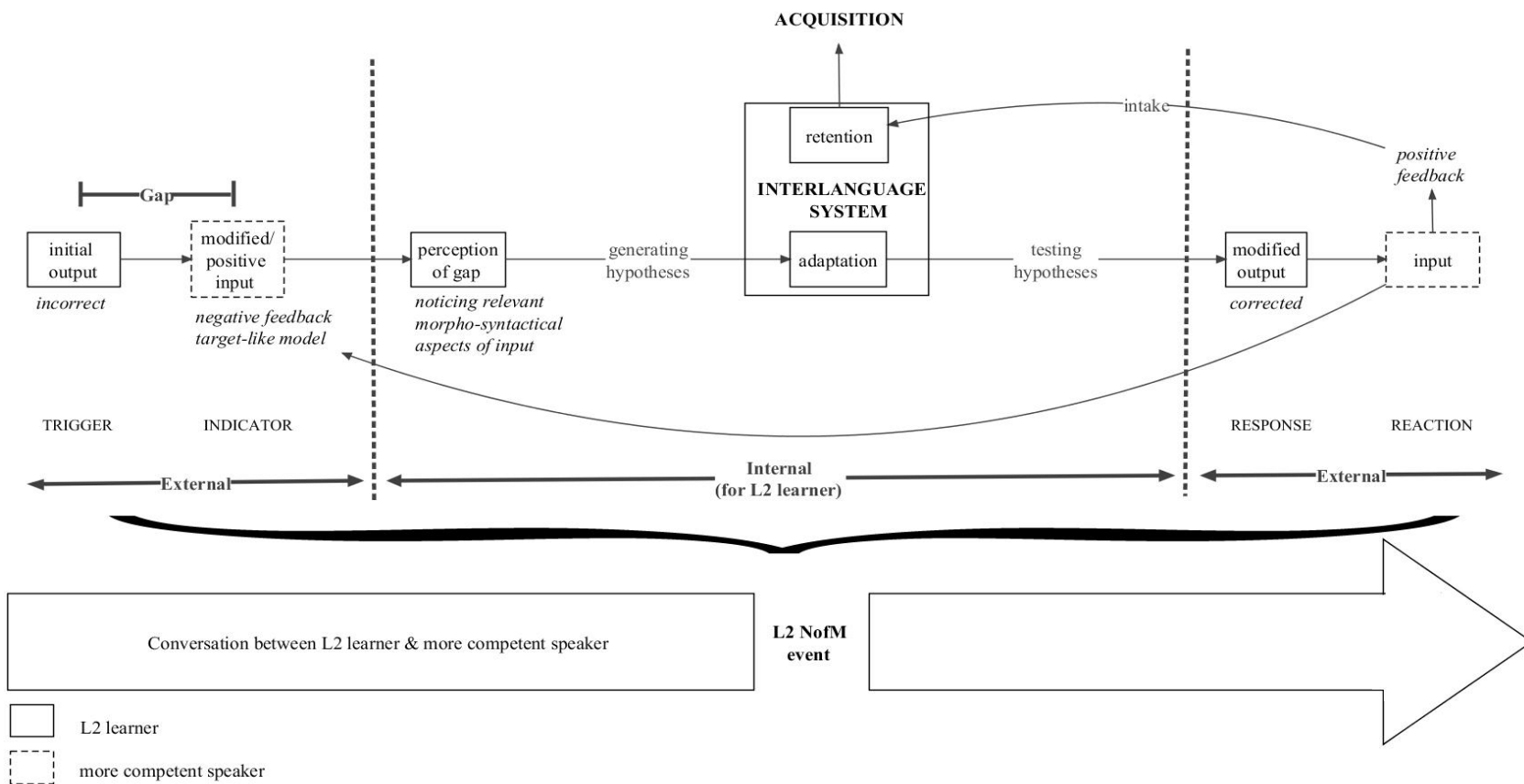
Two competing theoretical frameworks to define L2 negotiation of meaning

The first part of this review of literature is intended to present the two competing theoretical frameworks which have guided research on L2 negotiation of meaning, by providing distinct definitions of this construct. It is crucial to understand how these two paradigms, and their respective definition of L2 negotiation of meaning differ, in order to further understand research studies on L2 negotiation of meaning. We will first describe how the Cognitivist framework which has dominated research on L2 negotiation of meaning has described this construct. We will then describe a Socio-Constructivist approach to the definition of L2 negotiation of meaning, and highlight the points of divergence that it features, in comparison with the Cognitivist framework.

Cognitivist framework

As illustrated in Figure 2.2, in a Cognitivist paradigm, L2 learning is conceived as the acquisition by the L2 learner of the L2 morpho-syntactical systems in his/her interlanguage system. Meaning is equated to the operational rules governing these morpho-syntactical systems (Pica et al., 1989), and L2 negotiation of meaning thus

Figure 2.2. Cognitivist definition of L2 negotiation of meaning.



Note. Adapted from Chaudron, 1985; Faerch & Kasper, 1980; Long, 1983a; 1983b; 1996; Varonis & Gass, 1985.

corresponds to the retention as intake of correct forms of these linguistic systems in the L2 learners' interlanguage system (Chaudron, 1985; Faerch & Kasper, 1980; Swain, 1985). To better understand how L2 negotiation of meaning has been defined from a Cognitivist perspective, it is first important to briefly review the theoretical hypotheses contributing to its definition.

Three theoretical hypotheses

The Cognitivist framework that has predominantly served to define the construct of L2 negotiation of meaning in SLA research was directly inherited from Long's (1983a; 1983b, 1996) Interaction Hypotheses which posited that comprehensible input was one of the most critical and facilitative factors in language learning, and that access to this comprehensible input was better achieved when L2 learners had to interactively negotiate meaning. Central to the comprehensibility of input, according to Long, was the negative feedback provided by a more competent speaker to the L2 learner. The purpose of this feedback was to draw the L2 learner's attention to the gap between his/her original output and more target-like forms, as represented in the input s/he received.

The possibility for the L2 learner to notice a gap between original and target-like forms and to produce target-like output were thus two fundamental components in Long's (1983a; 1983b; 1996) Interaction Hypotheses, influenced by both Schmidt's (1990; 1993; 1994; 1995) Noticing Hypothesis, and Swain's (1985) Output Hypothesis. Schmidt's (1990; 1993; 1994; 1995) Noticing Hypothesis posited that L2 learners' conscious awareness of L2 morpho-syntactical features needed to be raised during a negotiation of meaning event. To accomplish this, learners have to be provided with input which makes relevant morpho-syntactical features more salient, resulting in input being processed by the L2 learner as intake (Chaudron, 1985; Faerch & Kasper, 1980). Swain's (1985) Output Hypothesis posited that the production of comprehensible output by the L2 learner (i.e. output which tends towards more target-like morpho-syntactical forms) was

fundamental if events of L2 negotiation of meaning were to promote second language acquisition. She considered that comprehensibility of output derived from the modification by the L2 learner of his/her interlanguage system. Swain (1985) more specifically stated the purpose of her Output Hypothesis by advocating the following:

Negotiating meaning needs to incorporate the notion of being pushed toward the delivery of a message that is not only conveyed, but that is conveyed precisely, coherently, and appropriately (...) [because] using the language as opposed to simply comprehending the language may force the learner to move from semantic processing to syntactic processing (pp.248-249).

L2 negotiation of meaning according to the TIRR model

In this Cognitivist framework, negotiation of meaning is considered as a vertical side- sequence interrupting the horizontal progression of a discourse (Varonis & Gass, 1985) developing between a L2 learner and a more competent speaker of the language (Varonis & Gass, 1985). This digressive event is intended to promote the acquisition of aspects of the L2 morpho-syntactical system by the L2 learner. It is triggered either by a lack of understanding among speakers (Long, 1983a; 1983b; Varonis & Gass, 1985) or by a need for the L2 learner to adjust or correct the linguistic structure of his/her output (Long, 1996; Pica, 1988; 1994; Pica et al., 1989; 1991; Swain, 1985). This vertical side- sequence of negotiation of meaning entails several stages, some corresponding to external processes, as conceptualized by Varonis & Gass (1985) in their TIRR model (a trigger, an indicator, a response, and a reaction to that response), and some corresponding to internal processes (noticing, generating and testing hypothesis about the L2, retention).

According to the TIRR model (Varois & Gass, 1985), the negotiation of meaning event is first externally *triggered* by the L2 learner who produces output in the L2 which the more competent speaker considers incorrect or unacceptable in the target language and which thus requires adjustment, modification, or correction (Bitchener, 2004; Swain, 1985; Varonis & Gass, 1985). Second, the more competent speaker is expected to *indicate* to the L2 learner the need for his/her output to be corrected, by providing

him/her with negative feedback (Long, 1983a; 1983b; 1996). The purpose of this feedback is to provide the L2 learner with access to target-like forms through positive input. This positive input is thus intended to serve as an exemplary and optimal linguistic resource to gain access into the specific aspects of the L2 morpho-syntactical system which are at stake in this precise negotiation of meaning event (Chaudron, 1985; Faerch & Kasper, 1980; Long, 1983a; 1983b).

For this negative feedback and its positive input to contribute to the needed adjustment, it needs to be modified by the more competent speaker to make the relevant morpho-syntactical aspects salient, so that the L2 learner internally *notices* the gap between his/her incorrect original output and forms that are more target-like (Schmidt 1990; 1993; 1994; 1995; Schmidt & Frota, 1986). The nature of this negative feedback, either implicit (e.g. recasting) or explicit (e.g. clarification requests), is thus considered crucial in providing the L2 learner with target-like resources which can be noticed to better inform the correction of the incorrect output (Ellis, 1991; Gass, 1990; Long, 1983a; 1983b; 1996; Swain, 1995). As noticing occurs, the L2 learner internally adapts his/her interlanguage system by generating hypotheses about possible alternative L2 linguistic structures. These hypotheses are then tested by the L2 learner who produces a new, modified output in the L2. This modified output serves as an external *response* to the initial negative feedback (Varonis & Gass, 1985).

Finally, the more competent speaker can *react* to this modified output either by accepting it through positive feedback (implicit or explicit), or by rejecting it by providing a second round of negative feedback. If the modified output is found to be acceptable by the more competent speaker, the L2 learner will internally process the input as intake in his/her interlanguage system. When intake results from the negotiation of meaning sequence equated to the internal retention of corrected linguistic forms by the L2 learner in his/her interlanguage system, L2 acquisition has occurred.

Cognitivist definition of L2 negotiation of meaning

With this description of the L2 negotiation of meaning process, as anchored in a Cognitivist paradigm, let us now consider Bitchener's (2004) definition of the construct of L2 negotiation of meaning. This definition corresponds to Definition #1, as mentioned in introduction of this chapter:

[L2 negotiation of meaning corresponds to] the negotiated interaction which occurs when conversational participants find a need to adjust and modify the linguistic form and structure of their interaction in order to be clearly understood [and] to resolve [a] communication difficulty (Bitchener, 2004, p.81)

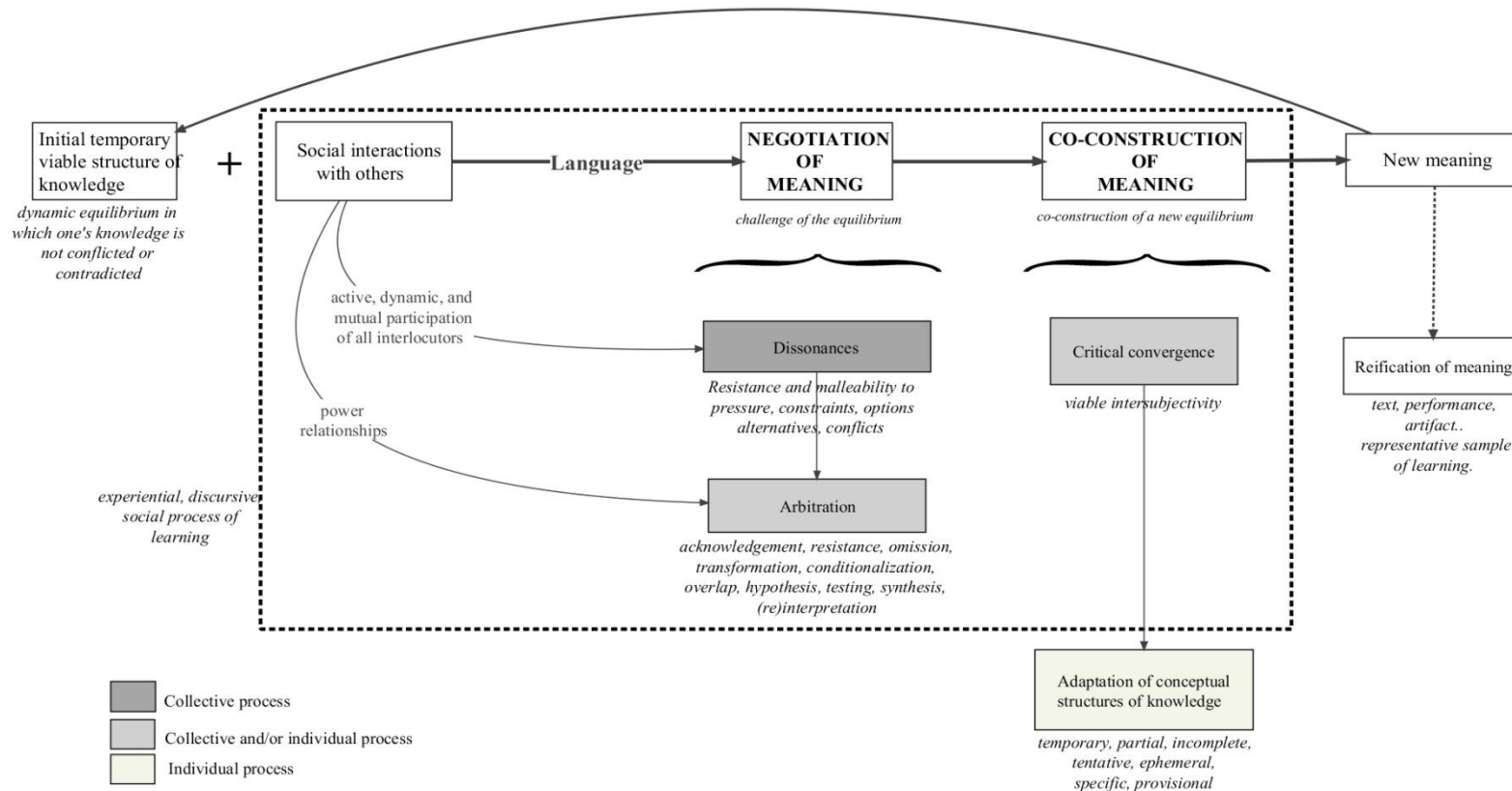
Based on this definition of L2 negotiation of meaning, we will now present the alternative theoretical framework, anchored in a Socio-Constructivist paradigm. We will also offer an alternative definition of L2 negotiation of meaning.

Socio-Constructivist framework

In a Socio-Constructivist paradigm, L2 learning is not conceptualized as acquisition but as the creation of new meaning. It is viewed as the construction by the learner of his/her individual subjective experiences of reality within the target language, the target cultures and the target communities. These subjective experiences are equated to meaning (Wells, 2007), so that L2 negotiation and co-construction of meaning corresponds to the management of these subjective experiences.

As illustrated in Figure 2.3, meaning is conceptualized as a dynamic equilibrium (Von Glasersfeld, 1989) corresponding to the temporary state in which the learner's pre-existing conceptual constructions are holding true, in the absence of contradictions. It is the very construction of new meaning that is considered L2 learning, which occurs when the learner's conceptual equilibrium is perturbed through experience, most notably through social interactions with others in the target language (Can, 2009; Von Glasersfeld, 1989; Wenger, 1999). The experiential and social context necessary to engender this perturbation in the learner's equilibrium is thus fundamental to promote L2

Figure 2.3. Socio-Constructivist paradigm: How meaning is socially negotiated and co-constructed.



Note. Adapted from Flower, 1994; Von Glasersfeld, 1989; Wenger, 1999.

learning (Wells, 2007). It is when social contact with others is at work that language mostly comes into play as the mediating tool that brings about the necessary perturbation and also allows for its resolution (Von Glasersfeld, 1989). In that sense, language and discourse are both the process and the product of L2 learning.

Negotiation of meaning as arbitration of dissonances

The process of negotiation of meaning (Wenger, 1999) corresponds to the management of this perturbation in the learner's prior conceptual equilibrium through social interactions and through language. It presupposes the active, dynamic, and mutual participation of all interlocutors for meaning to be ultimately created (Wenger, 1999; Windschitl, 2002). The postulate of an active engagement of all interlocutors is considered *sine qua non* for a mutual, interpersonal rapport to be established between the interlocutors, who take part in this negotiation process as independent thinkers (Flower, 1994). Mutuality in this rapport implies the capacity for each interlocutor to affect others and be affected by them to some extent. Nevertheless, it is important to note that mutuality does not necessarily imply equality. This distinction is crucial to understand that power relationships are not evacuated during the process of negotiation of meaning, and are, in fact, well at work (Wenger, 1999).

With the active, dynamic, and mutual participation of all interlocutors, a series of dissonances, under the form of pressures, constraints, options, alternatives, or conflicts, emerge out of the social interactions and through discourse, which engender the above-mentioned disequilibrium, and force the learner to critically examine his/her prior knowledge in a process of arbitration of these dissonances (Bednar et al., 1995; Duffy & Cunningham, 1996; Duffy & Orrill, 2001; Honebein et al., 1993). Arbitration is at the heart of the L2 negotiation of meaning process, but it does not imply choosing among the different dissonances or accepting them all at the expense of one's prior conceptual constructions. It is "more than a heteroglossic pastiche of voiced language and ideas"

(Flower, 1994, p.68). Rather, it implies a variety of personal and interpersonal sorting operations, where alternative propositions are gauged through such procedures as acknowledgement, resistance, omission, transformation, conditionalization, overlap, hypothesis, testing, synthesis, or (re)interpretation. It is in these moments of arbitration that intersubjectivity is established among interlocutors (Wells, 2007; Windschitl, 2002) and that the power relationships amongst interlocutors producing the discourse can be at work, giving authority to some voices at the expense of others (Flower, 1994).

Co-construction of meaning as critical convergence

Through the intersubjectivity established during the social process of negotiation of meaning, a moment of critical convergence finally emerges in the learner's conceptual framework. It consists of the achievement of a newly (co-)constructed conceptual structure that is perceived to be viable at a specific moment in time by the learner. Viability corresponds to the perceived acceptability and coherence by the learner of the reconciled multiple perspectives at stake during the process of negotiation of meaning, insomuch as their new transformed combination mitigates the dissonances brought by the social interaction (Von Glasersfeld, 1989).

It is this viable construction that is considered new meaning. Therefore, meaning cannot be said to be correct or incorrect, and thus cannot be prescribed. Rather, it is viable or it is not in the learner's conceptual framework. Meaning thus cannot be reduced to the mechanics of the language (Wenger, 1999) and cannot be prescribed or transferred since it is not static or stable, but only constructed by the learner him/herself (Grabinger, 1996; Herrington & Oliver, 2000; Von Glasersfeld, 1989; Wenger, 1999). In that sense, Von Glasersfeld (1989) noted that:

the physical signals that travel from one communicator to another – for instance the sounds of speech or the visual patterns of print or writing linguistic communication – do not actually *carry* or *contain* what we think of as 'meaning' (pp.131-132).

From this perspective, it results that the exclusive emphasis on the L2 learners' morpho-syntax is inadequate with the study of meaning-construction in the L2 negotiation of meaning process. In that sense, meaning is also "more than conscious awareness of metacognition: it is a response to perceived conflicts and alternatives in meaning-making" (Flower, 1994, p.74). From this crucial point, it can be argued that meta-talk is an inadequate object of study to investigate the process of L2 negotiation and co-construction of meaning. This specific point about the fundamental difference between the viability of meaning on the one hand, and prescribed morpho-syntactical mechanics of the language on the other, is absolutely fundamental in understanding the major differences that separate the two main trends of research on L2 negotiation of meaning that we will present next.

This new co-constructed meaning, under the form of a new viable conceptual construction, leads in turns to the reconfiguration of the learner's overall conceptual framework, in which it is accommodated and integrated. It is this reconfiguration of the learner's overall conceptual framework that is considered learning. Once this reconfiguration has taken place, the learner recovers a new temporary state of conceptual equilibrium, similar in its function to the one s/he had before the episode of negotiation and co-construction of meaning (Von Glasersfeld, 1989).

Reification of meaning: the tip of the learning iceberg

As a last and optional step in the meaning-construction process, learners may apply their newly co-constructed L2 meaning to create an artifact representative of their learning. This artifact corresponds to the types of evidence of learning that are most commonly required from learners in an educational setting (e.g. a piece of homework, the responses to a test, the writing of a composition, an oral performance, etc). Creating an artifact that represents the outcome of the learning process is a form of *reification* of the meaning co-constructed by the learner (Wenger, 1999). It is its representation under the

form of a palpable, concrete, consciously-made object. It is a sample of this learning, but it is not a representation of the learning *process* in and of itself. Reification of meaning thus leads to the learning outcome via the creation of learning objects. These learning objects are only “the tip of an iceberg”: they are indicative of, but not encompassing the occurrence of, a larger context of significance realized through experience, that is to say of the L2 learning process.

This distinction between the learning process, happening in negotiation and co-construction of meaning, as productive of discourse, and the learning object, under the form of an educational artifact, is crucial, insomuch as it can be argued that research on L2 negotiation of meaning should not limit its investigation to the latter and should rather focus on the former. In that sense, research on L2 negotiation of meaning should not be limited to the investigation of surface representation of learning, and should rather examine the deeper phenomena at work during the learning process. By adopting a Socio-Constructivist paradigm, a new definition of learning as the very discursive process of L2 negotiation and co-construction of meaning can be proposed, thanks to which access can be gained to deeper phenomena of the learning process, such as L2 learners’ critical thinking and problem solving abilities.

A new definition of L2 negotiation and co-construction of meaning

As framed by this Socio-Constructivist paradigm, we will thus offer a new definition of the concept of L2 negotiation and co-construction of meaning as a promising construct for the study of L2 learners’ critical thinking and problem solving abilities. This definition corresponds to Definition #2, as mentioned in introduction of this chapter:

L2 negotiation and co-construction of meaning is the subjective and alternatively collective and individual process by which learners produce and exchange discourse and meaning which is “affected, negotiated, [arbitrated], and reconstructed as a result of

conflict in social interactions”, as well as in individual perceptions (Jeong, 2003, p.28).

Based on this new definition of L2 negotiation and co-construction of meaning, in an attempt to investigate L2 learners’ critical thinking and problem solving abilities, we will now review the body of work on L2 negotiation of meaning.

Research on L2 negotiation of meaning

Research on L2 negotiation of meaning has been predominantly influenced by the Cognitivist paradigm previously described. We will now present a review of the main findings of the literature aligning with this theoretical framework. We will then offer a review of the critiques that has been expressed regarding the contradictory and inconclusive nature of these results, explained by what other researchers considered an erroneous definition of L2 negotiation of meaning. We will then present an alternative trend of research, better aligned with the Socio-Constructivist framework we just presented, and the promising findings that emerged from these studies.

Predominant Cognitivist-based studies

Research on L2 negotiation of meaning has been predominantly influenced by a Cognitivist paradigm, first and foremost relying on Varonis & Gass’s (1985) TIRR model. In this line of research, researchers’ attention focused on the study of *indicators* provided by the more competent speaker in the L2 negotiation of meaning process. Other researchers also focused on the *response*, as generated by the L2 learner. Finally, some attention was also dedicated to the impact of the L2 learner’s level of engagement in the L2 negotiation of meaning process.

Research on *indicators*

Based on the TIRR model (Varonis & Gass, 1985), a review of the vast Cognitivist-based literature shows that the *indicator* is the aspect of the L2 negotiation of meaning process which attracted the most researchers’ attention. As previously defined,

the *indicator* corresponds to the stage, during the L2 negotiation of meaning process, when the incorrectness of the L2 learner's original output is indicated by the more competent speaker. This indicator serves as negative feedback and is also intended to serve as positive input, that is to say as an exemplary form of the target-language morpho-syntactical features. Researchers more specifically attempted to determine the nature of diverse indicators, so as to establish their relative frequency in L2 negotiation of meaning episodes, thereby determining the amount of noticing and retention of morpho-syntactical features accomplished by L2 learners. By concentrating most of their attention on indicators, researchers thus focused primarily on the role of the more competent speaker in the L2 negotiation of meaning process, and only incidentally on the role of the L2 learner, which we will argue is insufficient if we are to comprehensively understand the SLA process.

Nature of indicators

Research on *indicators* in the L2 negotiation of meaning process started with the emergence of Long's (1983a; 1983b) first Interaction Hypothesis, in a study where he was particularly interested in exploring how NSs modified their speech when addressing NNSs while maintaining comprehension, and how these NSs to avoided or repaired non-understanding. Investigating this modified input, Long (1983a; 1983b) found that NSs resorted to two types of interactional mechanisms, the most important of which he termed *tactics*, corresponding to the indicator in Varonis & Gass's (1985) later TIRR model. These tactics consisted of compensatory methods aimed at helping to repair the L2 learner's discourse when communicative trouble arose, and took the form of confirmation checks, comprehensions checks, clarification requests, self-repetitions, or expansions.

Frequency count of indicators

Based on Long's (1983a; 1983b) results, as well as on Varonis & Gass's (1985) emerging TIRR model, a wave of studies were conducted in the 1980's and early 1990's,

which expanded on the importance of the modification of the input provided by the more competent speaker to the L2 learner in the L2 negotiation of meaning process. Whether in NS/NNS or in NNS/NNS forms of interactions, and usually structured around dyads, these studies primarily aimed at better determining the types of *indicators* that were being used in oral episodes of negotiation of meaning by quantifying the occurrence of various indicators to determine their frequency (Duff, 1986; Gass & Varonis, 1986; Jauregi, 1990; Pica & Dougherty, 1985; Porter, 1986; Rulon & McCreary, 1985; Takahashi, 1989).

Indicators, as related to noticing and retention

Influenced by Schmidt's (1990; 1993; 1994; 1995) Noticing Hypothesis and Long's (1996) second Interaction Hypothesis, studies focusing on episodes of L2 negotiation of meaning refined their focus on *indicators* in an attempt to inform the study of noticing and retention of L2 morpho-syntactical features (Ellis, 1991; Gass, 1990; Gass & Varonis, 1994; Schmidt, 1994; Swain, 1995). This focus was summarized by Long (1996) who proposed the following:

Selective attention and the learner's developing L2 processing capacity are brought together most usefully during *negotiation for meaning* [to contribute to acquisition]. *Negative feedback* obtained in negotiation work (...) may be *facilitative* of SL development, at least for vocabulary, morphology, and language-specific syntax, and essential for learning certain specifiable L1-L2 contrasts" (p.414).

Especially negotiation work that triggers interactional adjustments by the native speaker or more competent interlocutor, facilitates acquisition because it connects input, internal learner capacities, particularly selective attention, and output in productive ways (pp. 451-452).

A new wave of studies thus emerged, which more specifically investigated modified input and negative feedback that provided access to specific morpho-syntactical features, and whether these features were subsequently noticed and retained by the L2 learner (Gass & Varonis, 1994; Long, Inagaki, & Ortega, 1998; Loschky, 1994; Mackey, 1999; Mackey & Philp, 1998). As explained by Mackey & Philp (1998), this new wave of

studies was considered “the next step in research [as] the attempt to isolate the effect of individual interactional features (...) on L2 development (...) [and to determine] exactly which morphosyntactic structures may be internalized by learners” (p.338).

In this new trend in SLA research, Ellis et al.’s (1994) *Tokyo study* was the first prominent empirical attempt to test the fundamental components of Long’s (1983a; 1983b; 1996)’s Interaction Hypotheses. This study aimed at investigating whether the use of modified input by a more competent speaker in a L2 negotiation of meaning episode could be empirically claimed to improve L2 learners’ comprehension and thus lead to their L2 vocabulary acquisition. Results in this study empirically demonstrated that L2 learners’ comprehension was improved by receiving modified input from a more competent speaker, but failed to demonstrate that receiving this modified input led L2 learners’ to retain L2 vocabulary beyond the short-term. Similarly, Long, Inagaki, & Ortega (1998) investigated the role of positive input through negative feedback in the form of recasts on the acquisition of three specific syntactical structures in L2 Japanese and Spanish. Results were inconclusive on the retention of Japanese adjective ordering structures and on the acquisition of Spanish direct object topicalization structures, with only the Spanish adverb placement structures being significantly impacted by recasts in the negotiation of meaning process. Similar inconclusive results were found by Loschky (1994), who demonstrated that neither retention of Japanese vocabulary nor acquisition of two Japanese locative constructions were impacted by the negotiation of meaning process. Finally, Mackey & Philp (1998) also investigated the role of recasts for the acquisition of higher-levels of question formation structures in ESL. Their results varied based on the initial level of proficiency displayed by the learners. Significant results were also found for Intermediate, but not for Beginner learners in their development of higher-level of question formation structures.

Research on *responses*

The *response* component of the TIRR model (Varonis & Gass, 1985) is the other aspect of the L2 negotiation of meaning process which attracted researchers' attention in a Cognitivist tradition. As explained earlier, the *response* corresponds to the stage, during the L2 negotiation of meaning process, when the L2 learner produces modified output in response to feedback provided by a more competent speaker. Research studies focusing on *response* have investigated the L2 learner's output and led to two categories of findings of interest on the nature and quantity of response, as based on the type of feedback received (i.e. *indicator*) or on the nature of the original *trigger*.

Response, based on types of indicator

Pica and her associates (Pica, 1988; Pica et al., 1989; Pica et al. 1991; Pica, 1994) were at the forefront of research on response, based on the type of feedback received by the L2 learner. They looked at L2 negotiation of meaning episodes and whether different *indicators* elicited different subsequent *response*. Results from these studies were contradictory and often inconclusive. This led Pica (1994) to integrate all the results from these studies, and conclude that "the research points out areas in which negotiation does not appear to assist L2 learning, especially with respect to the learner's need to access L2 grammatical morphology and to strive toward accurate production of L2 morphosyntax" (Pica, 1994, p.493). Similarly, Mackey & Philp (1998), in their study on recast as negative feedback, showed that only very few learners actually provided a *response* to the recast *indicator*, that is, that very little uptake and very few modified output resulted from receiving implicit negative feedback during the process of negotiation of meaning.

Response, based on types of trigger

Bitchener's (2004) study measured the retention of a variety of morpho-syntactical features, as found in the L2 learner's *response*, based on the nature of the

trigger which caused the L2 negotiation of meaning episode. The study set out to establish the frequency of three possible *triggers* (vocabulary, pronunciation, and grammar), to determine which morpho-syntactical category led to the most modified output. Results indicated that vocabulary was by far the *trigger* leading to the most episodes of negotiation of meaning, while grammar was the lesser *trigger* of these episodes. In terms of retention, Bitchener found that only vocabulary items led to a good retention rate after one week, but nevertheless showed an important attrition rate after twelve weeks. These results are congruent with Ellis et al.'s (1994) on retention of vocabulary, but Bitchener (2004) warned that "it cannot be guaranteed that a response that simply repeats a modified signal, namely, one that modifies the trigger utterance with a target-like model, is evidence of learning" (p.93). Regarding pronunciation and grammar, Bitchener noted that no additional learning had occurred.

L2 learner's level of engagement

L2 learners' engagement in the process of L2 negotiation of meaning is the other aspect which attracted some researchers' attention. Ellis et al. (1994), in their *Tokyo study* investigated whether the active participation of students in the episodes of negotiation of meaning was a factor in their levels of comprehension and retention of L2 vocabulary. Their results were inconclusive, and the authors determined that active participation in the L2 negotiation of meaning process was neither a necessary nor an impeding condition for vocabulary comprehension and retention. These findings were congruent with Pica's (1992), which demonstrated that no significant difference could be found on comprehension between students who were actively engaged in the negotiation process and those who were only passively observing it.

Conversely, Mackey (1999), in a research article expanding on Mackey & Philp's (1998) study, showed that only the participants who demonstrated active participation in the process of negotiation of meaning displayed indications of question formation

structure development, both in terms of the quantity of structures produced and in terms of increased evolution in the acquisition of these structures. These findings were thus contradictory to Pica's (1992) and Ellis et al.'s (1994) and demonstrate that no clear findings have emerged in this Cognitivist trend of research, regarding the impact of active participation by the L2 learner in the negotiation of meaning process.

Conclusion on predominant Cognitivist-based studies

In conclusion, it is clear that the predominant trend of research on L2 negotiation of meaning is characterized by a series of inconclusive or contradictory results. What these studies have demonstrated was that L2 negotiation of meaning, as defined from a Cognitivist perspective, could improve comprehension by L2 learners and result in short-term retention of L2 vocabulary. Nevertheless, they failed to demonstrate that L2 negotiation of meaning, notably through the focus on form induced by the use of negative feedback, could promote noticing or retention of any other L2 morpho-syntactical features by the L2 learner. Finally, contradictory results have emerged regarding the need for L2 learners to be actively engaged in the L2 negotiation of meaning process, whether or not it is beneficial for their L2 learning.

In contrast to the predominant Cognitivist trend of research on L2 negotiation of meaning, the present study adopted a Socio-Constructivist theoretical framework. The selection of this particular framework was motivated by two elements in the review of literature. First, studies on L2 negotiation of meaning adopting a critical view of research supported by Cognitivist SLA theory better the reasons and consequences of the above-mentioned limitations encountered by the majority of studies on L2 negotiation of meaning. Second, by putting forth new definitions of the central construct of L2 negotiation of meaning, promising new orientations supported by more conclusive results, indicate that a Socio-Constructivist framework is more appropriate to serve as the theoretical anchor for the present study.

In the next section, we will first review the criticisms raised by these alternative researchers, in terms of the sources and consequences of the limitations reached by the predominant trend of research on L2 negotiation of meaning. We will then present their innovative contributions to the redefinition of L2 negotiation of meaning, as well as empirical results from their research.

Critiques on the predominant trend of research on L2 negotiation of meaning

Critiques raised by other researchers on the predominant trend of research on L2 negotiation of meaning concerned, on the one hand, the limitations they reached in terms of results and research methodology, and, on the other hand, the source of these limitations, as inherently induced by the very definition of the L2 negotiation of meaning construct.

Critical views on results and methodology

In reaction to the contradictory and inconclusive results reached by the Cognitivist-based trend of research on L2 negotiation of meaning on the syntacticality of L2 learners' output, Van den Branden (1997) rightfully noted that “before researchers [could] make strong recommendations to teachers about ‘pushing output’, their theoretical claims need[ed] to be further substantiated” (p.600). Moreover, inconclusive results on the need for L2 learners to actively engage in the L2 negotiation of meaning process were questioned, notably by Van den Branden (1997) who demonstrated that indicators that did not lead the L2 learner to actively participate in the negotiation process simply could not be considered instances of negotiation, since the repair was actually realized by the more competent speaker.

Furthermore, the research methodology adopted by most investigators on L2 negotiation of meaning was also questioned. Highlighting the predominant use of quantitative methods, Jauregi (1997) highlighted the limited impact of such research

method, insomuch as it only led to calculating the frequency of indicators, disregarding the rest of the overall discursive context. Conversely, Jauregi (1997) supported the need to conduct more in-depth inductive analyses of the overall discursive process surrounding episodes of L2 negotiation of meaning, and thus advocated a more qualitative approach. This stance on methodology was also shared by Brooks & Donato (1994) and Swain & Lapkin (1998) who advocated establishing a portrait of L2 learners' discursive functions in episodes of L2 negotiation of meaning, thus supporting a case-study approach to the investigation of L2 negotiation of meaning.

Critical views on the definition of L2 negotiation of meaning

More importantly, the predominant trend of research on L2 negotiation of meaning was extensively criticized by this other trend of researchers for what they considered to be a limited and erroneous definition of L2 negotiation of meaning, which they considered to be the fundamental cause of these limitations (Brooks & Donato, 1994; Foster & Ohta, 2005; Jauregi, 1997; Swain & Lapkin, 1998).

Jauregi (1997) explained that the definition used by the predominant trend of research raised considerable issues of validity, by adopting “a very formalistic and static view on discourse, [which] disregard[ed] any procedural, pragmatic, and in-depth approaches” to the speech-acts occurring during episodes of L2 negotiation of meaning (p.45). Similarly, Swain & Lapkin (1998) criticized the fact that language used during episodes of negotiation of meaning was simply considered as a means of communication rather than a tool for thinking. As a consequence of this narrow and formalistic definition, Jauregi (1997) demonstrated that researchers' perspective was restricted to the investigation of the *form* of the conversational modification devices in L2 negotiation of meaning episodes (trigger, indicator, or response), leading to isolate these utterances from

the rest of the discourse, and thus to erroneously equate their *form* to their *function* in that discourse. She noted the following:

These studies have undertaken to examine [negotiation of meaning] within an extremely formalistic paradigm. They have disregarded the sequence of discourse within which indications of lack of understanding are given and responses to those indications are offered. They have neglected crucial questions such as: what was happening at that precise moment in the conversation? What was the role of each of the interlocutors? Were the interlocutors involved in the conversation or not? What was the topic they were talking about? What came before and after the lack of understanding? (p.46)

It can be argued, based on these authors that what the predominant trend of research on L2 negotiation of meaning primarily focused on was the reification of L2 learners' knowledge (as presented in Figure 2.3), instead of their actual learning and discursive process.

What Jauregi (1997) showed had been consequently disregarded was the actual *sequence* of discourse within which the conversational modification devices were being used, as well as the *function* of these. Such perspective, she pointed out, generated a trend of research focused exclusively on the “negative angle” of L2 negotiation of meaning, omitting that L2 negotiation of meaning also involved the more positive co-construction of the on-going discourse. Similarly, Brooks & Donato (1994) highlighted the need to further consider the conversational aspects demonstrating that a co-construction of discourse was taking place among interlocutors (see also Foster & Ohta, 2005):

Analysis of target language interactions (...) is often confined to uncovering the ways interlocutors unwrap linguistic messages and achieve literal comprehension (...). Encoding and decoding reflect only the most ordinary and instrumental aspects of language use, i.e. message transmission and reception. (...) This dominant view serves only to obscure our investigations of what foreign language learners are actually trying to achieve during verbal interactions, (...) [using speaking] as a strategic tool for cognizing and constructing tasks, meaning, and shared situational definitions” (pp.262-263).

Likewise, Foster & Ohta (2005) noted that the focus put on L2 learners' communication failure led to an emphasis of research on their lack of success, which was an angle that, if

applied by practitioners, would lead to face-threatening learning environments, counter-conducive to adequate learning.

These researchers finally disapproved of the fact the field of study on L2 negotiation of meaning was over-represented by research studies anchored in this formalistic and narrow definition of L2 negotiation of meaning, which they considered “unduly influenc[ed] the second language research agenda” (Brooks & Donato, 1994, p.263). They consequently supported the need for research to explore new definitions of L2 negotiation of meaning and to engage in alternative forms of research, based on these new definitions.

Alternative studies on L2 negotiation of meaning

In reaction to the predominant trend of research on L2 negotiation of meaning, the above-mentioned researchers conducted studies intended to overcome the limitations summarized above. For that purpose, they offered alternative definitions of this central construct, some by adapting the Cognitivist framework used by the predominant trend of research (Jauregi, 1997; Van den Branden, 1997), and others by undertaking a paradigm shift, adopting a Socio-Constructivist framework, inspired by Vygotsky’s (1978; 1987) theories (Brooks & Donato, 1994; Foster & Ohta, 2005; Swain & Lapkin, 1998). With new definitions of L2 negotiation of meaning at the basis on their investigations, these researchers reached interesting and promising results, which considerably influenced the present study.

Alternative definitions of L2 negotiation of meaning

Cognitivist-based alternative definitions

Amongst the alternative definitions of L2 negotiation of meaning which adapted a Cognitivist framework, Jauregi (1997) differentiated *negative* and *positive* negotiation of meaning. She thus established a distinction between the episodes of L2 negotiation of

meaning intended for the *correction* of parts of the discourse, where non-understanding occurs, and those intended to maintain the on-going *construction* of this discourse, where understanding is sustained. She proposed that the *corrective* function of the conversational modification devices used in the discourse be called *negative negotiation of meaning*, and that other devices, as used to *construct* and sustain the conversation and understanding among interlocutors be called *positive negotiation of meaning*.

In a different but related fashion, Van den Branden (1997) also argued that a distinction should be made between different components of the umbrella construct of negotiation of meaning, which in fact encompassed three distinct, albeit related, concepts of negotiation, serving three distinct discursive *functions*: negotiation of *meaning*, negotiation of *form*, and negotiation of *content*. Negotiation of *meaning* was thus intended for conversational purposes in order to restore or maintain mutual understanding, while negotiation of *form* was not prompted by a lack of understanding or by conversational needs, but rather by a formalistic desire to push the L2 learner to produce a formally correct or appropriate utterance. Finally, negotiation of *content* was neither prompted by lack of understanding nor by formalistic objectives, but rather by a need to fill in an information gap by providing more details about the topic under discussion. These three functions of negotiation also had a distinct position in the overall discourse, with both negotiation of *meaning* and negotiation of *form* corresponding to vertical side-sequences stopping the horizontal progression of the discourse (see Varonis & Gass, 1985), and negotiation of *content* corresponding rather to the very horizontal development of this discourse.

Finally, in establishing their alternative definitions of L2 negotiation of meaning, both Jauregi (1997) and Van den Branden (1997) considered the active engagement of the L2 learner a *sine qua non* parameter in defining a given discursive process as an episode of negotiation, positioning themselves in contradiction with Ellis et al.'s (1994) or Pica's (1992) results.

Socio-Constructivist-based alternative definitions

Amongst the alternative studies which proceeded to a paradigm shift and adopted a Socio-Constructivist framework, Brooks & Donato (1994), Swain & Lapkin (1998), and Foster & Ohta (2005) considered L2 negotiation of meaning as the dialogue that occurs between L2 learners speaking together to create a shared social reality, to co-construct knowledge and language that may result in internalized linguistic changes, in order to plan and carry out task-relevant actions. In accordance with this definition of L2 negotiation of meaning, they considered that the empirical study of L2 negotiation of meaning should encompass a global study of L2 learners' discourse inasmuch as it elicited co-constructions of situated definitions among learners. Swain & Lapkin (1998) also supported a new form of empirical research which would consider L2 learners' discourse as both the process and the product of their L2 learning, since they considered that this discourse was in and of itself a co-construction of their linguistic knowledge. The present study was particularly influenced by this last conception of L2 negotiation of meaning, as well as with the need to take into consideration the global discourse produced by L2 learners during episodes of negotiation of meaning.

With these alternative definitions in mind, we will now review the empirical research conducted in reaction to the predominant trend of studies on L2 negotiation of meaning. We will first present their innovative choices, in terms of methodological design, and then explain the results which were reached by this alternative trend of research and contradicted previous results on L2 negotiation of meaning. We will finally present the emergence of new findings of interest, which were influential for the present study.

Alternative research studies

Alternative methodologies

It is first crucial to note that, in this alternative trend of studies on L2 negotiation of meaning, the adoption of newly redefined constructs of L2 negotiation of meaning called for the adoption of alternative forms of research methodologies. These alternative research methods tended to give more importance to qualitative methods and exploratory, as well as descriptive analyses.

Among the qualitative studies which emerged in this alternative trend of research, Jauregi (1997) opted for an in-depth longitudinal inductive study, using ethnographical methods, in an attempt to conduct a conversation analysis of L2 learners involved in episodes of L2 negotiation of meaning. Brooks & Donato (1994), as well as Swain & Lapkin (1998), opted for a case-study approach to the investigation of L2 negotiation of meaning, in an attempt to establish a portrait of L2 learners' discursive functions in episodes of L2 negotiation of meaning. These qualitative methods were influential for the present study, which also intended to establish a portrait of L2 learners' discursive patterns of L2 negotiation of meaning.

Even more innovative methodologically were Van den Branden's (1997) and Foster & Ohta's (2005) studies, both utilizing a mixed methods approach to the study of their respective revised construct of L2 negotiation of meaning. Although not formally anchored in a mixed methods research paradigm, these studies integrated both quantitative and qualitative data. In Van den Branden's (1997) study, this integration was intended to investigate the nature and quantity of discourse produced by L2 learners in episodes of negotiation of meaning. In Foster & Ohta's (2005) study, this integration was motivated an investigator triangulation, with the need to replicate previous studies' quantitative methodology and to compare these quantitative findings to other qualitative findings, indicating that the context of the discourse was crucial to interpret and more

reliably analyze L2 learners' discourse. These two studies were of great importance for the present study, which fundamentally relied on a mixed methods approach to the study of L2 negotiation of meaning, and also intended to integrate quantitative and qualitative data to better explain, expand, and/or contradict the results from one data source to the results of the other.

With these methodological considerations in mind, we will now review the results of interest which emerged from these alternative studies, whether because they contradicted previous results which had emerged in the predominant trend of research on L2 negotiation of meaning, or because they were innovative, and thus promising, findings.

Results contradicting the predominant studies on L2 negotiation of meaning

Based on her alternative definition of *positive* and *negative* negotiation of meaning, distinguishing the *construction* and the *correction* of discourse, Jauregi (1997) posited that the entire discursive context of L2 negotiation of meaning episodes should be taken into consideration in an in-depth inductive analysis. The purpose of her study was to explore and compare how these two functions (positive and negative negotiation) emerged in L2 Spanish learners' discourse, when paired up with NSs on the one hand, and when paired up with other L2 learners on the other hand.

Results related to *negative* negotiation of meaning indicated that corrective episodes were first and foremost *triggered* by issues of pragmatics, rather than lexical or syntactical issues in NS/NNS dyads, while NNS/NNS's episodes were primarily *triggered* by semantic issues. Jauregi also demonstrated that the need for correction tended to be *indicated* through non-verbal (i.e. gestures) and non-linguistic (e.g. "uhm?") cues, just as often as through linguistic, yet minimal cues (e.g. "¿qué?"). *Responses*, on the other hand, were shown to be highly context-bound, and based on the degree of

common grounding that had been previously established by the interlocutors. Finally, she showed that the overall negative negotiation sequences were much more complex and cyclical than the linear TIRR model (Varonis & Gass, 1985) would tend to suggest, with multiple instances of return to prior steps. Jauregi's (1997) results thus contradicted to a great extent the findings of many formalistic studies on L2 negotiation of meaning, mainly regarding the nature of the *trigger* as well as of the *indicator*. Her study also allowed to put the emphasis on the complexity and non-linearity of the discursive process at work in episodes of L2 negotiation of meaning, which was of great importance for the present study. Finally, her findings regarding the importance of non-verbal cues in episodes of L2 negotiation of meaning also turned out to be fundamental in the interpretation of some of the results emerging in the present study, mainly concerning RQ#2.

Van den Branden's (1997) empirical study of L2 negotiation of *meaning*, *form*, and *content* investigated both the quantity and the quality of the discourse produced by L2 learners of Dutch in NS/NNS dyads. Van den Branden thus analyzed indices eliciting either one of the three types of negotiation, and, more specifically, the quantity of output produced by the L2 learners, as well as the syntactic complexity, morpho-grammatical correctness, quality of information conveyed and range of vocabulary used in their output.

Results showed that episodes of negotiation of *content* were significantly and overwhelmingly the most common type of negotiation taking place, while episodes of negotiation of *form* were completely absent in the learners' discourse. Furthermore, no significant decrease in morpho-grammatical errors could be found before and after the task, despite the amount of negotiation happening. These findings only further confirmed the impasse that a study of the impact of negotiation of meaning on the acquisition of morpho-syntactical features represented (Long, Inagaki, & Ortega's, 1998; Mackey & Philp, 1998; Mackey, 1999; Pica, 1994). Van den Branden concluded that research on L2

negotiation of meaning had been clearly overemphasizing the role and impact of focus on form in episodes of L2 negotiation of meaning, and inversely underestimated the role and potential of negotiation of *content* in helping L2 learners produce more complete, more complex, and more accurate output. This advocated need for a shift in attention away from focus-on-form, and rather centered on negotiation of content, as promoting the construction of an on-going discourse among L2 learners, was fundamental for the present study.

Results reached by this alternative trend of research did not simply serve to contradict results from the predominant trend of research on L2 negotiation of meaning. They also allowed to bring to the forefront new emerging findings of great interest for SLA research in general, and for the present study on L2 negotiation of meaning in particular.

New emerging findings of interest

L2 negotiation of meaning as grounding

Results in Jauregi (1997) related to positive negotiation of meaning showed that the discourse produced by L2 learners integrated both individual and social processes, and developed first and foremost on the establishment of common grounds among interlocutors. Similarly, Brooks & Donato's (1994) study showed that many instances of situated meaning and situated definitions could be found in the learners' discourse, where episodes of negotiation of meaning served to arrive at a common language and to establish intersubjectivity. Likewise, results in Foster & Ohta (2005) indicated that two functions were primarily fulfilled by the discourse produced by L2 learners: on the one hand, to express interest and encouragements to each other, so as to sustain the conversation, and, on the other hand, to share and incorporate each other's contributions to co-construct discourse. Finally, results in Van den Branden (1997) indicated that episodes of negotiation of content were specifically marked by the significantly superior

use of confirmation requests, marking the grounding of comprehension among interlocutors, before more details were required by one of them.

Grounding common meaning among L2 interlocutors in episodes of L2 negotiation of meaning was thus shown to be, in all these studies, a consistent finding, and served to confirm the fact that construction, rather than correction, is what first and foremost led to the co-construction of discourse among L2 learners. The concept of grounding had a major impact of the present study, in its attempt to determine how critical convergence was reached among L2 learners.

L2 negotiation of meaning and the establishment of social rapport

Regarding the social aspect of the L2 negotiation of meaning process, results in Jauregi (1997) indicated that L2 learners would tend to favor a transactional and egocentric approach to conversation rather than establishing an interpersonal rapport with their interlocutor. These results showed the difficulty experienced by the L2 learners to establish mutuality in their social rapport and in the co-construction of discourse. Furthermore, power relationships also proved to have a significant impact on the quality of the discourse produced, and on the role and function of each interlocutor in the L2 negotiation of meaning process. Asymmetric relationships, as found in some dyads, were shown to impede reciprocity and collaboration between interlocutors in the co-construction of discourse. Contrary to these results, Brooks & Donato (1994) showed that students in their study used negotiation of meaning to establish social rapport in order to promote conditions for joint attention of the task to be accomplished or the problem to be solved.

Despite the lack of conclusive findings, the saliency of this theme of social rapport and power relationship was of great interest for the present study, which intended to further contribute to the exploration of this theme, notably in the treatment of RQ#2.

L2 negotiation of meaning as hypothesis-generating and hypothesis-testing

Results in Van den Branden (1997) indicated that episodes of negotiation of content were also marked by new creative language phenomena in the L2 learners' discourse, such as instances of hypothesis-generating and hypothesis-testing *in* the language, rather than simply *about* the language. Consistent with these findings, Swain & Lapkin's (1998) results indicated that the learners' discourse during negotiation of meaning episodes consisted in generating hypotheses in and about the language, collectively assessing these hypotheses, and applying the resulting knowledge to new linguistic contexts. Consequently, the authors pointed out the function served by L2 learners' dialogues to co-construct the language they needed in order to express the meaning they wanted to convey.

These results were of great importance for the present study inasmuch as they demonstrated that higher forms of mental functioning *in* the language could potentially happen with L2 learners. It is the investigation of these higher forms of mental functioning, through the study of critical thinking abilities, which was the intent of the present study, notably through the treatment of RQ#1.

With these results on L2 negotiation of meaning in mind (whether resulting from a Cognitivist trend of research or from a Socio-Constructivist one), we will now further frame the study of L2 negotiation of meaning within the field of computer-mediated communication (CMC) and computer-assisted language learning (CALL), and proceed to review its research literature.

L2 negotiation and co-construction of meaning in CMC and
in CALL

CMC affordances in the study of L2 negotiation of
meaning

With the new millennium came new technology-bound forms of communication, called Computer-Mediated Communication (CMC), which both L2 education and SLA research would consider as promising for the development of L2 learning and L2 acquisition. The pedagogical and research-based use of CMC for language learning purposes came to be part of the field of CALL (Computer-Assisted Language Learning). The most representative CMC tool for CALL was chat, allowing for script-based, online, verbal, interactions. With the use of chat spreading in CMC and in CALL, SLA researchers saw a new opportunity to further study L2 negotiation of meaning, by investing in the promising *affordances* of chat, and the subsequent changes that it could bring to the process of L2 negotiation of meaning and its empirical study

Affordances was a term first coined by Gibson (1979) and used since then by researchers. It refers to the specific set of technical and technological properties of a medium (real or perceived) which, as they come in contact with learners through interactions, determine and/or constrain how this medium can potentially support learning (Gibson, 1979; Greeno, 1994; Norman, 1988).

Chat's first important affordance was its online and real-time mode of delivery, which permitted to replicate a type of interactional environment that was similar to oral face-to-face communication (Lee, 2002; Peterson, 2006), bringing communities of learners together for innovative learning purposes, such as international tandem learning or cross-cultural partnership (O'Rourke, 2005; Zhao & Angelova, 2010). Even at the level of the classroom, chat could permit more collaborative and learner-centered learning activities (Fernandez-Garcia & Martinez-Arbelaiz, 2002; Peterson, 2006). The

anonymity induced by CMC could favor a reduction of learners' inhibitions (Peterson, 2006) and promote more equal participation of learners (Fernandez-Garcia & Martinez-Arbelaz, 2002; Lee, 2008; Peterson, 2006), therefore leading to increased motivation and a greater quantity of language produced by these learners (Fernandez-Garcia & Martinez-Arbelaz, 2002; Peterson, 2006).

More directly related to L2 negotiation of meaning, chat was specifically praised for its written format. As summarized by O'Rourke (2005), the written format of chat could first and foremost allow investing into L2 learners' literary skills. Second, its specific mode of generation could provide opportunities for learners to craft and edit their messages before transmitting them to their interlocutors. Once published from one interlocutor to the others, the written and semi-permanent nature of chat could permit unlimited access by the L2 learners to all previously sent messages during a conversation, providing them with opportunities to review and reconsider these messages as many times as needed.

Finally, and for research purposes, the written format of chat was also considered an advantage for data collection procedures, since computer-generated logs of L2 learners' chat could more easily and more efficiently be created and downloaded to investigate L2 learners' discourse.

Despite these promising affordances, some concerns were also raised regarding the characteristics of chat that may negatively or unexpectedly impact the L2 negotiation of meaning process. First, the absence of non-verbal cues in chat, when compared to more traditional face-to-face interactions, was seen as a potential threat for sustaining and maintaining communication among interlocutors (Lee, 2008). Second, the hybrid nature of the language used in chat-rooms rose grounds for concerns, since it soon appeared that this language displayed qualities of both written and oral language, as well as adding specific computer-related features, such as smiley faces (Anis, 2007; Jepson, 2005).

In view of these promising, more than concerning, affordances, a new wave of studies appeared in research on L2 negotiation of meaning, as taking place in chat-based interactions.

Cognitivist studies on chat-based L2 negotiation of meaning

In the overwhelming majority of studies on chat-based L2 negotiation of meaning, the definition of L2 negotiation of meaning that served as a starting point for the empirical investigation was very explicitly anchored in a Cognitivist paradigm, inherited from Long's (1996) Interaction Hypothesis, and closely resembled Definition #1 presented in introduction of this chapter, as formulated by Bitchener (2004):

[L2 negotiation of meaning corresponds to] the negotiated interaction which occurs when conversational participants find a need to adjust and modify the linguistic form and structure of their interaction in order to be clearly understood [and] to resolve [a] communication difficulty (Bitchener, 2004, p.81)

The body of works on chat-based L2 negotiation of meaning was characterized by the selection of a quantitative approach to research methodology (mainly frequency counts). Moreover, studies of chat-based L2 negotiation of meaning focused on dyads of interlocutors (except for Fernandez-Garcia & Martinez-Arbelaz (2002) and Zhao & Angelova (2010), with respectively 6 and 10 learners in each interactional group). Most researchers focused on NNS/NNS groups of similar proficiency level (Fernandez-Garcia & Martinez-Arbelaz, 2002; Jepson, 2005; Lee, 2002; Peterson, 2006; Smith, 2003), while others investigated NNS/NNS groups in expert/novice format (Lee, 2008; O'Rourke, 2005; Shekary & Tahririan, 2006; Zhao & Angelova, 2010). Results from these studies on chat-based L2 negotiation of meaning addressed four specific themes: (1) the effect of different tasks on the chat-based L2 negotiation of meaning outcome; (2) the comparative effects of chat-based and oral-based L2 negotiation of meaning; (3) the effect of chat-based L2 negotiation of meaning on L2 learners' focus on form and

retention of correct forms; and (4) the validity of Varonis & Gass's (1985) TIRR model for the analysis of chat-based L2 negotiation of meaning sequences.

Task effect in chat-based L2 negotiation of meaning

As reviewed in previous parts of this chapter, the relative effect of any specific task on the L2 negotiation of meaning outcome has always been a topic of interest for researchers. With a chat-based study of L2 negotiation of meaning, the attention dedicated to addressing this impact did not decrease, but amplified the amount of contradictions found in the overall body of work. In practice, both Smith (2003) and Peterson (2006) found that a decision-making task was significantly more conducive to L2 negotiation of meaning routines over jigsaw tasks, which were found to be the least conducive (including in Lee, 2008). These findings contradict previous results on task effect, notably Pica's (1993), who had reached an opposite conclusion, namely that jigsaw tasks were more conducive of L2 negotiation of meaning sequences than decision-making tasks, as well as Bitchener's (2004) who did not find any task effect in a longitudinal study involving a decision-making task and an information-gap task. We can thus conclude that claims of tasks effects in the study of L2 negotiation of meaning have thus remained inconsistent and inconclusive.

Chat-based versus oral-based L2 negotiation of meaning

Since the mode of delivery changed between a first generation of studies on L2 negotiation of meaning in oral and face-to-face interactions, and a second generation of studies in written-based online chat, it was legitimate for research to investigate how these two modes of delivery compared, in terms of their impact on the L2 negotiation of meaning process.

First, researchers were concerned to know whether chat could lead to as many opportunities for L2 negotiation as oral conversations. Jepson (2005) addressed this question by comparing the two modes of delivery, while holding the time constant. He

found a higher density of repair moves in oral-based than in chat-based L2 negotiation of meaning sequences. Consistent with these findings, Zhao & Angelova (2010) also showed comparative results on the density of negotiation of meaning sequences in these two modes of delivery, with a significantly higher density in oral-based interactions than in chat-based ones. Nevertheless, it can be argued that the impact, validity, and relevance of these findings are questionable, inasmuch as it is admitted that it takes more time to write and type than to speak, so that the overall quantity of potential output produced is naturally higher in oral-based communication than in chat-based one. Furthermore, there is no direct proven correlation between the quantity of negotiation of meaning sequences produced and the quantity or quality of language learned or acquired.

Related to the concern on the lack of non-verbal cues in chat-based interactions, some researchers intended to explore the type of communication strategies that differed from one mode of delivery to the other. Lee (2002) established that similar communication devices were used in oral-based and chat-based L2 negotiation of meaning sequences, but that the quality of the sequences was altered in chat, where negotiation routines tended to extend and where multiple types of indicators could happen concomitantly. Jepson (2005) alternatively showed that negotiation of meaning routines in chat tended to be more active, inasmuch as overt rather than implicit feedback would be predominantly provided to cope with lack of non-verbal cues. These findings are consistent with Fernandez-Garcia & Martinez-Arbelaiz's (2002), who showed that in the overwhelming majority of L2 negotiation of meaning sequences, learners indicated a breakdown in communication by means of an explicit indicator. Finally, Zhao & Angelova (2010) showed that both oral-based and chat-based interactions displayed a high number of completed TIRR sequences, with oral-based interactions displaying a superior number of these completed sequences over the chat-based interactions.

To summarize, the comparison of traditional oral-based sequences of L2 negotiation of meaning with chat-based ones resulted in the greater efficacy of traditional

oral-based conversations in terms of quantity of L2 negotiation of meaning sequences produced. Nevertheless, chat-based routines of negotiation of meaning resulted in more active and explicit indicators of a need for repair, compensating with the lack of non-verbal cues that would most commonly happen in oral-based sequences of negotiation of meaning.

Focus on form and retention of correct forms in CALL

The crucial affordance of chat which primarily attracted Cognitivist researchers' attention was the semi-permanency of the written input and output, considered as a new opportunity to push L2 learners to notice the gap between a target-like input and their incorrect output, therefore giving them a chance to better and more easily focus on the morpho-syntactical structure of their output (O'Rourke, 2005; Peterson, 2006; Shekary & Tahririan, 2006; Zhao & Angelova, 2010). Under the assumption that its written format would allow for an amplification of L2 learners' attention to linguistic forms, a vast number of studies intended to investigate whether focus on form and retention of correct forms were promoted by the use of chat for L2 negotiation of meaning.

Most research studies contradicted this prediction, showing that L2 learners were more focused on exchanging content and ideas than trying to attend to the correction of the linguistic mistakes. Rather, they would simply ignore each other's linguistic errors, especially related to their L2 morpho-syntax (Jepson, 2005; Lee, 2002; O'Rourke, 2005; Smith, 2003; Zhao & Angelova, 2010). On that subject, Jepson (2005) concluded that "it [was] possible that NNS conversational chat may not engender the type of repair move that is thought to force learners to focus on grammatical accuracy through their output" (p.92).

Regarding a more indirect type of focus on form, as represented by meta-talk utterances, Shekary & Tahririan (2006) showed that the amount of meta-talk instances found in their L2 learners' discourse was considerably inferior to what previous research

had stipulated (Ellis, Basturkmen, & Loewen, 2002; Lyster, 1998). With regards to the retention of correct forms, as elicited through instances of meta-talk, Shekary & Tahririan (2006) also showed that a significant retention of correct forms was found on the immediate post-test but that delayed post-tests showed a significant superiority of *incorrect* forms over correct forms. They thus concluded that CMC did not increase the potential for meta-talk or retention of correct linguistic forms. Moreover, Fernandez-Garcia & Martinez-Arbelaz (2002) and Lee (2008) showed that when meta-talk would happen, L2 learners in NNS/NNS dyads sharing the same L1 would tend to resort to code-switching and would attend to explain grammatical structures in their L1. Consequently, and as shown by these results, the chat-based format of interaction not only did not amplify learners' attention to form but rather seemed to decrease it. As some attention to lexicon was inversely found in some studies (O'Rourke, 2005), it is possible to conclude that students were only interested in attending to the global meaning of the topic discussed in their chat conversation, not the form.

Validity issues of the TIRR model in CALL

Finally, most research studies which intended to investigate L2 negotiation of form in a chat-based format selected Varonis & Gass's (1985) TIRR model to evaluate the nature and completeness of L2 learners' repair sequences. Some researchers thus also addressed the validity of this research instrument in accounting for L2 negotiation of meaning as specifically happening in a chat-based format. Smith (2003) explained that the traditional TIRR model needed to be expanded to account for the extended and delayed responses by one of some interlocutors due to the lack of strict turn adjacency in chat. O'Rourke (2005), on the other hand, reached a more radical conclusion, stating that the TIRR model was simply invalid to evaluate L2 negotiation of meaning in chat because of, on the one hand, the lack of relevance of the non-verbal categories the model included and, on the other hand, the absence of any category accounting for the use of

typographical means to convey understanding among interlocutors (such as smiley faces). He also pointed out the fact that the model could not account for combinations of a variety of indicators, as aggregated within one single message.

In other words, the TIRR model, which had been so far the most widely used instrument in the evaluation of L2 negotiation of meaning sequences in SLA research, showed severe limitations when used specifically for the analysis of chat-based L2 negotiation of meaning.

With these results in mind, we will now turn to the review of literature on negotiation and co-construction of meaning in CMC, as anchored in a Socio-Constructivist paradigm, and as congruent with the definition of L2 negotiation and co-construction of meaning that the present study advocated.

Socio-Constructivist studies of negotiation of meaning in CMC

The Interaction Analysis model (Gunawardena et al., 1997)

Aligning with a Socio-Constructivist perspective on negotiation and co-construction of meaning, as well as with the promising affordances that computer-mediated communication (CMC) could bring to promote collaborative learning, Gunawardena, Lowe, & Anderson's (1997) work was one of the very few research studies available to inform the investigation of negotiation and co-construction of meaning, as indicators of critical thinking and problem solving abilities. Their study, although investigating L1 negotiation and co-construction of meaning, invaluablely contributed to the development of research on this construct, and can be considered of great interest for SLA research.

The authors intended to inform research on interaction analyses by developing a research instrument (the Interaction Analysis model) capable of providing access into the critical thinking process, equated with negotiation and co-construction of meaning. They

were more specifically interested in learner/learner interactions, as taking place in CMC, to focus on the *content* of the discourse produced by participants, as well as the *meaning* of each participant's utterances, to determine how they contributed to the negotiation of meaning and co-construction of knowledge within the group. The Interaction Analysis model (IA model) thus consisted of a hierarchical framework of incremental levels of critical thinking abilities, allowing determining how these levels were displayed in a collective discourse.

Despite the fact that the IA model investigated L1 negotiation and co-construction of meaning, its emergence for the analysis of learners' collective discourse and their critical thinking abilities can be considered a significant contribution to a Socio-Constructivist trend of research on L2 learning as well, and was of great influence to the present study.

Validity and reliability of the Interaction Analysis model

The emergence of Gunawardena et al.'s (1997) Interaction Analysis model as a research instrument intended to empirically examine the discourse produced by learners and their negotiation and co-construction of meaning did not attract many researchers' attention despite its promising potential. This lack of noticeable interest can be accounted for by the fact that the development of this instrument was anchored in a Socio-Constructivist paradigm, which, as we have discussed earlier, was still a rare approach to the study of the otherwise predominantly Cognitivist concept of negotiation of meaning.

Nevertheless, two teams of researchers, also positioning their work in a Socio-Constructivist paradigm, showed an interest for this promising research instrument, and contributed to test its validity and reliability: first Jeong (2003) who was interested in investigating the effects of CMC on students' learning process in online discussions, then Hull & Saxon (2009), who intended to analyze the developmental process of learners' discourse and thoughts in a Socio-Constructivist CMC learning environment.

Nevertheless, both these teams of researchers focused on L1 negotiation and co-construction of meaning.

Sequential analysis of discourse with the IA model

Jeong's (2003) study focused on the quality of learners' messages in a CMC *asynchronous* conversation, and, more importantly, on the function of these messages in relation to their collectively constructed discourse. Examining the quality rather than the quantity of messages to account for the entire discourse was intended as a way of evaluating the learners' critical thinking skills. Using Gunawardena et al.'s (1997) IA model, Jeong conducted a sequential analysis to study each group of participants' discursive patterns to determine which interactions supported critical thinking. Results displayed by Jeong were consistent with those presented by Gunawardena et al. (1997) in uncovering critical thinking abilities via the study of negotiation and co-construction of meaning. The analytical approach adopted by Jeong, which consisted in using the IA model as a starting point to further conduct a sequential analysis of the learners' discourse to uncover its patterns, was of considerable importance for the methodology of the present study, as will be further explained in Chapter III.

A revised version of the IA model

Hull & Saxon's (2009) study specifically aimed at using and testing Gunawardena et al.'s (1997) IA model to compare the learning process in two different instructional settings via CMC: one designed on the basis of traditional instructional methods, the other on the basis of Socio-Constructivist learning theories, to determine which one better supported higher levels of negotiation and co-construction of meaning, that is to say, higher levels of critical thinking. Similar to both Gunawardena et al.'s (1997) and Jeong's (2003) studies, students in this research study worked *asynchronously* through CMC discussion boards.

Hull & Saxon's methodological procedure consisted in conducting a quantified verbal analysis of the learners' discourse. For that purpose, they used Gunawardena et al.'s (1997) IA model to allow for the transformation of inherently verbal data into quantitative data. This particular methodological procedure was of great interest for the present study. Commenting on the coding procedure, the authors pointed out that "it became necessary to understand the context of a statement within the discussion in order to appropriately assign a code" (p.633). This specific comment confirmed the role served by the IA model to focus on the *function* of each message within its broader discursive context, in order to more accurately examine the learning process through the negotiation and co-construction of meaning events. It also highlighted the importance of taking into consideration the entire interactional context surrounding the discourse being constructed, which was also of considerable importance for the present study.

As Hull & Saxon discovered that the lower level of the IA model required further discursive functions to account for all the discursive events that emerged in their data, they proceeded to its revision. Consequently, they offered a new model, composed of seven rather than five incremental levels. By proceeding to this revision of the IA model, Hull & Saxon's (2009) results more precisely showed that higher levels of mental functioning were reached by learners when working specifically in a Socio-Constructivist learning environment. Furthermore, findings pointed out to the crucial importance of inconsistencies among learners, as these dissonances appeared to be a critical step toward enabling participants in negotiation and co-construction of knowledge.

Hull & Saxon (2009) concluded on the use of the IA model by pointing out that:

The model developed by Gunawardena et al. deserves additional attention, scrutiny, and further research to support its use since it moves the analysis of dialogue away from reliance upon frequency counts under a theoretical framework that is well-matched with CMC. The model can be applied to dialogue in a way that assists the researcher in understanding the extent to which a group demonstrates learning (p.636)

This point was of crucial importance for the present study, insomuch as it offered a new promising possibility to overcome the limitations of traditional research on L2 negotiation of meaning, characterized by an over reliance on the sort of frequency count that Hull & Saxon denounced, and that was previously thoroughly detailed and denounced by Jauregi (1997) (see also Brooks & Donato, 1994; Foster & Ohta, 2005; Van den Branden, 1998). Moreover, Hull & Saxon's (2009) work allowed to demonstrate the validity of the IA model for research on discourse within a CMC context, as opposed to the more traditional TIRR model (Varonis & Gass, 1985), the validity of which was shown to be affected by its use in a CMC environment.

In conclusion, Jeong's (2003) and Hull & Saxon's (2009) works had a considerable influence for the present study. Because of their theoretical anchor in a Socio-Constructivist paradigm, their aim to investigate discursive patterns, and their research methodology (quantifying inherently verbal data via the IA model to allow for statistical analysis of learners' discursive patterns), these studies served as a model for the design of the present study, as will be further presented in Chapter III. Nevertheless, two gaps in this research were noticed, that the present study could invest: first, the fact that these studies focused on L1 rather than L2 negotiation and co-construction of meaning, and, second, the fact that they investigated asynchronous rather than synchronous interactions among learners.

Socio-Constructivist L2 negotiation and co-construction of meaning in CMC

Although several research studies on L2 negotiation of meaning in CMC referred to Vygotsky's theories (1978; 1987), notably about the influence of scaffolding in expert/novice learning settings, only one study could be found that truly addressed L2 negotiation of meaning both from a Socio-Constructivist perspective and in CMC. Vandergriff (2006) was, to our knowledge, the only author who conducted an empirical

study anchored in a Socio-Constructivist paradigm, in clear reaction to the predominant trend of research on L2 negotiation of meaning in CMC anchored in a Cognitivist paradigm. Along the line of the emergence of CMC and CALL and their potential for revisiting L2 negotiation of meaning in an online and written format, her study intended to determine the impact of the mode of delivery (CMC or face-to-face interactions) on a specific aspect of the L2 negotiation and co-construction of meaning aspect: grounding.

Grounding, as earlier theorized by Clark & Brennan (1991), is the process by which participants share information discourse, including “mutual knowledge, mutual beliefs, and mutual assumptions” (p.127). Vandergriff (2006) pointed out that negotiation and co-construction of meaning was one of the ways in which interlocutors could establish and update their common ground, and she was thus interested in investigating how this process occurred in CMC conversations, as compared with traditional face-to-face conversations. The important opposition displayed by Vandergriff to the predominant Cognitivist trend of research studies on L2 negotiation of meaning can be found in her deliberate focus on grounding, as a representation of what L2 learners can accomplish, rather than what they cannot yet. She mentioned the following in her purpose statement:

The concept of grounding shifts the focus away from miscommunication and learner deficiency that is at the core of acquisition-based negotiation research, to highlighting its crucial role in interactive talk where participants work together to co-construct discourse (p.112)

With an informal mixed method design to the study of grounding, Vandergriff's (2006) study involved 18 NNS of German, arranged in groups of three, and assigned a consensus-building task, alternatively in a face-to-face and in a CMC learning environment. Results in this study showed two important outcomes. First, in terms of the effect of CMC, compared with face-to-face interactions, both quantitative and qualitative results showed no medium effect could be found to compare these two modes of delivery in terms of their affordances to lead to more instances of grounding. Second, and more

importantly, Vandergriff showed that the negotiation sequences that appeared among the learners were not employed to compensate for the deficiencies or lack of comprehension: rather, they displayed grounding functions, in direct relation to the task-based nature of the activity and the subsequent goal that learners had set for themselves. This specific distinction between learners' deficiencies and their capacity to construct language and discourse together is consistent with Jauregi's (1997) distinction between *positive* and *negative* negotiation of meaning, but established from a Socio-Constructivist angle.

Vandergriff's (2006) study was of considerable influence for the present study, inasmuch as it was the only example, to our knowledge, of empirical research on L2 negotiation and co-construction of meaning, as anchored in a Socio-Constructivist paradigm, and as taking place in a synchronous CMC setting of interaction. The original use made by Vandergriff of a consensus-building task was important for the present study, inasmuch as it confirmed the validity of this specific type of task in permitting to elicit events of L2 negotiation and co-construction of meaning. The present study was thus influenced by Vandergriff (2006), in terms of the adoption of a consensus-building task as a form of curricular intervention allowing for the optimal emergence of events of L2 negotiation and co-construction of meaning. Furthermore, Vandergriff's (2006) findings, as congruent with Jauregi's (1997), confirmed the need for a research on L2 negotiation and co-construction of meaning which focuses on what L2 learners can accomplish, rather than on their deficiencies which need to be corrected. The concept of grounding used by Vandergriff was, in that sense, of crucial importance as it allowed demonstrating that the L2 negotiation and co-construction of meaning process was at work in the learners' discourse. Nevertheless, and if compared with Hull & Saxon's (2009) revised IA model, it can be argued that grounding primarily represented lower levels of critical thinking abilities. Based on Vandergriff (2006), we will contend that a gap exist in research, which the present study invested, to investigate higher levels of

critical thinking abilities, as displayed L2 learners' discourse, and as elicited by the use of Hull & Saxon's (2009) revised IA model.

Conclusion on L2 negotiation and co-construction of meaning in CMC

The predominant Cognitivist trend of research on L2 negotiation of meaning in CMC was found to be considerably inconclusive. Of particular importance for the present study, this trend of research showed that, despite its promising affordances, chat-based communication did not lead to more or better instances of focus-on-form events in the L2 learners' discourse, but did, inversely, tend to lead them to fall back in their L1 to handle such tasks. Furthermore, the TIRR model (Varonis & Gass, 1985), which served as the primary analytical framework in this Cognitivist trend of research, was also found to present severe limitations when used in a CMC context, thus opening a gap for the adoption of a more appropriate and more valid analytical model.

Empirical works on L2 negotiation of meaning reflecting the shift in paradigm advocated by the present study were found to be rare. Most research studies aligning with a Socio-Constructivist paradigm primarily focused on L1 negotiation of meaning and mainly investigated it in *asynchronous* CMC interactions. It can thus be argued that a gap in research exists for studies which address L2 learning and focus on *synchronous* rather than asynchronous modes of delivery. Nevertheless, this research offered valuable contributions for the present study. Of major importance was the development and revision of the Interaction Analysis model (Gunawardena et al., 1997; Hull & Saxon, 2009), as a valid and reliable research instrument allowing access to the different *functions* (rather than simply the *forms*) of each interlocutor's utterances within and in accordance with the broader discourse of which they are a part. It also permitted to evaluate learners' collective discourse in terms of critical thinking abilities. Furthermore, newer methodological approaches, such as Jeong's (2003) sequential analysis or Hull &

Saxon's (2009) quantification of verbal data, were of great interest to overcome the methodological limitations that were highlighted in many research studies on L2 negotiation of meaning (such as using frequency counts). These methodological innovations were of great influence for the present study, as will be discussed in Chapter III.

Finally, the single study directly related to L2 negotiation and co-construction of meaning, as conceived from a Socio-Constructivist angle, and in a CMC setting was Vandergriff's (2006). This study comforted the theoretical claims made earlier by Jauregi (1997), and supported by the present study, that research should focus away from learners' deficiencies, to rather invest in the evaluation of what they are already able to accomplish and construct in the target language.

Figure 2 4 is a recapitulative chart about research on L2 negotiation of meaning, more specifically in CMC and CALL, showing the original perspective and contribution that the present study intended to bring to research in SLA. With these results in mind, we will now proceed to further situating the study of L2 negotiation of meaning within the learning setting provided by Virtual Learning Environments (VLEs), as they inherently aligned with a Socio-Constructivist approach to learning. We will thus review the literature on VLEs, to better inform the study of L2 negotiation of meaning, as happening in this innovative tool for learning.

L2 negotiation and co-construction of meaning in Virtual Learning Environments (VLEs)

Since CALL has been shown to be the future of learning and research in SLA, we will now discuss how a specific and innovative synchronous CALL environment, which also align with a Socio-Constructivist perspective, can be used to further advance the study of L2 negotiation and co-construction of meaning in CMC. We will thus present a review of literature on Virtual Learning Environments (VLEs).

Figure 2 4. Recapitulative and comparative chart of research on L2 negotiation of meaning in CMC and CALL.

	Research on L2 negotiation of meaning	
	Predominant trend of research	Alternative trend of research
Paradigmatic anchor	Cognitivist	Socio-Constructivist
Field of research used for theoretical foundations	SLA	Educational psychology & philosophy
Main references in the field	Long, Swain, Pica, Ellis, Varonis & Gass	Vygotsky, Piaget, Bruner, Von Glasersfeld, Duffy, Cunningham, Wenger, Flower, Wells
Epistemological stand	L2 learning as language acquisition	L2 learning as meaning-making
Theoretical model of analysis	TIRR model (Varonis & Gass, 1985)	IA model (Gunawardena et al., 1997; Hull & Saxon, 2009)
Conception of interaction	Interaction as receiving input and producing output	Interaction as sharing and exchanging meaning and ideas
Main focus of study	Learners' focus on form and modified morpho-syntactical structure of output	Learners' discourse functions through negotiation and co-construction of meaning
Gap between the interlocutors	Non-understanding, negative error to be corrected, sign of deficiency in the learner's interlanguage system	Positive dissonances based on which a co-construction of meaning can happen
Status of the participants in the interaction	Novice/expert relationships (either NS/NNS or NNS/NNS) Dyads of learners	Mutual partnership Groups of multiple learners
Level of engagement in the interaction	<i>Inconclusive</i>	Active, dynamic, mutual
Definition of success	Retention of corrected forms Correction of the language	Reaching a critical convergence Construction in the language
Mechanisms towards success	Noticing the gap between a target-like input and a non-target-like output to be modified	Arbitrating multiple perspectives by examining them critically Grounding understanding
Research method of choice	Quantitative studies	Qualitative or mixed methods studies
Research analysis of choice	Frequency counts	Discourse analysis

Defining Virtual Learning Environments (VLEs)

We can first briefly define VLEs as technological environments for learning, which rely upon the association of two main components: on the one hand, an immersive and social technological platform, usually called a Three-Dimensional Multi-User Virtual Environment (3D-MUVE, the most famous of which is *Second Life*), and, on the other hand, an underlying pedagogical project. It is only by association to a specific underlying pedagogical project that a 3D-MUVE tool can become a virtual learning environment (VLE) (Livingstone, Kemp, & Edgar, 2008; Warburton, 2009).

Answering the need advocated by researchers in CALL to proceed to a paradigm shift from Cognitivism to Socio-Constructivism, it is important to note the strong affiliation that has been recently shown between VLEs, as innovative technological tools for learning, and a Socio-Constructivist paradigm. Researchers highlighted VLEs' potential for deep forms of learning, anchored in the resolution of complex problems and promoting negotiation of meaning, notably for language learning (Barab et al., 2005; Jeffery & Collins, 2008; Omale et al., 2009; Salmon, 2009; Warburton, 2009; Zheng et al., 2010). Because they align with the type of paradigm shift that research advocated for and that the present study intended to accomplish, VLEs can be deemed to be of considerable and promising interest.

VLEs are still fairly new objects of study in research. They have nevertheless growingly attracted researchers' attention, but in an uncoordinated fashion, so that no clear or agreed-upon definition can be found. To attempt to define VLEs, it is useful to rely on the works published about VLEs, since the vast majority of them were descriptive in nature, and primarily focused on the affordances of the 3D-MUVE platform upon which VLEs are built.

Dillenbourg, Schneider, & Syneta (2002) gave the most exhaustive and practical definition of VLEs to date, bridging the inherent affordances of 3D-MUVEs with the need for an underlying pedagogical project. According to these authors, VLEs are

purposefully designed social and information spaces, with explicit three dimensional graphic representations. These spaces are designed as authentic learning environments, designated for a population of learners, who are not only active but are also provided by the environment the possibility of becoming actors. Moreover, VLEs are not restricted to distance education, but rather overlap with physical environments. Finally, and based on Minocha & Roberts (2008), as well as on Savin-Baden (2008), VLEs also have an imperative sense of immediacy. We will now explore each of these characteristics and affordances in more details.

VLEs as information space

The first imperative characteristic of a VLE is its design as what Dillenbourg et al. (2002) called an “information space”. This characteristic corresponds to what we have called an underlying pedagogical project, that is to say that an explicit learning content, as well as explicit learning objectives should dictate both the design and use of the technological environment. The pedagogical content can thus take the technological form of multimodal information (i.e. written, audio, video, symbolic, etc.). This specific pedagogical property of VLEs is what distinguishes them from video games, such as MMORPGs (Massively Multiplayer Online Role-Playing Games), so that, even though they might look like video games, VLEs are first and foremost intended for learning purposes. For that matter, Roussou (2004) pointed out that interactivity in VLEs should not simply consist of mere navigation and manipulation, but rather in real learning engagement within the space. This is also what distinguishes the use of VLEs from the simple use of a 3D-MUVE platform.

VLEs as designated for learners, as actors

Second, and congruent with the first characteristic, VLEs are designated for a population of learners, not for “users”. This also confirms that the fundamental objective in using VLEs is to learn, not merely to communicate or to play. Moreover, several

researchers pointed out that the learners' role in the VLE is one of actors, inasmuch as they are able to impact the learning environment by their presence and transform it along the learning process (Dede, 2005; Dickey, 2010; Roussou, 2004; Savin-Baden, 2008). By that token, learners in a VLE are not restricted to consuming information, but, rather, they themselves become creators and producers of information to share with others.

VLEs as explicitly represented social and immersive spaces

Third, VLEs are inherently immersive spaces, thanks to an explicit three-dimensional graphic representation of both the space itself and the learners. In other words, VLEs permit a sense of sensory immersion, most notably through a three-dimensional representation of a physical space (real or imaginary) (Dede et al., 2005; Dickey, 2010; Hecht, 2006; Selverian & Hwang, 2003), as well as of the learners, under the form of virtual personas, called *avatars* (Edirisingha et al., 2009; Konstantinou et al., 2009; Minocha & Roberts, 2008; Mohler et al., 2010; Savin-Baden, 2008). In that sense, VLEs are distinguishable from more traditional course management systems (such as *Blackboard* or *WebCT*), as well as from social networks (such as *Facebook* or *Twitter*).

As a result of this explicit 3-D representation, VLEs are unique immersive social learning environments, in which learners find themselves engaged inside the information space they explore, and can see a representation of themselves, as well as others in it, while exploring it. This particular sensory perception causes VLEs to be *populated* spaces, and induces their inherent social nature. It is by allowing the 3-D space to be populated that VLEs serve their learning role, and can allow for the learning objectives to be met. This specific characteristic is also what distinguishes VLEs from more traditional websites, but also one that connects VLEs with social networks such as *Facebook* or *Twitter*.

The spatial and social immersive nature of VLEs, through their 3-D graphic representation, was particularly important and relevant for the present study, as

Dillenbourg et al. (2002) predicted that it “may have an impact of the learning process beyond motivational aspects” (p.6). It is the study of this type of impact, as experienced by the learners, that was deemed crucial by CALL researchers (Blake, 2008; Felix, 2005a; 2005b; 2005c; 2008; O’Rourke, 2005; Saarenkunnas, Kuure, & Taalas, 2003) and that was thus a central variable of research in the present study.

VLEs for hybrid, authentic, and immediate learning

Fourth, VLEs are not restricted to distance education. A significant number of studies has indeed led to believe that VLEs’ essential purpose was to contribute to the development of distance education courses (Byman, Jarvela, & Hakkinen, 2005; Edirisingha, et al., 2009; Konstatntinou et al., 2009; So & Brush, 2008; Yoon & Johnson, 2008). Despite VLEs’ potential for enhancing distance education, their use for learning purposes is not restricted to this learning context alone. Rather, VLEs can and should have a real role to play in more traditional classrooms.

For that reason, VLEs overlap with physical environments (Persky et al., 2009), that is to say that they are not entirely remote from students’ reality and culture, in order for learning transfers to happen (Minocha & Roberts, 2008; Savin-Baden, 2008). For this reason, the use of VLEs in traditional classrooms can lead to hybrid learning settings where the learning process, although occurring in a virtual space, is still anchored in and transferrable to the students’ reality.

Congruent with this previous point, VLEs are authentic learning environments (Barab et al., 2009; Feldon & Kafai, 2008; Hornick, Johnson, & Wu, 2007; Salmon, 2009). More specifically, they are intended to reproduce authentic learning tasks or authentic learning environments (notably through simulations), in order to promote authenticity and transferability of learning.

Finally, VLEs display an imperative sense of immediacy (Minocha & Roberts, 2008; Savin-Baden, 2008). In other words, VLEs allow for *synchronous* interactions

among learners, similar to the ones occurring in traditional chat platforms, whether written, audio, or video. This sense of immediacy thus distinguishes VLEs from other interactive platforms, which are asynchronous in nature, such as discussion boards, blogs, or wikis. Because VLEs allow immediate interaction among learners, they enhance the sense of presence and socialization perceived by the learners.

Comprehensive definition of VLEs

Based on the defining characteristics and affordances that research on VLEs highlighted, we will provide our own comprehensive definition of VLEs:

Virtual Learning Environments (VLEs) are inherently immersive and multimodal social spaces, physically and authentically represented in a three-dimensional Web 2.0 platform, and designed with fundamental underlying pedagogical objectives, intended to allow learners to transfer knowledge to real situations, by permitting them to synchronously engage with other learners through their own virtually-represented persona called *avatar*, and to act on the very environment in which they are immersed.

Deriving from the extensive research on affordances, researchers pointed out the inherent affiliation of these innovative environments with deep forms of learning, promoting the resolution of complex problems and negotiation of meaning, notably for language learning purposes. In that respect, VLEs were thus shown to be naturally well-matched with a Socio-Constructivist paradigm of learning (Barab et al., 2005; Jeffery & Collins, 2008; Omale et al., 2009; Salmon, 2009; Warburton, 2009). They can consequently be considered as technological tools of choice in a research that attempts to proceed to a paradigm shift towards a more Socio-Constructivist approach to learning.

The contribution made by the majority of studies on VLEs is thus considerable inasmuch as it permits to establish, via the establishment of a list of affordances, the inherent affiliation of VLEs with a Socio-Constructivist paradigm of learning. Nevertheless, it can be argued that this research holds important limitations by simply describing these affordances without testing them, since, as Greeno (1994) pointed out

The presence in a situation of a system that provides affordance for some activity does not imply that the activity will occur, although it contributes to the possibility of that activity. Additional conditions include aspects of the activity of an agent in the situation, having to do with motivation and perception (p. 340).

A gap in research on VLEs thus exists with studies which were limited to the description of their affordances. This gap indicates that further investigation of VLEs is thus required, that goes beyond a description of these affordances, to rather examine the actual occurrence of a learning activity in a VLE, and how it is perceived by learners.

We will now review other themes of interest that emerged in the literature on VLEs.

Emerging themes in the literature on VLEs

VLE teaching and learning projects

Besides dressing a list of affordances that characterize VLEs, the majority of studies on VLEs also encompassed illustrative examples of VLE projects which have been designed and/or implemented for teaching and learning purposes. These illustrative presentations aimed at providing concrete examples of what teachers or institutions can accomplish through VLEs, as well as defining criteria for the selection of a 3D-MUVE and for the design of a VLE.

Amongst the many different pedagogical projects reported in this descriptive trend of studies, one can find Cheung et al. (2008) *Farmtasia* project, involving a farming system covering the domains of cultivation, horticulture, and pasturage, as situated in a competitive economy governed by good public policies, or Harvard University's *River City* project, as presented by Dede et al. (2005) and Dieterle & Clarke (2005), corresponding to the simulation of a 19th century city and its environmental, economical, and health issues which learners need to solve. Other projects of interest include Barab et al. (2009) *Quest Atlantis*, as a teaching and learning environment designed on Socio-Constructivist principles and intended to engage learners through transformational play

and story-lines, or Gillen's (2009) *Schome Park*, aiming at the development of new literary practices through *Teen Second Life*'s chat, wiki, and forum. As related to L2 learning, Shih & Yang's (2008) *VEC3D* project is also an instance of innovatively designed VLE, intended to help learners develop English communicative competence through their interactions with NSs. In a more integrative manner, Livingstone & Kemp (2008) presented an example of VLE combining a 3D-MUVE platform and an open-source platform to develop the *Sloodle* project. Connolly, Stansfield, & Hainey (2011) described a similar integration of media in their *ARGuing Tower of Babel*, encompassing numerous technological components for L2 learning (such as emails, instant messaging, forums, wikis, blogs, SMS, etc.). Finally, Sykes & Cohen's (2008) project, aiming at the promotion of Spanish pragmatics, was also characterized by an integration of resources, namely an instructional website and its affiliated VLE (*Croquelandia*) for authentic assessment purposes.

Another part of this body of descriptive works also consisted of establishing criteria for the selection of a 3D-MUVE platform adapted to specific teaching and learning needs (Dickey, 2010; Konstantinidis et al., 2010; Konstantinou et al., 2009; Roussou, 2004). Others presented criteria for the actual design of a VLE (Connolly, Stansfield, & Hainey, 2011; Dede et al., 2005; Jauregi et al., 2011; Jennings & Collins, 2008; Minocha & Roberts, 2008; Rigby & Przybylski, 2009; Shih & Yang, 2008; Sykes & Cohen, 2008; Varlamis & Apostolakis, 2006).

Avatars in the study of VLEs

Amongst the themes that were most commonly addressed by research studies on VLEs, two were particularly recurrent: the use of an avatar, and the motivational potential of VLEs. First, the role, function, and impact of the avatar in VLEs attracted most authors' attention, as they related to learners' motivation, involvement, personal and social presence, as well as identity and power. Regarding motivation, some descriptive

studies reported on the first exploratory themes emerging from the alpha-test of their VLE and noted that learners' motivation seemed to be highly enhanced through the use of such innovative tools for learning (Barab et al., 2009; Berger, 2008; Connolly, Standsfield, & Hainey, 2011; Shih & Yang, 2008).

Most authors listed a number of potential affordances or issues related to the use of an avatar or to motivation, but did not further test the impact of these affordances on the learning events, as perceived by the learners. Only Feldon & Kafai (2008) and Persky et al. (2009) treated these matters in a more advanced manner. We will thus now review their work, related to the use of avatars in VLEs, as it impacts motivation.

Meaning of an avatar

The use and role of the avatar in learners' interactions was a central object of study in Feldon & Kafai (2008), who were interested in characterizing the way in which 88 6th-graders engaged with their avatars in the context of an informal science education program implemented through a VLE called *Whyville*. They examined the amount of learners' activity related to the modification of their avatar and explored the meanings that these learners ascribed to their avatar's appearances and activities. Results showed that avatar customization was a primary concern and interest for these children. Feldon & Kafai (2008) concluded that the avatar-mediated nature of interactions in VLEs had an important impact on the context in which learning takes place, since learners ascribed personal and social meanings and functions to their virtual representation. These findings were relevant and influential for the present study inasmuch as it was important to take into consideration the fact that participants may ascribe meanings and functions to their virtual representation, which may be relevant for the analysis of their collective negotiation and-construction of meaning.

Avatars and presence

Persky et al.'s (2009) study was rather focused on the concept of *presence*, as related to the avatar-mediated nature of interactions in VLEs. *Presence* refers to the degree of perceived reality of the environment, the task, the others, and oneself in the VLE. The team of researchers was more specifically interested in investigating whether there was a relationship between presence and learning outcomes. Involving 156 adult users (i.e. not students) assigned with learning genetic concepts in the VLE, Persky et al. (2009) showed that no relationship could be found between presence and learning outcomes, such as recall of the learning objectives, transfer of learned information, or attention for information, but that presence was related to learning engagement. Based on these results, the present study was influenced to consider *presence* as a potential theme of interest, but not as a central variable of exploration for the study of VLEs.

With these results in mind, it is now important to review the literature that more directly addressed the use of VLEs for L2 teaching and learning purposes.

Studies on VLEs for L2 teaching and learning

In-depth, evaluative research studies on VLEs are, at that point, very rare, as the field is still overly dominated by more descriptive types of studies, as discussed previously. About this scarcity of in-depth research on VLEs in general, and as more specifically related to SLA, Kuriscak & Luke (2009) rightfully noted that

When it comes to virtual worlds (...) the internet is full of loosely connected theories, anecdotal evidence, first-person accounts (...). What is lagging behind, unfortunately, is research – in-depth qualitative cases studies and quantitative research. There is a scarcity in this area, especially for language learning and teaching in virtual worlds. (...) Much remains to be studied with a particular need for data-driven studies of L2 learners interacting in these virtual environments (pp.175-177).

We will now review the studies and results obtained in in-depth evaluative works dedicated to investigating VLEs in L2 teaching and learning, as they were crucial to better inform the orientation of our investigation. Two such in-depth studies could be

found: Kuriscak & Luke's (2009) on language learners' attitudes toward the use of a VLE in Spanish learning, and Zheng et al.'s (2010) on negotiation for action in game-based VLEs for EFL learners.

L2 learners' attitudes toward virtual worlds

Kuriscak & Luke's (2009) study aimed at investigating L2 learners' attitudes towards the use of a virtual world for the learning of Spanish, first in NS/NNS interactions, then in NNS/NNS exchanges. The first part of the experiment consisted of learners exploring the *Second Life* platform to find NS of Spanish to converse with. The experiment was then modified: students, at that point, were assigned to converse with their NNS peers through chat in *Second Life* to work collaboratively on grammar and vocabulary tasks assigned by their instructor. Participants in the study were given a survey, intended to elicit their attitudes toward computers and language learning in general, then more specifically toward the use of *Second Life*, as related to their communicative experience, as well as to error corrections. In effect, the questions composing the survey did not, for most of them, elicit any specific situation or learning event, as they happened during the experiment, but rather asked global questions related to the general use of computers, *Second Life*, or error corrections in L2 learning.

Results showed that, although students had a rather positive appreciation of computer-use for Spanish learning before the experiment, their appreciation decreased by the end of the *Second Life* experiment. The researchers explained these unexpected results by pointing out the multifaceted nature of learners' attitudes and motivations, the inherent level of frustration related to the use of computers, and potentially the need for these "digital natives" (Prensky, 2001) to learn in unwired spaces.

We will offer alternative explanations for these unexpected results, by first pointing to the generalist nature of the survey used to elicit learners' attitudes, which rose considerable validity issues, inasmuch as it could not allow drawing an in-depth portrait

of the learners' experiences and perceived impact of the medium on their learning. Furthermore, the lack of pro-active pedagogical design of the activities taking place in *Second Life* can be considered to be the main explanation of learners' depreciation of this innovative technological tool. As mentioned previously in the definition we established, VLEs are distinct from the simple use of the 3D-MUVE platform in which they are technologically anchored, inasmuch as they fundamentally rely upon a pedagogical framework and upon pro-actively determined learning objectives. In Kuriscak & Luke's (2009) case, it can be argued that the lack or insufficiency of pedagogical design led the participants to consider that the use of *Second Life* did not bring any added value to their learning, if compared with traditional paper-based learning formats.

Regarding instances of error corrections, Kuriscak & Luke's (2009) study showed that they only happened in NS/NNS interactions, but not in NNS/NNS interactions. It can be argued that Kuriscak & Luke, by deciding to focus on this specific error correction aspect, aligned with a traditional Cognitivist approach to L2 negotiation of meaning, as focus-on-form. As extensively discussed earlier, we contend that such an approach is inadequate for the study of L2 negotiation of meaning, intended to elicit L2 learners' critical thinking abilities.

In conclusion, Kuriscak & Luke's (2009) study's purpose influenced the present study, by investigating learners' experience and perceptions rather than the technological affordances of the virtual environment. In that respect, Kuriscak & Luke's (2009) study can be said to follow the need advocated by research on CALL to attend to learners' perceptions and experiences (Blake, 2008; Felix, 2005a; 2005b; 2005c; 2008; O'Rourke, 2005; Saarenkunnas, Kuure, & Taalas, 2003). Nevertheless, several issues arose in the methodology of this study, including questions of validity on the main research instrument utilized to elicit learners' attitudes, as well as the pedagogical design (or lack thereof) of the virtual learning environment. We will argue that a gap exists based on Kuriscak & Luke's (2009) study to more precisely explore learners' experiences and

perceptions of their learning environment, as well as how it impacts their learning, through a more focused and in-depth approach, notably by using observational data or interviews of these learners.

L2 negotiation for action in a VLE

Zheng et al.'s (2010) study on negotiation for action for English language learning in virtual worlds was crucial in informing the present study, inasmuch as both shared the same two central variables: L2 negotiation of meaning on the one hand, and VLEs on the other hand. Also similar to the present study, and as advocated by research on both L2 negotiation of meaning and on CALL, the researchers anchored their investigation in a Socio-Constructivist paradigm. In that sense, the authors supported the need to fully recontextualize learners' interactions by taking into consideration the impact of the specific learning environment on the learning process.

Zheng et al. (2010) offered a new view on negotiation of meaning, which they called *negotiation for action*. Considering the learner as an active agent in the negotiation and the learning process, the authors defined negotiation for action as "learning, as located within the interaction of the learning and the immediate environment in which it takes place" (p.492) and more precisely investigated it by exploring how avatar-embodied interactions and collaboration provided resources for English language learners to learn the language by making sense of it. They thus examined the discourse produced by four NS/NNS dyads, as they collaborated and negotiated to solve content-related problems in English in quests taking place in a VLE called *Quest Atlantis*.

For that purpose, the authors selected a qualitative research methodology, based on ethnographic methods, and aiming at conducting a discourse analysis. Results obtained through qualitative analysis of the learners' computer-generated chat logs showed that some instances of learners' attention explicitly directed toward language could be found, but that most of the discourse consisted of sharing content and

information in order for the partners in a dyad to meet their common goal (i.e. solving the quest). Moreover, Zheng et al. (2010) highlighted the importance of *continuers*, as discursive procedures used by both NSs and NNSs to show interest, ask their interlocutor to go on, and implicitly request more information. These findings are consistent with those presented by Van den Branden (1997) about the importance of *negotiation of content* in episodes of negotiation. Finally, the authors noted that:

Co-construction of actual utterance did not occur, [but] the chat and co-quest do afford co-construction of content and culture on the discourse level. (...) Rather than focusing on practicing language for the sake of practicing a language, learners use language in a persistent form to collaborate in achieving a goal, thereby learning the language by using it (p.502)

Supported by these findings on the lack of focus on form, but the emergence of a co-constructed discourse, the authors made suggestions for future research that included the need to further investigate learners' L2 critical thinking, problem-solving, and collaborative abilities. These indications on the orientation that future research on L2 negotiation of meaning in VLEs should take, as well as the methodological procedure of discourse analysis for the analysis of L2 negotiation of meaning, fundamentally contributed to the development of the present study.

Conclusion on VLE studies

In conclusion, it can be argued that research studies on VLEs are still fairly uncoordinated. Establishing a list of VLEs' affordances is what first and foremost attracted most researchers' attention so far, thus allowing obtaining a more comprehensive picture of what VLEs can potentially offer to promote learning. Furthermore, a significant part of this body of research also dedicated considerable attention to the presentation of VLE projects to provide teachers and institutions with concrete examples of VLEs teaching and learning potential, thus showing the growing interest which exists in the community of practitioners for these innovative tools for teaching and learning. Nevertheless, the predominance of descriptive works created a gap

in research to further conduct in-depth studies beyond the simple statement of affordances or presentation of teaching and learning projects, notably to investigate whether these affordances are perceived by learners as actually impacting their learning.

Some rare in-depth studies were found, highlighting the emergence of some research themes of interest, notably regarding the use of the three-dimensional graphic representation of learners in a VLE, via an avatar, which was found to impact the learning process (although not its outcomes), either through the meaning learners affiliated to it or through the level of *presence* that it induced. This particular emerging theme was of great influence for the present study, in terms of the social aspect of L2 learning in events of negotiation and co-construction of meaning.

More directly related to the use of VLEs in SLA research, Kuriscak & Luke's (2009) study was important inasmuch as it revealed the fundamental importance of underlying pedagogical principles and objectives in the use of VLEs in general, and for L2 teaching and learning in particular. The limitations of this work were determinant for the present study, as it confirmed the need to anchor the use of VLEs in strong pedagogical objectives, which was accomplished in the present study, through the central role given to the implementation of a curricular intervention (a problem-based activity) accompanying the use of a VLE. Finally, Zheng et al.'s (2010) study on L2 negotiation for action in a VLE was crucial to validate the focus of the present study, by showing the emergence of persistent co-constructed discourse in the L2, serving collaborative functions for the L2 learners in achieving a common goal. The researchers' suggestions for future research, including the need to further investigate learners' L2 critical thinking, problem-solving, and collaborative abilities, confirmed the gap in research that the present study invested and intended to bridge, by focusing of L2 negotiation and co-construction of meaning in a VLE.

Conclusion

As reviewed in this chapter, the literature on L2 negotiation of meaning has demonstrated an uneven situation in research, with on the one hand an over-representation of studies examining L2 negotiation of meaning from a Cognitivist perspective, which has been criticized for its limitations, and, on the other hand, the rarity of research on this variable from a more innovative and potentially more adequate Socio-constructivist perspective. This gap in research has thus indicated that L2 negotiation and co-construction of meaning now needed to be apprehended as a positive and collective process of discursive construction emerging from inter- and intra-interlocutors' opportunistic dissonances. A new definition of L2 negotiation and co-construction of meaning was thus proposed, characterizing this construct as "the subjective and alternatively collective and individual process by which learners produce and exchange discourse and meaning which is 'affected, renegotiated, [arbitrated], and reconstructed as a result of conflict in social interactions', as well as in individual perceptions (Jeong, 2003, p.28). The present study is thus intended to explore these discursive constructions, to determine whether they entail specific significant patterns that could inform research on L2 learners' critical thinking and problem solving skills. This objective corresponds to RQ#1 in the present study.

The affiliation of the study of L2 negotiation of meaning to the field of Computer Assisted Language Learning (CALL) has also been established, and the need to embed its investigation within a broader study on the students' perceptions of the impact of the specific learning and technological environment has been shown to be critical. Amongst the many technological settings via which CALL can be implemented, virtual learning environments (VLEs) have been suggested to be promising for the development of such skills as L2 negotiation and co-construction of meaning. Yet, research on VLEs was shown to still display a gap regarding the evaluation of their actual impact on learning. For that purpose, it has been determined that the study of the perceived impact of a

problem-based virtual learning environment (VLE) by L2 learners on their L2 negotiation and co-construction of meaning was an important additional variable, also allowing to inform L2 learners' developing L2 technology literacy skills. The present study is thus intended to explore L2 learners' perceptions, experiences, and expression of the impact of a problem-based VLE on their L2 process of negotiation and co-construction of meaning. This objective corresponds to RQ#2 in the present study.

Finally, research on L2 negotiation of meaning, as well as on CALL and on VLEs have concluded for the timely need to conduct empirical studies that combine various data sources and various data collection methods, to strengthen the validity of results. The present study is thus intended to investigate both L2 negotiation of meaning and the impact of a problem-based VLE on L2 negotiation of meaning through the use of a mixed methods approach to research, which we will now present in Chapter III.

CHAPTER III

METHODOLOGY

Introduction

The methodology selected to conduct the present study was motivated by a pragmatic approach to empirical research (Rocco et al., 2003), that is to say by a need to tailor the study's methodological design and procedures to closely address the two research questions that structured it. In that sense, the present study holds two original aspects, which have considerably influenced the organization of Chapter III.

First, it is important to understand the complexity of the present study's methodological design, which utilized a mixed methods approach to research, intended to use both quantitative and qualitative data to work synergistically to inform each other, so as to fully address each research question, and entailing several phases, data sources, and subsequent data sets, in the data collection and data analysis procedures.

Second, it is important to understand the central role played by the curricular intervention that stood at the heart of this study (i.e. the problem-based activity anchored in a VLE). As mentioned in Chapter II, one of the fundamental characteristics of VLEs is their underlying pedagogical principles and objectives. These principles and objectives were operationalized in the present study as a problem-based activity, implemented as a curricular intervention. It is thus crucial to fully understand the different design aspects and pedagogical objectives of this curricular intervention to be able to later comprehend the methodology of this study.

Consequently, I will start Chapter III by providing an overview of the mixed methods design of the present study. We will then present the different pedagogical aspects of the curricular intervention, as well as its pace of implementation in the present study. Next, we will discuss the purpose and outcomes of the two pilot studies conducted to pre-emptively test the different components of this curricular intervention, in terms of

their contributions to the methodological design of the present study. We will then provide an account of the data collection procedure, structured around the three different phases of the mixed methods design of this study. Finally, we will describe and explain the data analysis procedure accomplished in this study in terms of the integration of the different data sets collected to answer each of the two research questions structuring this study.

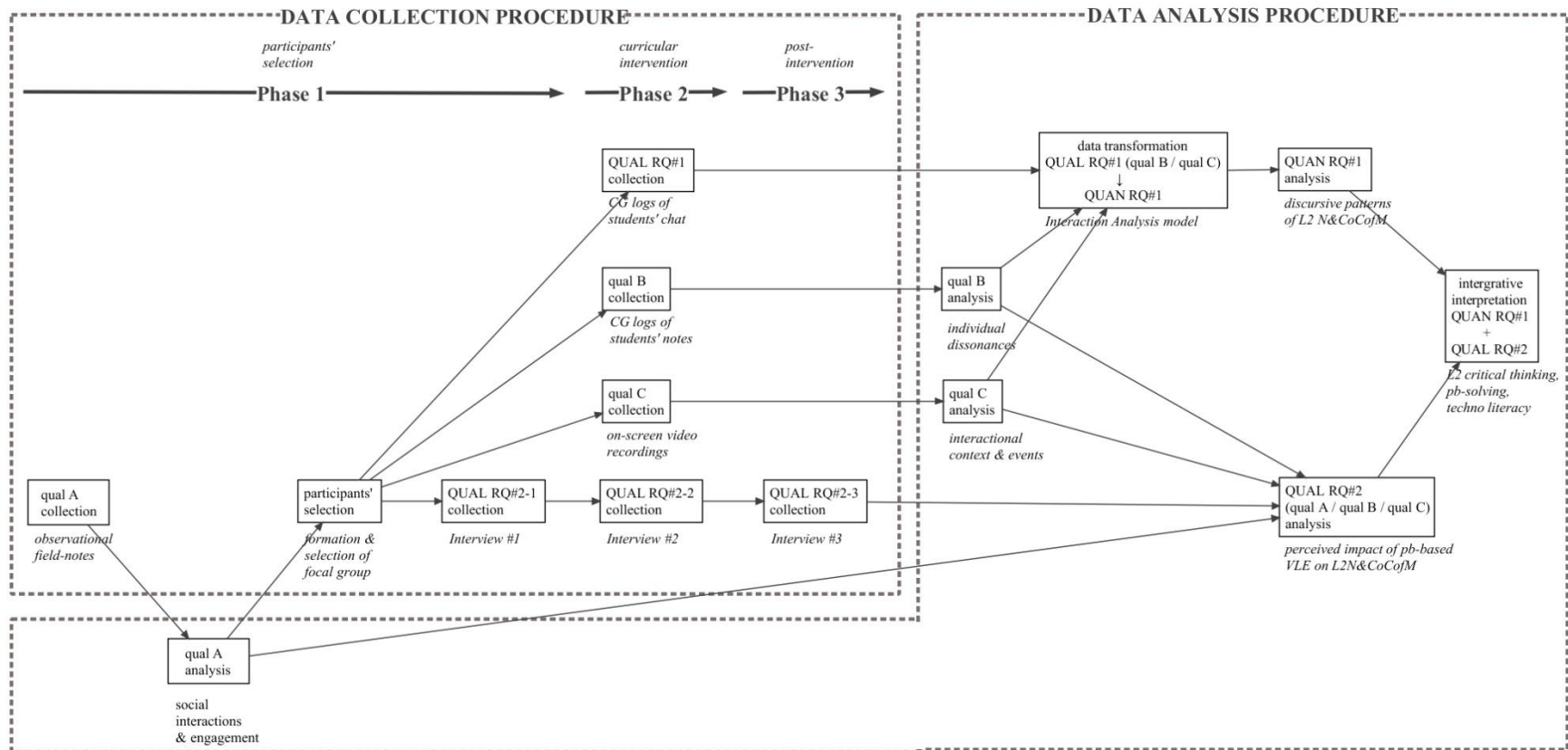
Overview of mixed methods design

The present study was conducted following a mixed methods approach to research, with both quantitative and qualitative components intended to work synergistically to inform each other. The methodological choices made for this study align with a dialectical philosophy of mixed methods research (Rocco et al.), that is to say with an intention to “consciously go back and forth between qualitative interpretation and quantitative analysis (...) to better reflect the social realities” (pp.596-597) at work in this study. For that purpose, the present study was methodologically designed following and adapting Creswell & Plano Clark’s (2007) nomenclature of mixed methods research models. The methodological design of this study thus corresponds to an original combination of two models: a predominant *embedded* design, further including a *triangulation* design. Figure 3.1 is a summary of the mixed methods design of this study. We will now present and explain the different characteristics and purposes of this study’s mixed methods design.

Embedded design

Several features of an *embedded* mixed methods design were relevant for the methodology of the present study (Creswell & Plano Clark, 2007). First, because this study relied on two different, although related, research questions, different types of data needed to be collected to answer each research question. As shown in Figure 3.1, data

Figure 3.1. Summary of mixed methods design for this study: an embedded model, including a triangulation component.



sets QUAL/QUAN RQ#1 (the computer-generated logs of students' collective chat), qual B (the computer-generated logs of students' individual notes), and qual C (the on-screen video recordings) served to answer RQ#1, while data sets QUAL RQ#2-1/2/3 (the three rounds of interviews), qual A (the observational fields notes taken prior to the curricular intervention), qual B (the computer-generated logs of students' individual notes), and qual C (the on-screen video recordings) served to answer RQ#2.

Second, sequential processes of data collection and analysis were required for development purposes (Greene et al., 1989), that is to say to use the results from one method to help develop the other method, most notably for sampling purposes, but also to answer each research question. For that purpose, the data collection and analysis processes of this study were built around phases. As shown in Figure 3.1, Phase 1 of this study was intended for participant selection purposes, while Phase 2 corresponded to the curricular intervention that stood at the heart of this study, and Phase 3 consisted of collection post-intervention data.

Third, while the present study was predominantly qualitative in nature, the inclusion of quantitative data within this otherwise qualitative study was necessary to answer RQ#1. As shown in Figure 3.1, in the data analysis procedure stage, the different data sets used for the treatment of RQ#1 allowed for the creation of a quantitative data set (QUAN RQ#1).

Fourth, the treatment of each research question needed to rely on data sets which played a primary role, while other data sets served were needed to play a supportive and secondary role. As shown in Figure 3.1, QUAN RQ#1 was the primary data set allowing to address RQ#1, while qual B and qual C were secondary data sets in the treatment of this research question. Similarly, QUAL RQ#2-1/2/3 was the primary data set allowing to address RQ#2, while qual A, qual B, and qual C were secondary data sets in the treatment of this research question.

Finally, the present study had an initiation purpose, that is to say that it was intended to seek the discovery of contradiction between the qualitative and the quantitative results, to better inform the interpretation of findings permitting to contribute to a research on L2 critical thinking, problem-solving, and technology literacy skills. As shown in Figure 3.1, the results emerging from the treatment of RQ#1 and RQ#2 were merged at the interpretation stage of this study to increase the depth of interpretations relevant to inform a research about L2 critical thinking, problem-solving, and technology literacy skills.

Although the main methodological design of the present study consisted of an *embedded* mixed methods model, a *triangulation* stage was also internally included, the characteristics and purposes of which we will now present and explain.

Internal triangulation stage

As previously mentioned, the present study was predominantly qualitative in nature, but required the inclusion of quantitative data to answer RQ#1. As shown in Figure 3.1, the primary data set collected for the treatment of RQ#1 was inherently verbal in nature (QUAL RQ#1), and needed to undergo a data transformation process to be treated as a quantitative data set. For that purpose, a *triangulation* stage was included within the otherwise *embedded* design of this study. During that stage, the complementary nature of the data obtained in the primary QUAL RQ#1 data set with the secondary qual B and qual C data sets was invested to allow for the merging of each of these data sets' results, so as to subsequently permit the quantification of QUAL RQ#1 into QUAN RQ#1.

In conclusion it is important to understand the complexity of the present study's mixed methods design, as it contributed to attending to the validity and reliability of the present study. The data collection and data analysis procedures of this study will later be

presented following the methodological organization of this study, as represented in Figure 3.1.

We will now present and explain the characteristics and purposes of the second original and influential aspect of the present study, in terms of its methodology: the curricular intervention that stood at heart of its methodological procedures.

Curricular intervention

Problem-based learning

In order for participants in this study to demonstrate deep learning processes, related to critical thinking and problem solving in the L2, it was imperative that the VLE, upon which the curricular intervention at Phase 2 of this study relied, be structured with precise pedagogical principles and objectives. These pedagogical principles and objectives were anchored in the Socio-Constructivist epistemological framework underlying this study, and were intended to trigger the emergence of the L2 negotiation and co-construction of meaning process that this study is investigating. For that purpose, a problem-based task was selected, based on the Socio-Constructivist literature that deemed it to be among the learning tasks that best lead to negotiation and co-construction of meaning, as well as higher levels of critical thinking (Grabinger, 1996; Honebein, Duffy, & Fishman, 1993; Jonassen, 1999).

Oliver & Nelson's (1997) *Un Meurtre à Cinet* murder mystery was selected as the basis for the design of a problem-based task in French, after evaluating and observing its potential for L2 negotiation and co-construction of meaning during several years of implementation in its original form in the Department of French and Italian from which the participants in this study were selected. Oliver & Nelson's (1997) *Un Meurtre à Cinet* murder mystery was originally created for L2 learners of French "to promote writing for communicative purposes" in a computer-mediated environment using chat as the main tool for communication (Nelson & Oliver, 1999, pp.102-103). It thus served as the basis

Figure 3.2. *Un Meurtre à Cinet*: design of a socio-constructivist task.

Criteria for constructivist learning	Definition	Design feature in <i>Un Meurtre à Cinet</i>
Leamer-centeredness	Ownership of the learning process by learners, settings goals, strategies, learning, and performance	Murder mystery task owned by the students, as characters in the story, who have to set their strategies towards solving the crime
Authenticity	Same type of cognitive challenges as those in the real world	Students need to gather real evidence to make a strong case and cannot accuse anyone without strong argumentation and evidence
Contextualization	Anchoring the task in a physical, organizational, and sociocultural context in which it is likely to occur	Task situated in a virtual environment where <i>Cinet</i> has been recreated entirely
Complexity	Multiple solution paths, multiple criteria for evaluating potential solutions, uncertainty of relation between different concepts, need to make judgments and defend them	All the characters in the story have a motive; they are all potential suspects. They will all have to defend themselves from others' suspicion.
Multiple perspectives	Generating and comparing different perspectives so as to evaluate and refine goals and strategies	Students will have to compare and evaluate multimodal texts (clues and interviews of other characters) and refine their goals and strategies according to their findings
Collaborative learning	Communities of positively interdependent learners with common interests, interacting towards shared goals, and accountable to one another	Alliances of characters are established in the scenario to foster collaboration by infusing shared interests in the story
Tools supporting knowledge-construction	Scaffolding tools providing temporary frameworks to support learning and performance beyond learners' capacities	Design of a multimedia Detective Notebook for each student, to guide them to keep track of, organize, revisit, and reflect on their learning

Note. Adapted from Jonassen, 1999; Honebein et al., 1993; Oliver & Nelson, 1997.

for a new problem-based task, the design of which was established to respond to Gunawardena et al.'s (2006), Honebein et al.'s (1993) and Jonassen's (1999) criteria for the design of constructivist learning environment. Figure 3.2 shows how this new version of *Un Meurtre à Cinet* integrated the designing criteria for socio-constructivist learning environments.

The task thus needed to be:

- Learner-centered, that is to say that learners get complete ownership of their learning process by “directing, monitoring, and taking responsibility for their goals, strategies, learning and performance” (Honebein et al., 1993, p.90)
- Authentic, that is to say engaging “the learners in activities which present the same type of cognitive challenges as those in the real world” (Jonassen, 1999, p.221)
- Contextualized, that is to say anchored in the physical, organizational, and sociocultural context in which it is likely to occur (Jonassen, 1999)
- Complex, that is to say possessing multiple solution paths, multiple criteria for evaluating different potential solutions, presenting uncertainty about how different concepts relate to one another, and requiring learners to make judgments and defend them (Jonassen, 1999)
- Supporting multiple perspectives, that is to say generating multiple perspectives and allowing learners to evaluate them, so as to refine their learning goals and strategies (Honebein et al., 1993)
- Collaborative, that is to say leading to communities of positively interdependent learners who share common interests, interact and work towards shared goals, and are individually accountable to the group (Jonassen, 1999)
- Supported by knowledge-construction tools, that is to say “scaffolding learning tools that provide temporary frameworks to support learning and student performance beyond the learners’ capacities” (Jonassen, 1999, p.235)

The newly designed version of *Un Meurtre à Cinet* thus consists of a more complex murder mystery, anchored in a set of scenarios, featuring a French rural village (*Cinet*), where a young woman has just been murdered. In the absence of the police, the town folks, as represented by the students, have to become investigators to try to discover who amongst them committed the crime.

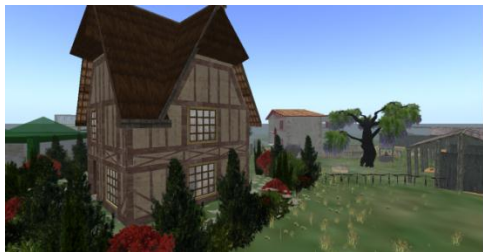
Context, tools, and texts for learning

Immersion in a virtual learning environment (VLE)

The heart of the murder mystery, which served as the problem-based task around which the curricular intervention of this study was designed, was the VLE in which learners were immersed. The town of *Cinet* was thus graphically represented as a three-dimensional immersive, virtual learning space in the 3D- MUVE platform *Second Life*. The design of this virtual learning space was intended to provide cultural authenticity, by reproducing both the specific spatial organization of typical French villages, in terms of crowdedness, density, and entanglement, as well as the specific architectural and textural aspects of different geographical and socio-economic French landscapes. Figure 3.3 provides some views of *Cinet Second Life*, its density, and its diversity.

Students participating in this study were thus immersed in this fictional town, and represented characters in the *Un Meurtre à Cinet* story, via a three-dimensional graphic representation of their persona (i.e. their avatar) in the VLE. Each of these characters had a pre-determined, personal story, which learners had to first learn and understand in depth, in order to fully know their character. They then populated the *Cinet Second Life* platform, playing the role of their character on the day following the murder, and interacting with both the virtual environment and other avatars (i.e. other students) to try to solve the murder mystery. Solving the murder mystery implied, in terms of learning objectives, being able to collectively build and then present a viable and supported argument, answering the following questions:

Figure 3.3. The *Cinet Second Life* platform.



- How was the murder committed? (Where? At what time? What was the cause of death or the modus operandi of the murder?)
- Who committed the murder? (Who was the main murderer? Did s/he have (an) accomplice(s)? If so, what are their relationships?)
- What was the motive for the murder? (What was the main murderer's reason for killing? What were his/her accomplices' reasons for helping?)
- What testimonies did you collect that support your theory in this case? (Who told you what? Was it a reliable testimony? What does it mean? Why is it important?)
- What clues did you find that support your theory in this case? (What kind of clue is it? What does it say? What does it mean? Why is it important?)

The entirety of information necessary to solve the murder mystery was contained in the VLE and in the learning context via two types of information provided. On the one hand, information was provided within the VLE in the form of clues, disseminated around the village which learners had to search for, as they would in a scavenger hunt. On the other hand, information could be collected amongst avatars (that is to say amongst learners), as they were all individually in possession of their own specific piece of the overall puzzle needed to solve the mystery (by knowing the detailed personal story of their own character), and thus had to trade information with one another to complete the jigsaw. Learners consequently had to interact with both their environment and other students to access the information that stood as the key to solving the murder mystery. Interacting with other learners/avatars in the VLE was done under the form of written chat and instant-messaging. Interacting with the environment consisted of moving around the town, from one place to another, searching for clues and for other avatars to talk to. Retrieving clues required students to click on salient objects, and to follow the instructions attached to them. Figure 3.4 is an illustration of the different interactions happening in *Cinet Second Life*.

Figure 3.4. Interacting with the environment and with others in *Cinet Second Life*.



Scaffolding tools for learning.

Students in *Un Meurtre à Cinet* were also guided and assisted in their learning process by a multimedia *Detective Notebook*, designed to promote scaffolding during the problem-based task, standing at the heart of the curricular intervention taking place at Phase 2. Figure 3.5 is an illustration of how the multimedia Notebook was organized to serve as a scaffolding tool for learning. The purpose of this multimedia *Detective Notebook* was to help learners manage the complexity of the task by allowing them to keep track of their navigation and progress within the enquiry process, thanks to an organizational template that was intended to prompt them to summarize the information they gathered step by step, and to determine the relationships existing among different and disparate pieces of information. This personal tool for learning aimed at promoting cognitive and metacognitive constructivist learning, notably generating hypotheses and strategies based on the confrontation of multiple perspectives, and being able to revisit and evaluate them to better refine them.

Multimodal French texts

As mentioned previously, the entirety of information needed to solve the murder mystery was contained in the VLE. This information took the form of authentic multimodal French texts, that is to say composite texts that integrated different types of modalities, whether verbal, pictorial, symbolic, gestural, or numerical. Stein (2004) observed that meaning-making is multimodal, and that pedagogy should invest in the exploration of the variety of modalities, as “the making of meaning involves the use of several semiotic modes as resources, all working in conjunction to create particular communicative effects” (p. 105). For that matter, and to pursue with Jonassen (1999) and Honebein et al. (1993) criteria for the design of constructivist learning environments, a variety of texts was created, involving the combination of different modalities. As illustrated in Figure 3.6 for instance, students had to decode the information contained in

Figure 3.5. The multimedia *Detective Notebook*: a scaffolding tool for learning.

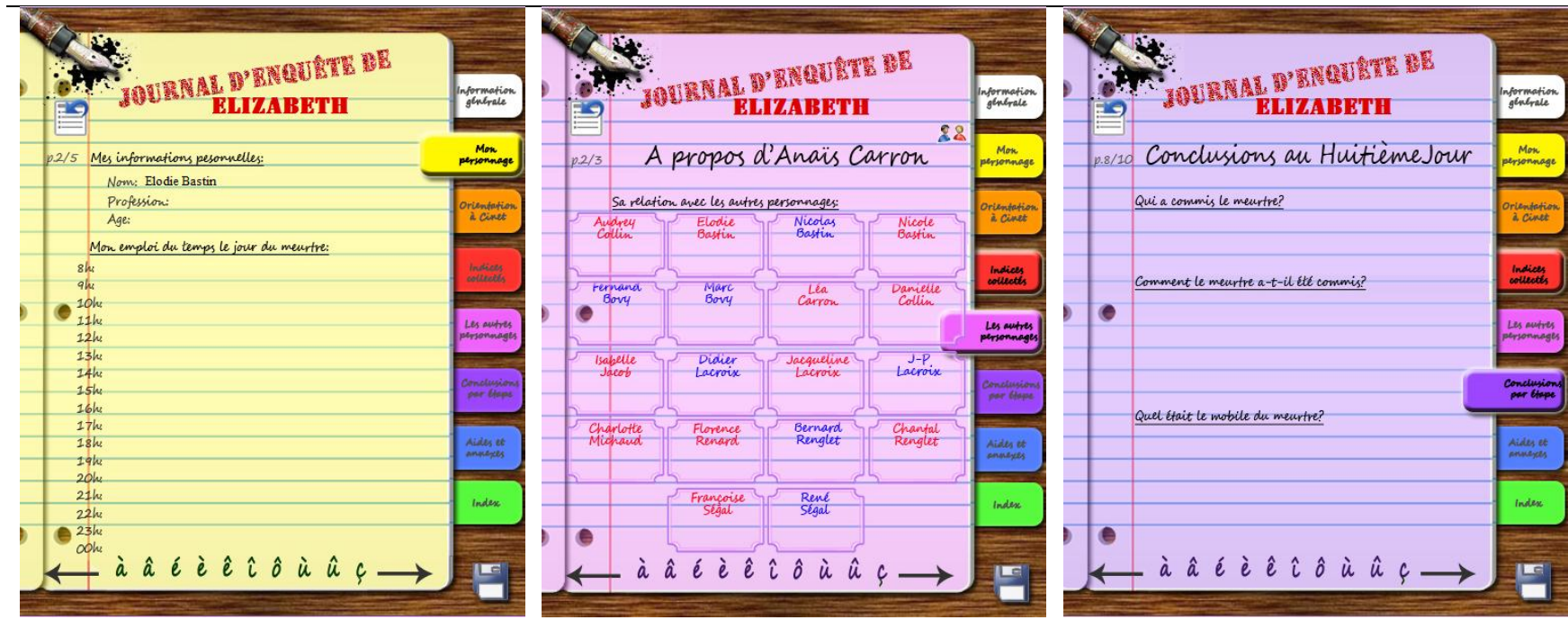


Figure 3.6. Examples of multimodal French texts.

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CABINET MÉDICAL DE CINET – 14 rue de l'hôpital – 28580 CINET
MÉDECINE GÉNÉRALE

Tél : 02.37.83.58.96
Fax : 02.37.83.58.97

Docteur Élodie BASTIN

n° 34 1 0133351

Consultations:
Lundi - Vendredi 10h-18h
Samedi 10h-14h

Cinet, le 20 Septembre 2009

Ordonnance pour Marc BOVY

Hallicoron 250 mg

Prendre deux comprimés une demi-heure avant le coucher.

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2	19,60	175,78	1072,64	896,86	175,78	1072,64	
				1 Euro =	6,55957	Total en Franc : 7036,06	

clues that were disseminated in the VLE, such as a ticket from a movie theater, a doctor's prescription, or a mechanics' bill, and to decipher which pieces of information were relevant and useful to solve the mystery.

Pace of the problem-based task

The *Un Meurtre à Cinet* activity was organized sequentially in a five-step fashion, to follow Honebein et al. (1993) criteria for complexity management, which stated that a Socio-Constructivist learning task should progress additively, from easier to more and more complex. Figure 3.7 gives a summarized view of the overall pace of the activity.

For the purpose of complexity management, the task evolved as follows:

- Step 1: learners worked individually with a limited amount of texts, to learn about the story and their own character.
- Step 2: first learner-to-learner interactions, but the sharing of information was still safe, as it took place among a restricted group of learners belonging to the same collaborative group (i.e. the groups formed at Phase 1 of this study).
- Step 3: learners had to encompass the entirety of multimodal texts and apply communicative strategies to their learner-to-learner interactions outside of their collaborative group.
- Step 4: learners worked collaboratively with their group towards building a viable consensus that they could defend and support with clues and information gathered through interviews of other characters.
- Step 5: learners had to be able to present a coherent argument to the entire group of learners, supported with clues and information collected during interviews, OR to understand other groups' presentation and reflect on the viability of it, compared to theirs.

Moreover, it is important to note that, because the task was designed to be highly student-centered, the role of the instructor was reduced to providing students with the

Figure 3.7. Pace of *Un Meurtre à Cinet* problem-based activity, as presented to students.

Steps	Pace	Learning events in <i>Cinet Second Life</i>	Learning events in <i>Detective Notebook</i>
Step 1 Getting to know the story and my own character	Day 1 & 2	Picking up my diary and discovering the clues I left behind me. Reading the newspaper edition of the day, my personal diary, and the census report.	Completing my timeline, my relationships with others, and my list of secrets
Step 2 Getting to know my friends and exploring the town for clues	Day 2, 3, & 4	Meeting with my friends: - to exchange information and secrets so as to tie a relationship of trust and start collaborative brainstorming - to discuss possible strategies Hunting for clues disseminated all around the town.	Filling in the pages that concern my friends based on the information and secrets they shared with me. Reading through the content of each clue found during clue hunting
Step 3 Interviewing the town folks and sharing with my friends	Day 5, 6, & 7	Alternatively: - Visiting anchored characters and interviewing them OR - Waiting in my anchor location for other characters to come and interview me	Checking the locations and characters I visited on the map and in the lists. Filling in pages about the characters I interviewed or about other characters I got information on Stating first temporary hypotheses or conclusions according to what has been discovered during the day, and sharing them with my friends.
Step 4 Building a viable reasoning to explain the murder	Day 8 & 9	Meeting with my friends: - to summarize all the information found - to brainstorm on a possible reasoning - to draft the group reasoning	Referring back to all information recorded in Detective Notebook Using Conclusions on Day 8 & 9 pages to guide the building of a reasoning
Step 5 Presenting conclusions to the whole town	Day 10	Meeting with all the town folks and: - either presenting my conclusions and accusing someone / defending myself - or listening to other people presenting	Using final conclusions stated the day before to argument in front of the town folks and accuse someone or defend myself

learning objectives of the day at the beginning of each session of the activity, and being a help on the side, notably for technological purposes. Instructors thus played a very minimal and non-influential role in the conduction of the problem-based activity, although they were eventually in charge of the assessment of the task.

We will now present and explain the two pilot studies conducted to test the different components of this curricular intervention, and the relevant outcomes of these pilot studies in terms of the methodological decisions made for the present study.

Pilot studies

The design and construction of both the *Cinet Second Life* VLE and the problem-based learning task *Un Meurtre à Cinet* were completed in May 2009. Two pilot studies were conducted, aimed at fine-tuning the problem-based task, technological apparatus, methodological design model, and research instruments for this study. The first pilot study was conducted in October 2009. The second pilot study was conducted a year later, in October 2010. Following is an account of the results of these two studies and the extent to which they impacted the final methodological decisions made for the present study. Figure 3.8 is a summary of findings obtained during both pilot studies, and how they were relevant for the methodology of the present study.

Pilot study #1

Purpose and setting of Pilot Study #1

The purpose of the first pilot study was to conduct an alpha-test of the technological apparatus (both the *Cinet Second Life* platform and the *Detective Notebook*). The study took place over a 2.5-hour session in a computer lab resembling the one in which participants for this study would be working, and where all the necessary software and hardware were installed. Twelve participants took part in this pilot study:

- The researcher and the assistant designer

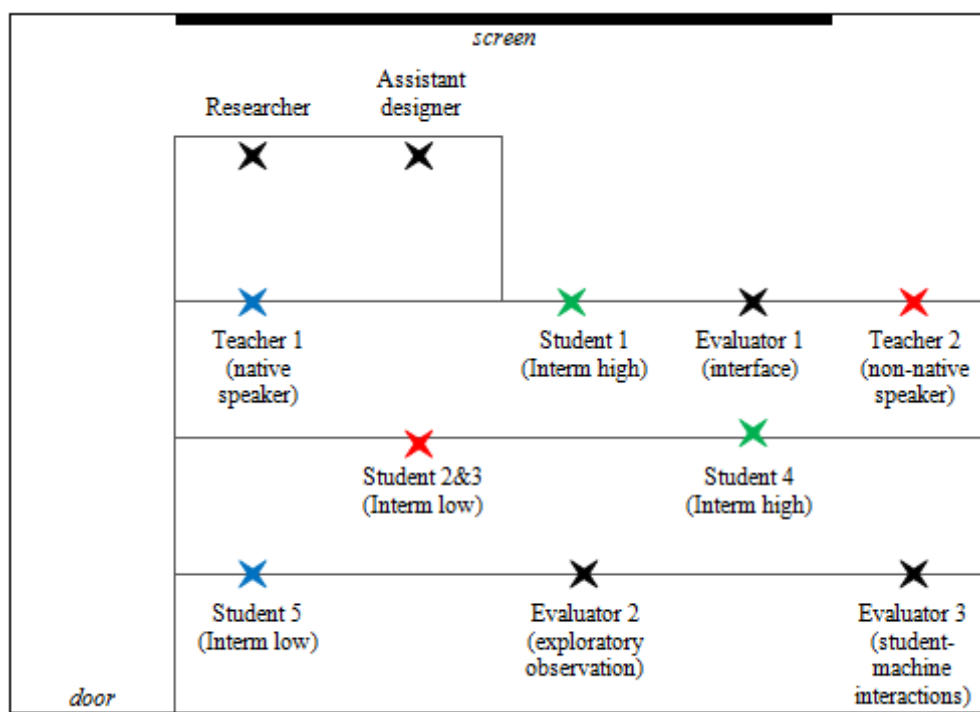
Figure 3.8. Summary of pilot studies' relevant findings for the main study.

	Pilot Study #1 (Oct 2009)	Pilot Study #2 (Oct 2010)	Final decision for main study
Technological interface	<ul style="list-style-type: none"> - Expand <i>Detective Notebook's</i> interface for legibility purposes - Heighten buildings in <i>Cinet Second Life</i> for navigation purposes - Prevent "eavesdropping" phenomenon by favoring instant-messaging and anchoring each group in distant locations in <i>Cinet Second Life</i> 		<ul style="list-style-type: none"> - Expand <i>Detective Notebook's</i> interface for legibility purposes - Heighten buildings in <i>Cinet Second Life</i> for navigation purposes - Prevent "eavesdropping" phenomenon by favoring instant-messaging and anchoring each group in distant locations in <i>Cinet Second Life</i>
Participants selection and organization	<ul style="list-style-type: none"> - Pairs of students is not adequate for group formation - Three-student groups seem to work better - Intermediate-Mid learners seem more adequate than Intermediate-Low (overly challenged) - Three groups is an adequate dynamic 	<ul style="list-style-type: none"> - Three-student groups are inadequate - Five-student groups are optimal - Four-student groups are adequate - Advanced-Low students are not challenged enough / Intermediate-Mid students seem adequately challenged 	<ul style="list-style-type: none"> - Selection of Intermediate-Mid learners - Formation of three groups in each class - Formation of groups of five students (ideally), no less than four - Overall participants in the study should thus be $24 < N < 30$
Research instruments	<ul style="list-style-type: none"> - Need to include interviews as a supplementary data source to capture students' perceptions - Need to include recordings as a supplementary data source to account for the full context of interactions 	<ul style="list-style-type: none"> - Video recordings do complement the transcripts of students' verbal interactions - Avoid collective interviews and favor one-on-one interviews - Further access to students' perceptions on power and on their conception of thinking in French 	<ul style="list-style-type: none"> - On-screen video recordings of students' computer-mediated interactions - One-on-one interviews - Interview protocol containing questions about power and thinking
Variables of study	<ul style="list-style-type: none"> - Investigate negotiation of meaning in terms of discursive patterns - Integrate learners' perceptions, about the impact of the learning environment on their learning 	<ul style="list-style-type: none"> - Investigate negotiation of meaning in terms of discursive patterns 	<ul style="list-style-type: none"> - Investigate negotiation of meaning in terms of discursive patterns - Investigate students' perceptions about the impact of the VLE on their learning.

- 3 evaluators
- 5 students of French, including 3 Intermediate-low level students and 2 Intermediate-high level students
- 2 French teachers, including a native speaker of French, experienced in teaching College-level Intermediate-level students, and a non-native speaker of French, experienced in Teacher and Learners Education.

An abridged version of the *Un Meurtre à Cinet* activity was implemented (see Figure 3.7). Participants were provided with the main introductory information prior to the actual pilot test (information corresponding to what students would encounter at Day 1 & 2 of the actual activity). Figure 3.9 is an illustration of the overall setting and pair-up system used during Pilot Study #1.

Figure 3.9. Setting and pair-up system during Pilot Study #1 (October 2009).



Participants' interactions with each other to share information in a fashion similar to what was designed at Step 2 and 3 of the activity, were the focus of this pilot test.

For that purpose, participants were paired up to form collaborative groups that would resemble the ones implemented for the Phase 2 curricular intervention of this study. A choice was made to pair up each French teacher with the students featuring the lowest proficiency level. One of these groups was actually composed of three participants (one teacher, and two students, who shared the same online character during the test).

The researcher and assistant designer's role consisted in initially presenting and guiding the activity, and in assisting participants in case of technical problems. The three evaluators present during the pilot study brought their expertise to observe, evaluate, and provide constructive feedback on different aspects of the project, namely:

- The computer-based interface, looking for needed technical improvements (Evaluator #1)
- The overall dynamic of participants, as an exploratory way of helping to determine what salient themes could be relevant for a subsequent study (Evaluator #2)
- The student-machine interactions (Evaluator #3)

Data collection for Pilot Study #1

Data were collected in a variety of manners during Pilot Study #1, but were all qualitative in nature. First, computer-based activities and interactions were systematically recorded as computer-generated logs, both by the *Cinet Second Life* platform and by the *Detective Notebook*, providing a detailed and timed account of participants' interactions with the objects in the virtual platform (i.e. the clues disseminated in *Cinet Second Life*), as well as their verbal interactions with other participants through chat or instant-messaging, or in the notes taken in the *Detective Notebook*. Second, a survey was distributed to participants during the last 15 minutes of the pilot study, aiming at

gathering their individual views on the technology and the pedagogy involved in this activity. Finally, observational data, as captured by Evaluator #2, were collected as a list of possible emerging themes that would deserve further exploratory attention for the main study to come.

Outcomes of Pilot Study #1

Several types of results obtained through the analysis of the data collected during Pilot Study #1 were relevant to (1) the technological interface design, (2) the selection and organization of participants, (3) the variables of study, and (4) the research instruments.

First, participant survey results showed that some modifications of the technological apparatus were necessary before it could be utilized for the main study. These necessary modifications included the need to expand the *Detective Notebook* interface, as well as the need to heighten some of the buildings in the *Cinet Second Life* platform. Also related to the technological apparatus, it was found that an unanticipated “eavesdropping” phenomenon could happen in the *Cinet Second Life* platform where some participants, who thought they were conversing privately, found out that others who were in their vicinity would see their chat appearing on their screen. This finding led to a refined design of the technological interface to be used for the present study.

Second, results relevant to the selection and organization of participants indicated that pairs of students were not sufficient to emulate problematic conversations that would lead to negotiation of meaning events. Only the group of three students displayed a more complex conversational dynamic, which led to conclude that collaborative groups for the main study should be composed of at least three students. Nevertheless, the total number of groups of students (i.e. three groups) showed to be an efficient organization of participants. The decision was thus made to maintain a three-group structure for the problem-based activity to be implemented for the main study. Finally, a decision was

made for the main study to select students at the ACTFL (1999; 2001) Intermediate-Mid level of proficiency, based on both the computer-generated logs of students' verbal interactions and on their personal report on the pilot study, that indicated that Intermediate-Low learners were overly challenged by the difficulty of the task, while Intermediate-High learners were under-challenged.

Third, results relevant to the variables of study for the main research project encompassed the validation of the need to investigate events of negotiation of meaning, and more specifically in terms of the discursive patterns that would appear in the discourse constructed by a group of students. A specific discursive episode amongst students in one of the groups showed an interesting evolution, from sharing information to debating it, while generating hypotheses, confirming or rejecting them by making references to supporting clues, and revisiting conclusions at the group-level. The presence of this episode in a 2.5-hour session was a promising finding that had an impact on the orientation to give to the study of L2 negotiation and co-construction of meaning events, by focusing on the discursive patterns that could arise in a group's discourse. Furthermore, the open-ended questions from the survey, that were initially intended to receive technical feedback from the participants, turned out to be a space for them to express their personal opinions about how they thought the VLE had helped them, as well as the potential they could see in it for teaching and learning purposes. These unprompted and unexpected findings had a crucial impact for the main study, inasmuch as they showed how important students' perceptions were, regarding the impact of the VLE on their learning, and that it should become an integral variable of study in the main research project.

Finally, findings that were relevant to the selection and development of research instruments for the main study first related to this last point on the importance of taking students' perceptions into account. After discovering that students had spontaneously voiced their opinions, it was decided that a more structured approach to capturing their

perceptions should be established for the main study, and that semi-structured interviews would be the most appropriate instrument for this endeavor. Moreover, based on the reports made by Evaluator #2 on the overall dynamic of participants amongst themselves and Evaluator #3 on the student-machine interactions, it was found that the computer-generated logs of students' verbal interactions alone only accounted for one restricted aspect of the more complex interactional phenomena, and that, consequently, additional research instruments should be used to capture the broader context of their interactions (both with the machine and amongst each other). It was thus decided that on-screen video recordings of interactions should be used as an additional research instrument, to provide data on this broader interactional context.

Pilot study #2

Purpose and setting for Pilot Study #2

The second pilot study was conducted in October 2010. Based on Pilot Study #1's findings, notably regarding the need to take into consideration students' perception about the impact of the learning context on the learning itself, Pilot Study #2 was first and foremost intended to conduct interviews, aiming at capturing these students' perceptions. It was also intended to allow for practice in the collection and analysis of observational data, as Pilot Study #1 proved that a need existed to use video recordings, to enrich the transcripts of students' verbal interactions with information about their broader interactional context. Since most of the technological aspects of the main study had been covered during Pilot Study #1, it was decided that Pilot Study #2 would concentrate on other key aspects of the study (most notably on discursive patterns of L2 negotiation of meaning) and would thus not involve any use of technology by the participants. The study involved two First Semester of Third-Year French Oral Expression classes, a morning class with 7 students, and an afternoon class with 10 students. Students who participated in this pilot study were Intermediate-Mid to Advanced-Low in their language

proficiency (ACTFL, 1999; 2001). The study was designed around a problem-based activity that was not the *Un Meurtre à Cinet* activity, but which shared the same Socio-Constructivist design principles (see Figure 3.2). Figure 3.10 is a sample of the materials used for Pilot Study #2. This time, the central problem-based activity was based on a short semi-authentic newspaper article, relating a complex and ambiguous car accident that led to the death of a pedestrian, and in which several people (drivers, pedestrians, road workers, mechanics...) were involved. The task related to this text consisted of rank-ordering the different characters in the story, from the most reprehensible to the least reprehensible, while being able to support one's opinion for this ranking. Each group of students was instructed that they formed a jury duty for this case in court, and that they had to reach a consensus on this ranking. Students thus had to take part into interactive higher levels of thinking characterized by negotiation and co-construction of meaning.

Groups of three or four students were formed by the instructor, based on Pilot Study #1's results. Pilot Study #2 entailed a group of three and a group of four in the morning class, and two groups of five in the afternoon class.

Data collection for Pilot Study #2

Figure 3.11 is a recapitulative chart of the nature, pacing, and purpose of the data collected during Pilot Study #2. Three types of data were collected during Pilot Study #2, all qualitative in nature: students' documents, observations, and interviews. Two types of documents were created by students and further collected. First, the individual chart filled in by students, with their individual initial ranking was collected to gain insight into the starting point of the following consensus-building. Second, the supporting text for the consensus-building task, as individually annotated by students, was also collected to provide insight into some meaning-making process, as experienced by students

Figure 3.10. Learning materials used for Pilot Study #2's consensus-building task (October 2010).

Un accident de la route meurtrier

Un jeune homme de 28 ans a été tué sur le coup hier vers 7h00 alors qu'il rentrait d'une fête, écrasé par le conducteur d'une décapotable au croisement de la rue du 14 Juillet et du boulevard Aragon. Le jeune homme décédé était ivre au moment des faits. Les freins de la décapotable étaient défectueux et le feu du croisement ne fonctionnait pas correctement. Une enquête a été ouverte par la police, qui montre que la responsabilité de plusieurs personnes est en jeu.

D'après les premiers éléments de l'enquête, le conducteur de la décapotable ne conduisait ni sous l'emprise de l'alcool, ni sous celle d'un quelconque stupéfiant. Il a expliqué à la police que le feu du croisement semblait être en panne et qu'il clignotait. Il aurait alors ralenti pour pouvoir céder la priorité au croisement, mais aurait été percuté à l'arrière par la conductrice qui le suivait, au volant d'un monospace. Cette collision aurait alors projeté la décapotable sur le passage piéton, fauchant le jeune homme de 28 ans qui s'y était déjà engagé.

La police, qui a enquêté auprès de la compagnie de téléphone de la conductrice du monospace, a pu démontrer que celle-ci était distraite au moment de l'accident car elle était un train d'écrire un SMS. Par ailleurs, l'expertise mécanique de la décapotable a montré que les freins avaient été récemment endommagés lors de la dernière visite de son conducteur chez le garagiste, la veille. Il semblerait que le garagiste ait alors négligé de resserrer les freins correctement, engendrant la perte de contrôle du véhicule hier matin, lorsque son conducteur a voulu freiner pour éviter le piéton.

En outre, il est important de noter qu'un témoin de la scène a confié aux enquêteurs que le feu pour piéton était au rouge lorsque l'accident a eu lieu. De plus, un test d'alcoolémie a été pratiqué sur le jeune homme décédé et a révélé un taux d'alcool de 1,5 gramme/litre dans le sang de celui-ci.

Enfin, l'agent municipal qui était en charge de la remise en service des feux du croisement de la rue du 14 Juillet et du boulevard d'Aragon, en travaux depuis déjà quinze jours, est également mis en cause. En effet, l'agent aurait dû rétablir le système de signalisation du croisement au plus tard à 8h du matin, mais ne serait arrivé sur les lieux qu'à 9h10, après avoir dû amener sa fille à l'hôpital.

Il revient désormais aux jurés assignés à l'affaire de déterminer la part de responsabilité de chacun des protagonistes dans cette histoire malheureuse.

Tu es juré dans l'affaire de cet accident de la route. Etablis un classement des responsabilités, de la personne que tu penses être la plus répréhensible(1) à la moins répréhensible(5). Justifie ton choix par une ligne d'argument.

- Conducteur de la décapotable : M. Bourdoin
- Conductrice du monospace : Mme Daniard
- Piéton : M. Milet
- Agent municipal : M. Gérome
- Garagiste : M. Tudord

	Nom	Justification
1		
2		
3		
4		
5		

Figure 3.11. Nature, pacing, and purpose of data collected during Pilot Study #2.

Steps in research activity	Timing of data production	Types of data collected	Recording formats	Nature of data	Rationale for collection
Phase 1	Day before task implementation	Doc.	Actual document	Initial and individual rankings of characters in the story	Gaining insight into the starting point of the collective consensus-building process by looking at where each student in a group was standing individually and initially
	Day before task implementation	Doc.	Scanned copy	Individual students' annotations on supporting text	Providing insight into the meaning-making process, as experienced by students individually and initially
Phase 2	On day of task	Obs.	Audio- and video-recorded	Observations of 4 focus-groups' students' interactions	By which discursive processes do students reach a collective consensus when collectively negotiating for meaning?
	On day of task	Doc.	Actual document	Final and collective rankings of characters in the story of each focus-group	Gaining insight into the end point of the collective consensus-building process by looking at where each group was standing and allowing comparison with the initial individual rankings
Phase 3	Within 24 hours of task completion	Int.	Audio-recorded	5 Interviews of students (3 individual interviews, 2 group-interviews, 7 students total, at least one student from each group)	How do these students experience and perceive their individual role and contribution in the consensus-building process? How do they conceive "thinking in French?"

Note. Doc = documents / Obs = Observational data / Int = Interviews

individually and initially. Third, each group's collective ranking chart, as created by the group at the end of the consensus-building, was collected to allow for a comparison of students' initial positions with their respective group's final collective decision-making outcome. Each group of students was audio- and video-recorded during their collective discussion of the case, allowing for the collection of four observational data sets intended to provide and re-construct the broader interactional context surrounding students' verbal interactions.

Finally, students from each group were invited to take part in a post-task interview. These interviews were intended to explore how students had experienced and perceived their individual role and contribution in the consensus-building process, as well as how they conceived the idea of thinking in French. Seven students were willing to participate, with at least one student from each group. Since one of the purposes of these interviews was to practice the interview procedure, it was decided that students would choose to be interviewed either on a one-on-one basis or with any other member from their group. Based on students' decision, the round of interviews ended up comprising three individual interviews and two collective interviews (each collective interview comprising 2 students at a time). All interviews were audio-recorded.

Outcomes of Pilot Study #2

Several types of results obtained through the analysis of the data collected during Pilot Study #2 were relevant to the present study's design: results related to (1) participant selection and group formation, (2) the research instruments, and (3) the variables of study.

First, findings relevant to participant selection concerned students' level of proficiency. Students participating in Pilot Study #2 ranked from Intermediate-mid to Advanced-Low in their language proficiency. The transcripts of their interactions indicated that Advanced-Low students easily reached higher levels of critical thinking,

thus being very moderately challenged by the problem-based task. Intermediate-Mid students, in comparison, appeared to be adequately challenged by the task. The decision was thus made that Intermediate-Mid would be the preferred level of proficiency at which participants in the present study would be selected. Moreover, results indicated that the optimal number of students in a collaborative group was five, four being an adequate number, while three was found to be insufficient. The decision was thus made for the present study to favor the formation of groups of five students, with a tolerance for groups of four students.

Second, findings relevant to research instruments concerned first the use of observational data obtained through video recordings. This specific data source was found to be highly valuable to recontextualize students' verbal interactions' transcripts. It was thus decided that the main study should use video recordings as a complementary data source. Since the main study was intended to involve computer-mediated interactions, it was decided that on-screen video recordings, capturing students' online interactions, would be an optimal research instrument. Moreover, the interview procedure from Pilot Study #2 showed that a supplementary dynamic was developing in the course of collective interviews. It was thus found that collective interviews might negatively impact of the validity of the data intended to be collected through interview (i.e. the student's individual perceptions). It was consequently decided that the interview procedure for the main study would be conducted on a one-on-one basis. Finally, the interview protocol used during Pilot Study #2 revealed two emerging themes of interest: on the one hand, the perceived power relationship and power status impacting the consensus-building process, and expressed by students, and, on the other hand, the way students described and explained how they thought and/or experienced the way thinking in French functioned for them. Both themes were found to have deep relevance in the study of L2 negotiation of meaning as a mark of critical thinking ability. The decision

was thus made to further these two specific trends (power and conception of thinking in the L2) in the interview protocol developed for the main study.

Finally, results relevant to the variables under study concerned the transcripts of students' verbal interactions. These transcripts provided a valuable insight into the negotiation of meaning events that happened in each group, notably about how they became more and more complex and intricate as the group's discourse was revolving on itself, leading to higher levels of critical thinking, such as hypotheses generating. These findings corroborated the need to look at these negotiation of meaning events in terms of collective discursive patterns.

Based on the outcome of these two pilot studies, specific research design principles were adopted for the present study, anchored in a mixed methodology, and related to participant selection, data collection, research instruments, and data analysis. We will now present these design principles and their purpose in helping to answer the two research questions that structured this research.

Data collection procedure by phases

Figure 3.12 is a summary of the procedure and components of the data collection process for by phase of this study.

Phase 1: Participant selection

Phase 1 of this study started in March 2011. Its main purpose was to collect data intended to inform the selection of participants, as well as to further this selection by allowing for the formation of collaborative groups of students, necessary for Phase 2 of this study, and for the selection among these of a focal group, whose results are the object of this study. Finally, Phase 1 was intended to allow drawing the profile of each of the students, selected in the focal group.

Phase 1 permitted to collect data from two different sources:

- Observational field-notes of all the students pre-selected for the study, particularly

Figure 3.12. Phases and components of the data collection procedure.

Phases of data collection	Timing of data production	Length of data production	Format of data collected	Nature of data	Purpose of data set	Use in research questions
PHASE 1: PARTICIPANT SELECTION	2 months before intervention	12 sessions for each of the two classes over a 7-week period	Observations <i>Typed field-notes</i>	qual 12 sets of observations for both Intermediate French II classes selected	<ul style="list-style-type: none"> - Group formation for the curricular intervention - Participant selection to form a focal group - Evaluating participants attendance, preparedness, social rapport, engagement, and ease in French in their unmodified learning setting 	N/A
	Formation and selection of the focal group					
	1 week before intervention	1 session for each participant	Interview #1 <i>Audio-recorded</i>	QUAL Individual interview of the 5 focal group students	Students' <ul style="list-style-type: none"> - academic and informal background about learning style, L2 learning and prior knowledge - attitudes, habits, and expectations towards the use of technology for learning purposes 	RQ#2

Figure 3.12. Continuation

Phases of data collection	Timing of data production	Length of data production	Format of data collected	Nature of data collected	Purpose of data set	Use in research questions
PHASE 2: CURRICULAR INTERVENTION	During intervention	10 days of intervention	Screen captures <i>On-screen video recordings</i>	qual Observations of each focal group student's daily interactions	Full recontextualization of students' discourse and social interactions in the VLE	RQ#1 RQ#2
	During intervention	10 days of intervention	Documents <i>Computer-generated logs of students' Detective Notebook</i>	qual Focal group students' individual daily notes	Students' individual dissonances	RQ#1 RQ#2
	During intervention <i>Day 2 - Day 9</i>	8 days of collective interactions during intervention	Discourse <i>Computer-generated logs of students' chat</i>	QUAL → QUAN Focal group students' collective discourse	Students' collective discourse	RQ#1
	Half-way through intervention <i>Day 6 - Day 8</i>	1 session for each participant	Interview #2 <i>Audio-recorded</i>	QUAL Individual interview of the 5 focal group students	Students' first impressions and experiences about: - the VLE and the avatars - the L2 negotiation of meaning process	RQ#2

Figure 3.12. Continuation

Phases of data collection	Timing of data production	Length of data production	Format of data collected	Nature of data collected	Purpose of data set	Use in research questions
PHASE 3: POST-INTERVENTION	Within 1 week of the end of intervention	1 session for each participant	Interview #3 <i>Audio-recorded</i>	QUAL Individual interview of the 5 focal group students	Students': - overall conclusions and appreciations of the intervention - reflective and retrospective opinions of the collective L2 negotiation of meaning process perceptions of the impact of the problem-based VLE on their L2 negotiation of meaning process	RQ#2

targeting their social interactions and engagement in the French class, in unmodified teaching and learning conditions, as word-processed files typed by the researcher-observer.

- Semi-structured interviews of students from the focal group, as audio files recorded with an audio voice-recorder. These audio-recordings were later transcribed verbatim.

Setting for selection of participants

Two classes of Intermediate-Mid French learners

Based on the outcomes of Pilot Study #1 and Pilot Study #2, participants for this study were L2 French learners selected among two Intermediate French II classes. This selection was done in a purposeful manner, that is to say “based on a specific purpose rather than randomly” (Tashakkori & Teddlie, 2003, p.713). Two purposes guided this selection.

First, a practical purpose guided the selection of clustered students in pre-existing classes, rather than isolated individual students, with the need for research that is able to inform the daily L2 classroom by taking into account its intrinsic social dynamic and its near homogeneity of learners’ proficiency in the target language. It was thus important that the students selected for this study had already shared time and work together, in the reality of a class where they met on a daily basis, so that the results from this study could be in direct relation to and of direct practical interest for the L2 practitioner.

Second, a purpose of “representativeness” (Teddlie & Yu, 2007) also dictated the selection of Intermediate French II learners, based on Pilot Study #1 and #2 outcomes, which indicated the need to target a population of students exhibiting on average an Intermediate-Mid level of proficiency in reading and writing abilities (the two skills relevant for this study), as indicated by and as defined by ACTFL Proficiency Guidelines (1999; 2001) (see Figure 3.13). The Intermediate-Mid level of language proficiency was

Figure 3.13. Reading and writing language proficiency displayed by participants in the study.

Skill	Description
Reading (1999) Intermediate-Mid	<p>Able to read consistently with increased understanding simple connected texts dealing with a variety of basic and social needs. Such texts are still linguistically noncomplex and have a clear underlying internal structure. They impart basic information about which the reader has to make minimal suppositions and to which the reader brings personal interest and/or knowledge. Examples may include short, straightforward descriptions of persons, places, and things written for a wide audience.</p>
Writing (2001) Intermediate-Mid	<p>Writers at the Intermediate-Mid level are able to meet a number of practical writing needs. They can write short, simple communications, compositions, descriptions, and requests for information in loosely connected texts that are based on personal preferences, daily routines, common events, and other topics related to personal experiences and immediate surroundings. Most writing is framed in present time, with inconsistent references to other time frames. The writing style closely resembles the grammar and lexicon of oral discourse. Writers at the Intermediate-Mid level show evidence of control of syntax in non-complex sentences and in basic verb forms, and they may demonstrate some ability to use grammatical and stylistic cohesive elements. This writing is best defined as a collection of discrete sentences and/or questions loosely strung together; there is little evidence of deliberate organization. Writers at the Intermediate-Mid level pay only sporadic attention to the reader of their texts; they focus their energies on the production of the writing rather than on the reception the text will receive. When Intermediate-Mid writers attempt Advanced-level writing tasks, the quality and/or quantity of their writing declines and the message may be unclear. Intermediate-Mid writers can be understood readily by natives used to the writing of non-natives.</p>

Note. From ACTFL Proficiency Guidelines (1999; 2001).

determined to be the optimal level of proficiency for this study's focus on L2 critical thinking and problem solving skills. At this level, participants have already acquired enough functional skills in the language to be able to function at the discourse-level of the specific problem-based task underlying the curricular intervention, rather than on a word-level decoding and encoding process or on linguistic forms alone. Conversely, students at the Intermediate-Mid level were also chosen so that the opportunity of being challenged to employ L2 critical thinking and problem solving skills was possible. Of particular interest for this sampling criterion was the following statement from the ACTFL Proficiency guideline (2001): "Writers at the Intermediate-Mid level pay only sporadic attention to the reader of their texts; they focus their energies on the production of the writing rather than on the reception the text will receive". Given the highly social and interactive nature of L2 negotiation of meaning, selecting students at this precise level of writing proficiency meant that their L2 critical thinking and problem solving skills had probably not been fully acquired, but that the possibility for their development was potentially attainable as the next step in their language acquisition process.

In other words, the selection of participants at an Intermediate-Mid level of proficiency was done purposefully to provide an optimal window of language abilities to meet the present study's objectives. This specific level provided access to participants who had already acquired enough functionality in the language to be able to work at the discourse-level and to start engaging in higher levels of L2 critical thinking and discourse, while allowing for the likelihood that their L2 critical thinking and problem solving skills had not been acquired, and the consequent possibility to gauge their potential for developing these skills.

Demographic information for all pre-selected participants in the study.

The pre-selected pool of participants for this study were 27 students of French enrolled in two different sections of an Intermediate French II course in the Department of French and Italian at a Midwestern university (N = 27). Table 3.1 is a summary of their demographic information.

Table 3.1. Summary of demographic information on all participants in the study.

	Morning class	Afternoon class	TOTAL
Male participants	5	7	12
Female participants	9	6	15
TOTAL	14	13	27
Instructor	Female NNS	Male NS	

Both sections of this Intermediate French II course were following the same curriculum at a similar pace. All students in both classes gave their approval to participate in the study. Fourteen of these participants belonged to a morning class, while the other thirteen belonged to an afternoon class. In the morning class, out of the fourteen students participating in the study, nine were female students and five were male students. In the afternoon class, out of the thirteen students participating in the study, six were female students and seven were male students. Consequently, the overall study comprised fifteen female students and twelve male students. Each of these two classes had a different instructor: the morning class instructor was a female non-native speaker of French, whereas the afternoon class instructor was a male native speaker of French.

Selection of participants to form the focal group

Overview of sampling procedure

As discussed earlier, the present study relied on the implementation of a curricular intervention in which all 27 participants, gathered in collaborative groups, took part. A methodological decision was made to narrow the scope of this study to one of these collaborative groups. In order to select this focal group, a sampling procedure was thus conducted within the pool of 27 pre-selected participants, based on the observational data collected at Phase 1, under the students' unmodified teaching and learning conditions.

Phase 1 first data collection component consisted of bi-weekly observations, conducted over a seven-week period with the two pre-selected Intermediate French II classes, under unmodified curricular teaching and learning conditions. The purpose of these observations was two-fold: first, to allow for the formation of the collaborative groups of students around which the problem-based activity structuring the curricular intervention was going to be organized and, second, to allow for the selection of one of these groups as the focal group.

It is important to note that the collection of Phase 1 observational data intended to guide the participant selection, as well as the collection of interview responses at Phases 1, 2, and 3, emanated from a more subjective research instrument, namely the researcher herself. It is thus imperative to understand her position towards the research project and the research participants to be able to evaluate her trustworthiness as a research instrument. For that purpose, Figure 3.14 corresponds to the researcher's positioning statement.

Observations' settings at Phase 1

The bi-weekly observations were scheduled to happen randomly, that is to say on any randomly selected day of the week, in order to limit capturing skewed phenomena or

Figure 3.14. Researcher's positioning statement

“Although my position in the present study was first and foremost one of researcher, it is important for me to make explicit the multiple roles I have been playing during the research process, so as to acknowledge possible biases and ensure trustworthiness during the time when I become a research instrument. It is thus important to first acknowledge that I was the main designer of both the *Un Meurtre à Cinet* activity and its technological platforms (*Cinet Second Life* and the multimedia *Detective Notebook*). That being said, the present study in general, and the interviews in particular, are not intended to serve as a beta test for the above mentioned products.

Furthermore, it is important for me to acknowledge that I used to be professionally affiliated with the Department that will serve as the research site for the present study, and that I have kept both professional and sometimes friendly rapport with some of the collaborators to the project, namely some of the instructors that were in charge of implementing, teaching, and assessing the *Un Meurtre à Cinet* activity. This past affiliation and present rapport undoubtedly helped me gain access to the research site and to potential research subjects. That being said, it is important to note that I am no longer professionally affiliated with the above mentioned Department, that I am not, in any way, related to the actual research participants (i.e. the students), and that I did not have any teaching or assessing function towards them. Moreover, the interviews, although consecutive to and intertwined with the *Un Meurtre à Cinet* activity, remained confidential and did not serve as an assessment instrument for the instructors.

Despite the fact that I was not related to the research participants, I did develop a good rapport with them, due to my presence in their classroom before and during the data collection process. Establishing this rapport was neither a strong objective in the research study, nor was it actively avoided, since it helped students to consider me as a member of the class rather than a visitor. That rapport developed in such a manner that research participants would not exclusively consider me as a researcher, but probably also as their instructor's co-worker (even if I was not), due to the fact that I used to be a French instructor and that I am a native French speaker. They also considered me as a technical support person during the time of the study in the computer lab.

I was thus necessarily a participant observer, endorsed with a multiplicity of roles, but only served as a research instrument during the phases of interviews, happening consecutively to, but independently from the other data collection procedures. Trustworthiness during interviews was ensured by following an interview protocol, which had been reviewed and commented by my peers and by faculty members, to ensure validity and to avoid any threatening or leading questions.”

events related to the specificity of any given day. A decision was made to conduct two observations per week for each class, out of the four-day week schedule of these French classes, to find a balance between collecting enough information to reach saturation and avoiding imposition due to the presence of the researcher.

The observations were operationalized as open field-notes taken by the researcher on her laptop over a window of time covering 10 minutes before the official beginning of class, the entire 50 minutes when class was in session, and 5 minutes after the official end of class. This window of observation time covering a pre-class and a post-class moment was chosen in order to capture as many social phenomena and interactions happening amongst students as possible. Consequently, the field-notes taken for each class observation involved different social settings in which students were interacting with each other within the context of their French course:

- the hallway before class started, where students were waiting when they arrived early
- the classroom, once its previous occupants had vacated, but before the French instructor arrived, where students would get set up and would keep waiting for the class to start
- the classroom, once the instructor had arrived, but before the class started
- the classroom, in session
- the classroom, at the end of class, while the instructor was still present
- the classroom, at the end of class, once the instructor had left the room
- the hallway, at the end of class, where students would sometimes still maintain a conversation amongst themselves.

Furthermore, based on the assumption that students would tend to routinely choose to sit at the same place every day, the researcher-observer purposefully selected different posts of observation in the classroom, from one day of observation to the next, to promote both the variety and the objectivity of the observations conducted, since she

could not move around the classroom when the class was in session. This change in posts of observation was a preemptive measure aiming at preventing the over- or, inversely, under-representation of certain students in the overall collection of field-notes, due to their physical proximity or distance from the point of observation.

Observations' procedure at Phase 1 of the study

The bi-weekly observations conducted at Phase 1 of this study during a seven-week period in both pre-selected Intermediate French II classes and before Phase 2 (the implementation of an curricular intervention) aimed at establishing a portrait of each class as a social organism, by looking at both the class, as a whole, and at its students, as individual components of this whole. With representativeness criteria in mind, the objective resulting from such portrait was to be able to form groups within each class that could be representative of these revealed social and educational characteristics. For that purpose, although the instructors were irremovable parts of the social organism under study, the focus was first and foremost put on the students and the dynamic that existed amongst them. In other words, the object under observation was the students and how they functioned with each other, not the instructor in his/her relation to the students.

The observations were at the same time inductive in nature, and thus open to the emergence of any unexpected phenomenon or event, and guided by purposeful themes that were deemed to be crucial to meet the objectives that these observations were intended to serve (i.e. the formation of representative groups and the selection of a focal group). Moreover, as both the guiding and the emerging themes were arising in the structure of the observational data being collected, daily tentative group formations were established for each class. At the end of the seven-week period of observations, the complete list of tentative group formations for each class was compiled, in order to determine which combinations of students into groups was most frequently repeated, and if these recurrent combinations were consistent with the overall narratives from the field

notes. In other words, the compiling of tentative combinations of students to determine the most frequent combinations was compared with the field notes narratives, and both were triangulated in order to establish a final list of groups. It is also important to note that the gender distribution of students in each class was another parameter that guided the formation of these groups. Each final group thus entailed a male/female ratio which was representative of the one found in each class.

Formation of collaborative groups and selection of a focal group

Three groups were thus formed in each class, each one composed of either four or five students. Consequently, the fourteen students from the morning class were distributed into one group of four and two groups of five students, while the thirteen students from the afternoon class were distributed into two groups of four and one group of five students. Based on the formation of these groups, the selection of a focal group was undertaken. The first criterion for this selection consisted of favoring a group belonging to the morning rather than the afternoon class, due to the high level of absenteeism observed in the afternoon class with students spread in all three groups. The scope of selection for the focal group was thus narrowed to the three groups from the morning class.

Furthermore, one of the three groups in each class was assigned a specific role to play within the problem-based activity structuring the curricular intervention to come (students from this group were intended to play the role of guilty characters in the murder mystery activity, and would thus have to accomplish a task that was somewhat different from what the other two groups, representing innocent characters, would have to accomplish during this same activity). To avoid skewing the patterns of L2 negotiation and co-construction of meaning during the curricular intervention, it was considered to be more appropriate to select a group whose task would not entail any need to resort to

deception in the L2, as could potentially be the case with the group representing the guilty characters in the story. The scope of selection for the focal group was thus narrowed to two groups from the morning class, each one composed of five students, and each one having a similar gender distribution.

All 10 students from both groups were thus contacted to determine whether they would be willing to be the subjects of a data collection procedure that would more closely focus on them, notably through interviews, designed to take place before, during, and after the curricular intervention. Only one approval was received from students in one of the two groups, while all five students from the other group agreed to participate in this data collection procedure. It is consequently this last group which was selected as the focal group, whose data are the specific object of the present study.

Interview #1: first part of RQ#2 primary data set

Setting and purpose of Interview #1

During Phase 1 of this study, after the focal group was selected, a first round of semi-structured interviews was conducted with all five students in that group. Interview #1 was the first of a series of three rounds of semi-structured interviews taking place before, during, and after the curricular intervention, and consisting of the primary data set intended to address RQ#2. The research instrument for all three rounds of interviews was the researcher herself. Trustworthiness during these interviews was promoted by following an interview protocol, which emanated from the outcomes of Pilot Study #2, and was reviewed and commented by peers beforehand, to ensure validity and to avoid any threatening or leading questions (see Appendix A for Interview #1 protocol). All three rounds of interviews took place in the researcher's office, were conducted in the students' L1 (i.e. in English), were audio-recorded with students' consent, and were later transcribed verbatim.

The purpose of Interview #1 was to contribute to answer RQ#2 by permitting to establish students' profile, as an initial point of reference allowing further comparisons with subsequent interviews. More specifically, it first aimed at obtaining the focal group students' academic and informal background, as related to their L2 learning, their general learning style, and their prior knowledge. Second, it was meant to unveil their background, attitude, and habits towards the use of technology in life and for L2 learning purposes, notably to gauge their pre-conceived apprehensions or expectations regarding the curricular intervention to come, as related to its technological aspect. Interview #1 was took place in the researcher's office, within a week prior to the implementation of the curricular intervention, with one-on-one interviews intended to last approximately 20 minutes. The final recordings obtained during Interview #1 ranged from 15 minutes to 45 minutes in length, depending on how much each interviewee wanted to share.

Focal group students' demographic information and language background

Data collected through the first round of semi-structured interviews allowed to establish the focal group students' demographic profile and language background. This focal group was composed of 3 female students (Charlotte, Jacqueline, and Florence), and 2 male students (Bernard and Daniel). Students' age in the focal group ranged from 18 to 24 years old. None of these students had majored or minored in French at the time the study took place.

Out of the five students, three were native speakers of English (Charlotte, Jacqueline, and Bernard). For the other two students (Daniel and Florence), English was not a native language. Daniel was a native speaker of Haitian Creole, while Florence was a native speaker of Spanish. Nevertheless, they both considered that English was their most proficient language, and thus considered it to be their L1 (i.e. the language that spoke most commonly in their daily life). All five students from the focal group had had

experience learning at least one other foreign or second language, before learning French. The three native speakers of English (Charlotte, Jacqueline, and Bernard) all had an experience learning Spanish, either in middle school or in high school, and for at least two years, before they started learning French. Daniel's first experience learning a second language was when he started Kindergarten and learned English as a second language. Finally, Florence's experiences learning a foreign or second language were very diverse, and included her learning Italian for two years in Kindergarten as she was living in Italy, then learning English as a second language upon arriving in the United States as a child, and finally learning German for a year in high school.

More specifically related to learning French, three of the focal group students only started in College (Jacqueline, Bernard, and Florence). Charlotte started in high school and learned French for two years, before she interrupted it, and resumed it in College. Daniel, on the other hand, had the most extensive experience learning French, as he started early and informally as a child, through communicating with some of his French-speaking relatives from Haiti. He pursued his French learning in a more formal context in high school for two years, before interrupting his classes, and resuming in College. Finally, he also mentioned that his experience with French included attending a French-speaking church. Regarding their access to the Intermediate French II class, Charlotte, Jacqueline, and Bernard attained this level after four uninterrupted semesters of French, while Daniel and Florence reached this level in three semesters.

In terms of personal goals for learning French, all five students mentioned that reaching oral fluency in the language was an important objective in learning the language. Only Charlotte also mentioned the ability to fluently read in French as a learning goal. Except for Jacqueline, who displayed a clear instrumental motivation in her learning of French, mentioning the need for her to complete her foreign language requirement to graduate, and relating her desire to reach oral fluency with her need to enrich her professional profile, all other students had a more integrative motivation for

reaching oral fluency, with a will to enhance their connection with French speaking communities, by being able to better communicate with French speakers. Daniel even mentioned personal stakes in this goal, saying that he wanted to be able to better understand his own French-speaking relatives. Bernard, on the other hand, was the only one explicitly mentioning that reaching fluency in French was a life-long learning objective, as he was also the only student with a concrete plan to spend time in France during the following semester, via a one-semester study abroad program.

Figure 3.15 is a summary of the focal group students' profile and foreign/second language background.

Phase 2: Curricular intervention

Phase 2 of this study started mid-April 2011 and ended early-May 2011. It was organized around the problem-based activity that served as the curricular intervention, as administered to all selected students, but centered on the focal group, and relying on the use of the VLE. The intervention per se lasted over a 2.5-week period of time, corresponding in practice to 10 sessions of activity, since the classes met four times a week. It took place in a computer lab, hosting all the technology required both for the problem-based activity and for the data collection procedure. The computer lab thus granted access to one individual computer per student, and encompassed all the necessary tools for the data collection procedure. Between Day 6 and Day 8 of the 10-day problem-based activity, the second round of interviews was also administered in the researcher's office to students from the focal group.

Phase 2 permitted to collect data from four different sources:

- Daily computer-generated logs of students' collective chat of all participants, particularly targeting students from the focal group, as word-processed files recorded by the *Cinet Second Life* platform
- Daily computer-generated logs of students' individual notes of all participants,

Figure 3.15. Focal group students' demographic profile and language background.

	Gender	Native language	French is their	Other foreign languages learned	Context for learning French	Personal goals in learning French
Charlotte	F	English	L3	Spanish (2 years in middle school)	<ul style="list-style-type: none"> • Started in high-school (2 years) → interruption • Resumed in College → 4 semesters of French 	<ul style="list-style-type: none"> • Living in Paris one day • Being able to comfortably interact orally with French speakers • Being able to read it
Jacqueline	F	English	L3	Spanish (2 years in high school)	<ul style="list-style-type: none"> • Started in College → 4 semesters of French 	<ul style="list-style-type: none"> • Completing her foreign language requirement in College • Reaching some fluency to enhance her marketability
Bernard	M	English	L3	Spanish (3 years in high school)	<ul style="list-style-type: none"> • Started in College → 4 semesters of French 	<ul style="list-style-type: none"> • Becoming fluent in the language through life-long learning of French • Working with non-profit organizations in French-speaking countries • Going to France for one semester
Daniel	M	Haitian Creole	L3	English (ESL)	<ul style="list-style-type: none"> • Started learning informally with relatives • Formal learning in high-school (2 years) → interruption • Resumed in College → 3 semesters • Attend a French-speaking church 	<ul style="list-style-type: none"> • Being able to converse in French with relatives • Being able to use French wherever he goes and whatever he chooses to do in life • Being able to live and share with people in French speaking countries
Florence	F	Spanish	L5	<ul style="list-style-type: none"> • Italian (2 years in pre-school) • English (ESL) • German (1 year in high school) 	<ul style="list-style-type: none"> • Started in College → 3 semesters of French 	<ul style="list-style-type: none"> • Becoming fluent in French

particularly targeting students from the focal group, as word-processed files recorded by the multimedia *Detective Notebook*

- On-screen video recordings of several participants, particularly targeting students from the focal group, as video files recorded by the *Camtasia* software. These video-recordings were later transcribed verbatim.
- Semi-structured interviews of students from the focal group, as audio files recorded with an audio voice-recorder. These audio-recordings were later transcribed verbatim.

We will now describe the different data sets obtained through these four different data sources, in terms of their weight (primary or secondary) and purpose to address RQ#1 and RQ#2.

Collection of primary data sets

Primary data set for RQ#1

As prompted by RQ#1, it was necessary to gain access into the L2 discourse produced collectively by students in the focal group in order to assess the nature of this discourse in terms of discursive patterns of L2 negotiation and co-construction of meaning, as happening during the problem-based activity. For that purpose, the computer-generated logs of students' verbal interactions (i.e. their daily chat), as recorded by the *Cinet Second Life* platform, served as the primary data set, collected to answer RQ#1. Vandergriff & Fuchs (2009) noted the importance of a reliability of transcription of informal data and the need to use a systematic method of transcription for research, advocating for the use of computer-generated logs from students to allow for objective and complete transcripts. For that matter, as well as for matters of manageability of large amounts of data, computer-generated logs are readily and reliable tools that allow the incursion into students' communication and learning process (Garrison et al., 2006; Rourke et al., 2001).

Interview #2: second part of RQ#2 primary data set

As prompted by RQ#2, it was necessary to gain access into students' individual perceptions and experiences of the impact of the problem-based VLE on their collective process of L2 negotiation and co-construction of meaning. For that purpose, the second round of semi-structured interviews was intended to serve as the second part of the primary data set used to address RQ#2. It was collected to gain access into the focal group students' in medias res perceptions half-way through the curricular intervention, that is to say at a time when they would be already accustomed to all aspects of this intervention, yet at a point where they would still be closely involved in it .

Two objectives guided the interview protocol utilized during Interview #2 (see Appendix B for Interview #2 protocol). First, it aimed at capturing students' first impressions and experiences about the VLE, particularly related to how they felt the use of an avatar impacted their group dynamic and interactions, as well as their learning. Second, it was intended to capture their first impressions and experiences about the L2 negotiation of meaning process, more precisely regarding what they felt their function in the group was, as well as the social dynamic they perceived in specific moments, such as moments of agreement or disagreement.

Interview #2 was thus scheduled to take place half-way through the curricular intervention, with one-on-one interviews intended to last approximately 30 minutes. The final recordings obtained during Interview #2 ranged from 13 minutes to 32 minutes in length, depending on how much each interviewee wanted to share.

Collection of secondary data sets

Two supplementary data sets were collected at Phase 2 of this study. These two data sets were intended to serve a secondary function in addressing both RQ#1 and RQ#2.

First, on-screen video recordings of the students' online interactions during the problem-based activity in the VLE were collected, and later transcribed descriptively. As related to RQ#1, and as indicated by the outcomes of the two pilot studies, it was determined that a need existed to complement the analysis of students' discourse, as gathered in the computer-generated logs of their daily chat, with data allowing to further reconstruct the context of their interactions, to as to fully understand each student's intentions in the collective discourse under investigation. It is thus this recontextualization purpose that this secondary data set was intended to serve to address RQ#1. Furthermore, these on-screen video recordings were also intended to serve a comparative function in addressing RQ#2. For that purpose, they aimed at complementing the analysis of the inherently subjective accounts by the focal group students of their perceived impact of the problem-based VLE on their L2 negotiation and co-construction of meaning process through their comparison with a more objective account of the interactional events students referred to during Interview #2 and #3.

Second, the computer-generated logs of students' individual notes, taken in their *Detective Notebook*, were also collected as a secondary data set. As related to RQ#1, this data set was considered to be crucial to gain further access into the more individual aspect of the otherwise collective process of L2 negotiation and co-construction of meaning under scrutiny. As related to RQ#2, and in the interest of richness of data allowing the support of an integrative view of the treatment of RQ#2, it appeared expedient to complement the information gained through interviews by also relying upon students' individual notes, as documents created by the students themselves.

Phase 3: Post-intervention

Phase 3 of this study took place mid-May 2011, within a week after the end of the curricular intervention and after students had completed the problem-based task in the VLE. Phase 3 permitted to collect data from one source: semi-structured interviews of

students from the focal group, as audio files recorded with an audio voice-recorder. These audio-recordings were later transcribed verbatim.

Interview #3: third part of RQ#2 primary data set

As prompted by RQ#2, it was necessary to gain access into students' individual perceptions and experiences of the impact of the problem-based VLE on their collective process of L2 negotiation and co-construction of meaning. For that purpose, the third round of semi-structured interviews was intended to serve as the third part of the primary data set used to address RQ#2. It was collected to gain access into the focal group students' retrospective and reflective perceptions.

Three purposes guided the interview protocol utilized for this round (see Appendix C for Interview #3 protocol). First, it aimed at obtaining students' overall conclusions and appreciations about the curricular intervention, gathering voluntarily impressionistic accounts of what they liked and disliked about it. Second, it aimed at exploring their reflective and retrospective opinions about their collective process of L2 negotiation and co-construction of meaning, mainly regarding the consensus-building phase of the activity. Students were thus asked about the perceived ease or difficulty of different aspects of the consensus-building experience in French, and how they felt they were thinking in French at that point, as well as to reflect upon the role and function they felt they and their group members had played over the ten-day activity. Finally, the interview protocol was intended to capture their opinions explicitly regarding the perceived impact of the virtual learning environment on the process of L2 negotiation and co-construction of meaning, notably by reflecting on their previous and current considerations on the use of an avatar, as well as on the immersive aspect of the VLE.

Interview #3 was thus scheduled to take place after the curricular intervention, with one-on-one interviews intended to last approximately 30 minutes. The final

recordings obtained during Interview #3 ranged from 22 minutes to 75 minutes in length, depending on how much each interviewee wanted to share.

Data analysis procedure by research questions

Research Question #1

The first objective of this study was to empirically and deductively assess the nature of the collective L2 process of negotiation and co-construction of meaning, and its potential discursive patterns, as displayed by Intermediate-Mid learners of French, immersed in a problem-based VLE, in order to inform a research on L2 learners' critical thinking and problem solving skills. This objective corresponds to RQ#1:

RQ#1: Do significant patterns of L2 negotiation and co-construction of meaning exist in the discourse produced collectively by a group of Intermediate French II college-level learners working collaboratively to solve a complex problem and as they are immersed in a virtual learning environment? If so, what is the nature of these patterns and what do they reveal in terms of these learners' L2 critical thinking and problem solving skills?

For that purpose, the analysis of data collected to address RQ#1 was oriented towards a form of discourse analysis, where students' collective discourse was intended to be treated in a quantified verbal analysis. In that perspective, RQ#1 primary data set, corresponding to the focal group's discourse, and which was inherently verbal, underwent a data transformation procedure to be quantified. For that purpose, this discourse was first segmented into units of analysis corresponding to units of meaning (Strijbos et al., 2006), then transformed through coding according to a framework of analysis called the Interaction Analysis Model (Gunawardena et al., 1997; 1998; 2000; 2006; Hull & Saxon, 2009; Jeong, 2003; 2005), and finally statistically analyzed to determine if it contained significant discursive patterns related to critical thinking abilities for the study of L2 negotiation and co-construction of meaning (Jeong, 2003; 2005).

We will now discuss in details what each of these steps in the analysis procedures entailed.

Unit of analysis and segmentation procedure

Research on quantified verbal analysis showed that selecting an appropriate unit of analysis on which to base the segmentation and coding procedures of data for quantitative data transformation was highly critical for the validity and the reliability of the content analysis procedure, but also a very difficult endeavor (Chi, 1997; Hull & Saxon, 2009; Jeong, 2003; Krippendorff, 2004; Rourke & Anderson, 2004; Strijbos, 2006). What was at stake was “to select the empirically most meaningful and informative units that are not only efficiently and reliably identifiable but also well suited to the requirements of available analytical techniques” (Krippendorff, 2004, p.110). Rourke & Anderson (2004) warned that “assessing the surface characteristics of a written [text] (...) and measuring the cognitive processes that underlie [this text] are two different things” (p.7). What RQ#1 intended to investigate was the latent content of the computer-generated logs of students’ discourse. Based on Rourke et al.’s (2001) theoretical recommendations on the selection of a unit of analysis for content analysis, as well as on Jeong’s (2003) study, “units of meaning” (Henri, 1992) were selected as the units of analysis used to code the computer-generated logs of students’ collective discourse standing at the heart of RQ#1.

Nevertheless, Strijbos et al. (2006) pointed out the ambiguity and lack of clear definition of such unit of analysis as “unit of meaning” in the literature, often leading to coding issues threatening reliability of the content analysis procedure due to “unit boundary overlap” (p.34). Strijbos et al.(2006) tested and recommended two important procedural activities to reach reliability in quantitative content analysis. First, they recommended that segmentation and coding be two separate and independent procedures, in order to increase inter-rater reliability. Second, they suggested and tested an alternative

definition of “unit of meaning”, which also took into consideration the genre specificity of online chats. Strijbos et al. (2006) alternatively defined “unit of meaning” as “a sentence or part of a compound sentence that can be regarded as meaningful in itself, regardless of the meaning of the coding categories” (p.37). It was thus decided for the present study that RQ#1 primary data set would be segmented by units of meaning, according to Strijbos et al.’s (2006) segmentation procedure, and independently from the subsequent coding procedure. Figure 3.16 is a reproduction of Strijbos et al.’s (2006) segmentation procedure, as used in this study.

Coding and data transformation procedure

The coding procedure at stake to address RQ#1 was critical, insomuch as it corresponded to the *triangulation* stage included within the *embedded* design of this study’s methodology (Creswell & Plano Clark, 2007). This procedure thus intended the integration of data through their triangulation, in order to allow for the primary data set (the computer-generated logs of students’ discourse), which was inherently qualitative in nature, to be transformed into a quantitative data set. Each unit of meaning in the focal group’s discourse, as previously segmented, was thus coded into one of seven possible levels of critical thinking ability, as presented and operationalized in Hull & Saxon’s (2009) revised version of Gunawardena et al’s (1997; 1998; 2000; 2006) Interaction Analysis (IA) model. Figure 3.17 is a complete transcription of the IA model, as it was used in the coding procedure of RQ#1 primary data set for its transformation.

Furthermore, two types of triangulation procedure were conducted, to ensure validity, credibility, trustworthiness, and reliability of the coding and data transformation procedure. First, a variety of data sources were used synergistically to complement and validate the coding procedure in a *source triangulation* (Janesick, 1994; Lincoln & Guba, 1985). RQ#1 secondary data set, composed of the on-screen video recordings of students’ interactions and of the computer-generated logs of their individual notes in the *Detective*

Figure 3.16. Segmentation procedure.

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1. Each message is first segmented in sentences by using a 'full stop', 'question mark' or 'exclamation mark' that the author of the message has written
 2. Each sentence that is followed by a 'full stop' constitutes a segment, regardless whether a 'finite form' or 'verb' is missing
 3. Each compound sentence is split in segments using punctuation signs and symbols or signs that are used for punctuation purposes
 - a. Comma
 - b. Semicolon
 - c. Colon
 - d. Brackets
 - e. The word 'and'
 - f. Dash
 - g. (...) or ...

Segmentation is always subject to the criterion that each part of that compound sentence can be regarded as a 'meaningful' sentence in itself (regardless of the coding categories).
 4. When determining whether a part of a compound sentence can be regarded as a 'meaningful' sentence in itself, the following rules apply
 - a. It is allowed to ignore the words that form the collocation
 - b. It is not allowed to add mentally a 'finite form' or 'verbs', if it has not been written.
 - c. It is not allowed to leave out words that are written
 - d. It is allowed to mentally rearrange the order of 'verbs' and 'finite form' to create a 'meaningful' sentence
 - e. In case parts of a compound sentence share a conditional relationship, those parts are not regarded as separate segments
 - f. Statements between brackets are often in a telegraphic style, and thus they are difficult to rearrange in a 'meaningful' sentence. If either the 'finite form' or 'verb' is missing, the statement between parentheses will be regarded as a separate segment. The statement is not regarded as a separate segment if both are missing
 - g. Citations and hyperlinks that are included in the message are segmented according to the previous rules and examples below (see point five of this procedure that addresses the handling of summations (including summations of hyperlinks))
 - h. If an abbreviation is used in the middle of a sentence, the sentence is not split after the 'full stop' at the end of that abbreviation
 - i. An introductory statement, two or three words, is not regarded as a separate segment (even if placed as such by the author) and is added to the next sentence that it introduces
 - j. An introductory sentence is regarded as a separate segment
 5. Segmentation of summations: textual and lists (or bullets)
 - a. If the majority of statements in a summation can be regarded as a 'meaningful' sentence in itself, each statement is treated as a separate segment
 - b. If the majority of statements in a summation can not be regarded as a 'meaningful' sentence in itself, all statements are treated as one segment
 - c. If half of the statements in a summation can be seen as a 'meaningful' sentence in itself, all statements are treated as a separate segment
 - d. In case the introductory sentence of a summation can be regarded as a 'meaningful' sentence in itself, this sentence is regarded as a separate segment. If not, this sentence is added to the first statement of the summation
 - e. If the main point in a summation is divided in sub points (e.g., 2.1, 2.2, etc.), then the above rules (see a, b, c) apply. An exception is the 'claw construction' in a summation: the main point and sub points comprise separate segments and the sentences in between can be regarded as a 'meaningful' sentence in itself. They are not directly part of the summation and thus behave as an appropriation in a summation
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Note. From Strijbos et al.'s (2006). Reproduced with Elsevier's authorization.

Figure 3.17. Operationalization of the coding procedure: Interaction Analysis model.

Code	Definitions	Indicators
1. Direct instruction(s) to the group	Initiating new activity for the group	<ul style="list-style-type: none"> a. statements that cause the group to undertake a discussion on a totally new subject b. statements that provide clarity to a previous instruction
2. Sharing new information	Information is provided that has not been previously discussed	<ul style="list-style-type: none"> a. a statement of observation or opinion b. a simple response to a question or instruction c. definition, description, or identification of a problem
3. Situated definition	Information is validated through a socially-shared, distributed consciousness	<ul style="list-style-type: none"> a. statements of agreement b. realization of agreement c. providing corroborating example(s) d. providing encouragement for a previously expressed idea e. basic questions of clarification
4. Intersubjectivity/dissonance	Inconsistency is discovered between a new observation and the learner's existing framework of knowledge.	<ul style="list-style-type: none"> a. identifying or stating areas of disagreement b. asking and answering questions c. restating someone else's position d. clarifying one's own position (without substantial changes to that position)
5. Negotiation/co-construction (semiotic mediation)	Higher mental functioning that attempts to bridge differences in situated definitions.	<ul style="list-style-type: none"> a. clarifying someone else's position b. re-proposing an idea previously provided to the group c. statement that appears new but that may contain elements from others
6. Testing tentative constructions	Testing new ideas developed through the course group	<ul style="list-style-type: none"> a. "what-if" questions/statements b. proposed behaviors that incorporate newly constructed ideas
7. Reporting application of newly constructed knowledge	Behavior is provoked by course discussions resulting in reports about activities in which a participant engaged	<ul style="list-style-type: none"> a. statements indicating that new ideas are being tried b. reports (successful or unsuccessful) of attempts to implement a new concept or idea

Note. From Hull & Saxon, 2009. Reproduced with Elsevier's authorization

Notebook, was used as a contextual support, allowing to reconstruct the complete interactional events surrounding the collective construction of the students' discourse at stake in the primary data set under transformation. This contextual reconstruction was intended to account for each student's intentions, so as to accurately code each unit of meaning in the collective discourse with one of the seven categories from the IA Model. For instance, if a student's utterance consisted of a simple "yes", at a point in the discourse where several threads of conversation were taking place (e.g. thread A and thread B), it was difficult yet crucial to determine what part of the conversation and which interlocutor(s) this student was manifesting his/her agreement towards (thread A or thread B? response to interlocutor X or interlocutor Y?). Using the on-screen video recordings of this student's interactions allowed to replace this "yes" into its global interactional context, and to discover that, for instance, s/he had started typing "yes" upon the specific reception of a interlocutor's X message from thread A, thus indicating that the manifested agreement was referring to interlocutor's X utterance within thread A in the discourse.

Second, several and different evaluators were involved in the coding procedure (namely, two coders) to validate the coding procedure in an *investigator triangulation* (Janesick, 1994; Lincoln & Guba, 1985). These coders were first in charge of independently coding the different units of meaning of this discourse, with the support of the on-screen video recordings of students' interactions, using the seven categories of Hull & Saxon's (2009) revised IA model. They would then compare their independent coding and discuss any non-congruent unit of meaning, until reaching an agreement on the code which should be applied for these units of meaning. During this phase of comparison, coders discussed, defended, and negotiated their own coding, until intersubjective agreement could be reached on each unit of meaning that had been found to be incongruently coded (Krippendorff, 2004). The discussion on each problematic unit of meaning was documented in memos (Richards, 2005), so that a trail of coding

decisions was built as a reference for further coding decisions, in order to guarantee consistency in the coding procedure. Through discussion of incongruent coding, the coders could reach either one of three conclusions: it was decided that (a) Coder 1's initial coding was the appropriate one, or (b) that Coder's 2 initial coding was the appropriate one, or that (c) none of the initial coding was appropriate and that a new coding was required.

Thus, through both *source triangulation* and *investigator triangulation* (Janesick, 1994; Lincoln & Guba, 1985), RQ#1 primary data set, consisting of the computer-generated logs of students' discourse, was coded following the seven critical thinking categories in Hull & Saxon's (2009) revised IA model and thus underwent a transformation from a verbal data set to a quantitative data set. Each unit of meaning composing this data set was attributed a number ranging from 1 to 7, corresponding to the incremental levels of critical thinking abilities at stake in the IA model. Thanks to this quantification of the primary set of data, subsequent statistical analyses could be conducted, aiming at investigating whether discursive patterns existed in the students' collective discourse (RQ#1).

Statistical analyses

Once the focal group's discourse was transformed into a quantitative data set, statistical analyses could be conducted to address RQ#1, in order to determine whether significant discursive patterns existed in this discourse, related to L2 negotiation and co-construction of meaning, and providing information about these L2 learners' critical thinking and problem solving skills. Three rounds of statistical analysis were conducted on the primary data set to address RQ#1: (1) a non-parametric test of variance with repeated measures (Friedman's test); (2) descriptive statistical analysis on the means and standard deviations of the group's results; and (3) a sequential analysis.

Non-parametric test of variance with repeated measure
(Friedman's test)

First, a non-parametric test of variance with repeated measures, called Friedman's test, was conducted, in an attempt to determine whether the curricular intervention had had a significant impact at $p < .05$ and $p < .01$ on any of the seven levels of critical thinking abilities displayed in the students' collective discourse, as based on the seven categories from the IA model (Hull & Saxon, 2009). The selection of a non-parametric test allowed accounting for the violation of the hypotheses of normality and homogeneity of variance in the distribution of the group's scores. The repeated measures of this non-parametric test of variance also permitted to determine if this impact existed across the ten days during which the curricular intervention took place.

Analysis of descriptive statistics: means and standard deviations

Second, descriptive statistics, as obtained through Friedman's test, and comprising means and standard deviations, were analyzed to deepen the interpretation of the first results obtained through Friedman's test.

The focal group's means and standard deviations thus obtained provided a better understanding of how the levels of critical thinking that were found to be significantly impacted by the curricular intervention were in fact impacted, in terms of the evolution of the group's means at any of these impacted levels, as well as of its standard deviations. In other words, these descriptive statistics allowed to determine, in the case of a level of critical thinking found to have been significantly impacted by the curricular intervention, whether the impact on the group consisted of a decrease, an increase, or a stagnation of this level (via a means' analysis), and whether the group discourse displayed variability amongst students (via a standard deviations' analysis).

Sequential analysis

Finally, a sequential analysis was conducted to determine whether significant discursive patterns could be found in the students' collective discourse, notably through the significant over-representation, or, inversely, under-representation of certain of these patterns. For that purpose, Jeong's (2003; 2005; 2006; 2007) multiple studies on discourse analysis offered a precise insight into the type of statistical analysis that needed to be conducted during a quantitative content analysis that aims at examining latent phenomena of critical thinking as a process, as is the objective of RQ#1 with the study of potential discursive patterns of L2 negotiation of meaning in students' collective discourse (see also Jeong & Frazier, 2008; Jeong & Joung, 2005; Jeong & Lee, 2008).

Jeong's (2003; 2005; 2006; 2007) works permitted to indicate how to further an analysis based on simple descriptive statistics (as obtained through Friedman's test and the analysis of means and standard deviations), to explain or predict "how response patterns are influenced by latent variables and exogenous variables" (2005, p.368). With Jeong's (2003; 2005; 2006; 2007) works in mind, the aim of the sequential analysis was to determine:

- "what types of two-event interactions [were] most likely to occur" (*latent variable*) (2003, p.28)
- whether the sequences found "support critical discourse in decision-making, problem-solving, and learning" (2005, p.368)
- the extent to which "messages elicit responses in conjunction with when, how, who, and why messages are presented" (*exogenous variable*) (2005, p.368).

The objective was to determine whether any significant pattern existed in the students' collective discourse at $\alpha = 0.05$. For that purpose, an appropriate index of comparison was needed, which allowed to control for the varying occurrences of both any given preceding speech-act event and any given following speech-act event. z-scores, as defined and formulated by Bakeman & Gottman (1997), were shown by Jeong

(2005) to be such an appropriate index. According to Jeong (2005), Bakeman & Gottman's (1997) z-score "takes into account not only the observed total number of responses to a particular message category, but also the marginal totals of each response type observed across all message types" (pp. 369-370). Mc Comas et al. (2009), in a study also relying upon sequential analysis, noted that Bakeman & Gottman's (1997) z-score formula was highly appropriate "to identify whether a particular transitional probability deviates significantly from its expected value" (p.416). Bakeman & Gottman's (1997) z-score formula was thus selected to help in the sequential analysis of students' collective discourse, and is provided in Figure 3.18.

Figure 3.18. z-score formula.

$$z = \frac{p(t/g) - p(t)}{\sqrt{\frac{p(t)[1 - p(t)][1 - p(g)]}{Np(g)}}$$

Note. From Bakeman & Gottman, 1997

If we apply Bakeman & Gottman's (1997) formula to the current study, then:

- g corresponds to the preceding speech-act event
- t corresponds to the following speech-act event
- $p(t)$ is the expected unconditional probability, that is to say what would be expected if the following speech-act event was not influenced by the preceding speech-act event
- $p(t/g)$ is the observed conditional probability of a given t speech-act event occurring after a given g speech-act event

As applied to the present study, z-scores were thus computed on the students' daily collective discourse, based on the previous coding of the units of meaning of this discourse into seven possible categories of the IA model, to determine which pairs of speech-act events were found to be significantly higher or lower than expected. In other words, what was found by using Bakeman & Gottman's (1997) z-scores in this sequential analysis was whether certain discursive patterns were significantly over-represented or, inversely, under-represented in the students' collective discourse.

Research Question #2

The second objective of this study was to obtain a comprehensive and inductive understanding of students' individual experiences and perceptions as they were immersed in the problem-based VLE. The goal was to explore and capture the essence of the experienced and perceived impact that this specific learning context had on their collective process of L2 negotiation and co-construction of meaning. This second objective corresponds to the second research question of this study (RQ#2):

RQ#2: How do these learners individually perceive, experience, document, and express the impact of the specific problem-based virtual learning environment in which they were immersed on their L2 collective process of negotiation and co-construction of meaning? What does this perceived technological impact reveal in terms of these learners' L2 technology literacy skills?

For that purpose, the analysis of data collected to address RQ#2 was oriented towards a qualitative analysis, influenced by instrumental case studies and phenomenology, intended to capture the essence of the impact of the context in which the curricular intervention took place on the focal group students' L2 negotiation and co-construction of meaning process, as they perceived it. In that perspective, three analytical processes were at stake in addressing RQ#2. First, RQ#2 primary data set (the three sets of semi-structured interviews) was triangulated with the two secondary data sets (the on-screen video recordings and the computer-generated logs of students' individual notes in their *Detective Notebook*) to allow for the emerging themes in interviews to be

recontextualized through comparison of factual and perceived events. Second, the emerging themes thus recontextualized were organized through a cross-referencing process, taking into consideration the main characteristics and affordances of the problem-based VLE. Finally, the portrait thus established of this perceived impact was also intended to inform a research exploring L2 learners' technology literacy skills, and to be compared with RQ#1 findings to offer an integrative interpretation of these two combined research questions.

We will now present these three analytical processes in more details.

Triangulation of the primary data set with the secondary data sets

The primary data set used to address RQ#2 was qualitative and verbal in nature, and consisted of the three sets of semi-structured individual interviews administered to the five students from the focal group before, during, and after the curricular intervention. In these interviews, students were explicitly prompted to express and elaborate on their individual perceptions of different aspects of the impact of this specific learning environment on their collective process of L2 negotiation and co-construction of meaning. As discussed earlier, the three interview protocols structuring these semi-structured interviews, although opened in nature, primarily aimed at prompting students to reflect on such issues as power status and relationships in their group's dynamic, as well as on the use of an avatar in developing a form of social presence. These interviews were thus transcribed verbatim, so as to be treated through an inductive thematic analysis, aiming at promoting the emergence of themes relevant to answering RQ#2.

A similar inductive thematic analysis was conducted with the secondary qualitative data set used to address RQ#2. This secondary qualitative data set was first composed of the on-screen video recordings of students' daily interactions, which were observational in nature, and were subsequently transcribed as rich descriptions of all

inter-related interactional events happening on each student's screen on each day of the problem-based activity. The purpose of this rich description was to obtain an objective account of the different interactional events, in order to compare them with the more subjective account of these same events by the students in the interviews. In other words, the data from the on-screen video recordings of students' daily interactions were triangulated with the data from the interviews to better interpret students' perceptions of the impact of the learning environment on their L2 negotiation of meaning process with the support of a more factual account of the interactions at play in this process. Moreover, the computer-generated logs of students' individual notes, which were verbal in nature, also composed this secondary qualitative data set, and were transcribed as conceptual maps, enriched with direct quotations from the students, allowing to visualize the evolution across days of each student's individual problem-solving process. The purpose of these conceptual maps was to capture the overall individual L2 thinking process for each student, as documented by him/herself along the course of the curricular intervention, and to use these maps to enrich students' perceptions, as expressed during the interviews. In other words, here again, the data from the computer-generated logs of students' individual notes from their *Detective Notebook* were triangulated with the data from the primary data set.

Two examples can be given to illustrate this overall triangulation process in the data analysis conducted to answer RQ#2. First, and as related to power issues, students were prompted during Interview #2 to talk about whether they felt that the group dynamic had allowed them to fully voice their ideas. Triangulation of the primary and the secondary data set could allow to determine if a gap existed between the students' perceptions when they answered positively to that question during the interview, and the more objective events, accessed through the on-screen video recordings, showing prominent instances of self-erasing at multiple moments, and thus showing a tension between the students' perceptions (positive) and the interactional events (negative).

Second, and as related to issues of grounding in the construction of the final and consensual reasoning that was the outcome of the problem-based activity, students were prompted during Interview #3 to talk about whether they felt that the solution proposed by their group was viable. Triangulation of the primary and the secondary data set could allow determining if a gap existed, here again, between the students' perceptions when they answered positively to that question during the interview, and the personal note they had taken in their *Detective Notebook* upon reflecting on this viability issue. In these two examples, if a gap was indeed found, it served to complement the interpretation of the purposefully impressionistic data gathered from the interviews to permit the subsequent construction of rich and integrative vignettes describing each aspect of the perceived impact of the learning environment on the L2 collective negotiation and co-construction of meaning process.

Cross-referencing with the problem-based VLE's characteristics and affordances

Once the different themes emerging from RQ#2 primary data set were triangulated and enriched with the data gathered in the two secondary data sets, these themes were further reduced to obtain the essence of the phenomenon under investigation (i.e. the perceived impact of the problem-based VLE on students' L2 process of negotiation and co-construction of meaning). For that purpose, the multiple themes obtained and enriched through triangulation were cross-referenced with the list of characteristics and affordances defining the problem-based VLE, as posited in Chapter II, and presented in Figure 3.19.

Integration of RQ#1 and RQ#2 findings for interpretation

Finally, findings emerging from the analysis procedure of RQ#2 were also intended to complement the results obtained for RQ#1, and to offer an integrative interpretation of these two combined research questions, thus allowing to provide a

comprehensive portrait of the overall L2 critical thinking, problem solving, and technology literacy skills of the focal group students, aligning with the dialectical philosophy underlying the methodology of this study. This integrative interpretation also permitted an assessment of the methodology chosen for this study, in order to contribute to the development of and the reflection on a mixed methods approach to research.

Figure 3.19. Characteristics and affordances of the problem-based VLE, for cross-referencing purposes.

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| <p>Characteristics of the VLE:</p> <ul style="list-style-type: none"> • Immersive • Multimodal • Social • 3-D representation of space • 3-D persona representing learners (avatar) • Synchronous interactions • Transfer of knowledge • Acting on the environment • Underlying pedagogical principles <p>→ Characteristics of the problem-based activity:</p> <ul style="list-style-type: none"> - Learner-centeredness - Authenticity - Contextualization - Complexity - Multiple perspectives - Collaborative learning - Support of knowledge construction |
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CHAPTER IV

RESULTS

Introduction

The primary purpose of the present study was to empirically and deductively examine the nature of patterns of negotiation and co-construction of meaning emerging in the discourse collectively produced by a group of L2 learners invested in a problem-based virtual learning environment, to determine whether they could inform research on L2 learners' critical thinking and problem solving skills. For that purpose, a quantified verbal analysis of the discourse co-constructed by this group of L2 learners was conducted, primarily relying on Hull & Saxon's (2009) revised version of Gunawardena et al.'s (1997; 1998; 2000; 2006) Interaction Analysis model as a research instrument, intended to provide "a bird's-eye view of student interactions and critical thinking processes" (Jeong, 2003, p.28). More specifically, the research question guiding the primary purpose of this study was:

RQ#1: Do significant patterns of L2 negotiation and co-construction of meaning exist in the discourse produced collectively by a group of Intermediate French II college-level learners working collaboratively to solve a complex problem and as they are immersed in a virtual learning environment? If so, what is the nature of these patterns and what do they reveal in terms of these learners' L2 critical thinking and problem solving skills?

Furthermore, it was determined that the study of the perceived impact of a problem-based virtual learning environment (VLE) by L2 learners on their L2 negotiation and co-construction of meaning was an important additional variable, also allowing to inform L2 learners' developing L2 technology literacy skills. The second purpose of the present study was thus to obtain a comprehensive and inductive understanding of these L2 learners' L2 technology literacy skills by examining their individual experiences and perceptions regarding the impact of the VLE in which they were immersed on their L2

negotiation and co-construction of meaning process. The research question guiding the second purpose of this study was:

RQ#2: How do these learners individually perceive, experience, document, and express the impact of the specific problem-based virtual learning environment in which they were immersed on their L2 collective process of negotiation and co-construction of meaning? What does this perceived technological impact reveal in terms of these learners' L2 technology literacy skills?

To this end, a qualitative analysis, influenced by instrumental case studies and phenomenology, was conducted on these learners' interviews, and enriched through the analysis of their personal daily notes and the recordings of their on-screen interactions, to capture the essence of the impact of the problem-based virtual learning environment on students' L2 negotiation and co-construction of meaning process, and as perceived by these students. The resulting portrait also intended to inform us about these L2 learners' technology literacy skills.

This chapter will present the results corresponding to each phase of the study, with Phase 1 results allowing to establish the profile of each student of the focal group, whose results are the object of this study, and Phase 2 & 3 results, which will more directly address the two research questions structuring this study.

Phase 1 results

As previously mentioned in Chapter III, a sub-sampling of the 27 Intermediate French II students selected to participate in the research project was performed at Phase 1, allowing for the formation of a focal group of 5 students, whose results are the object of the present study.

Learning setting for the focal group prior to the curricular intervention

Phase 1 of this study corresponded to in-class observations of the 27 students enrolled in the two pre-selected Intermediate French II classes, in their unmodified

teaching and learning conditions, and before implementation of the curricular intervention. These observations aimed at establishing a portrait of each class as a social organism, by looking at both the class, as a whole, and at its students, as individual components of this whole, so as to capture the main respective social, interactional, and educational traits of each of these classes. The formation of groups of four to five students resulting from these observations was then motivated by a purpose of representativeness, as mentioned in Chapter III, so that each group of students in each of the two classes could be considered to socially, interactionally, and educationally represent the diversity of the class as a whole. From the different groups formed, one was selected in the morning class to serve as a focal group. Before presenting in details the five students belonging to the focal group, it is first important to gain a sense of what their learning environment looked like prior to the curricular intervention.

The focal group selected for this study belonged to the morning class, which met four times a week for 50 minutes. Their Intermediate French II class would meet in the same seminar room every day, equipped with a whiteboard and fairly modern, although minimal, computerized materials for the teacher, such as a recent computer with projecting capabilities, and an internet connection. This room, although recently renovated and fairly spacious, could not be qualified as a particularly pleasant setting, due to the fact that it had no window and that the only source of light came from the neon lamps on the ceiling, projecting a fairly artificial and somewhat aggressive light. The sitting arrangement of the room could be easily modified, since it consisted of mobile individual tables attached to their respective chair.

The class was taught by an experienced female non-native instructor. The curriculum for this course relied primarily on grammar-oriented French textbook, which served as the basis upon which the lessons were taught. A typical daily lesson would first consist of the interactive correction of grammar exercises that students had been assigned to do at home, with the instructor asking for volunteers to offer their answer. Then, the

instructor would usually introduce a new grammar or vocabulary point to the students, as presented in the grammar section or in an audio-recorded and scripted dialogue from the textbook, and in a teacher-centered manner. Once the topic of the day was presented to the students, they would usually have to work on a series of exercises to apply or practice the newly presented content, sometimes individually, but more often in small groups, ranging from two to five students, and lasting from five to fifteen minutes, depending on the type of exercise. At the end of each in-class exercise, the instructor would usually ask the class to regroup as a whole, and ask students to volunteer their answers to the rest of the class. Most of these exercises consisted of one-word fill-in-the-blanks or short sentence constructions. The class would usually end with the instructor assigning homework to the students, under the form of specific grammar or vocabulary sections to read in the textbook, exercises to complete, and some indications about longer-term assignments (such as a one-page composition).

With this learning setting in mind, let us now provide an account of the social, interactional, and educational profiles of the five students from the focal group who were part of this class (Charlotte, Jacqueline, Bernard, Daniel, and Florence), as they emerged from the bi-weekly observations led at Phase 1 of this study.

Focal group students' social, interactional, and educational profile before the curricular intervention

Charlotte

Before the curricular intervention took place, Charlotte appeared in her French class as a fairly shy and uninspired student. Out of the twelve sessions of observations, she missed class twice and also arrived late twice. Like most students did, Charlotte would systematically sit at the same table and would often arrive in class listening to some music on her iPod until the official beginning of class, thus not taking part in any social interaction with her classmates who were already present in the room. When she

arrived early, she would directly go to her seat, and wait on her own for the class to start, listening to some music, without interacting with her classmates. She would sometimes look unprepared for class, only displaying her textbook and a single blank piece of paper on her table, as if no homework had been done or as if she had forgotten to bring her work to class.

During whole class activities, she would often be day-dreaming, passively observing what was being said in French around her, and considering her instructor as the primary anchor for her involvement and engagement, as she would look at her in a fixed manner, often giving the impression that she was lost and could not understand most of what was happening. She seemed to only want to engage minimally in the class activities, barely ever volunteering to give answers to a question or an exercise. As a consequence, she would often lose engagement and be off-task, yawning, laying on the table, sometimes even using her cell phone in the middle of class to text, hiding the phone under the table.

When put in small groups, Charlotte would also tend to engage very minimally, both with the French of the task content and with her group partners. She would tend to work on the activity on her own, and to only interact with her group partners towards the end of the period dedicated to the group activity, to compare the correctness of the answers to an exercise, keeping very limited interactions and often falling back into English, in a very quiet voice.

Jacqueline

Jacqueline, on the other hand, was almost Charlotte's opposite. She appeared as a highly social and intergratively engaged student in her French class. Out of the twelve sessions of observation, Jacqueline did not miss class once, and only arrived late one day. Like most of the students, she would routinely sit at the same table, but she was one of the very few students who would actually change their seating position once in a while.

With a very jovial and enthusiastic attitude, she would often arrive in a classroom where other classmates were already seated and waiting quietly, and she would be the first person breaking the silence and greeting others, thus initiating most informal social interactions, and leading other students to engage socially with others, before the official beginning of the class. It seemed that Jacqueline served as a pro-active social agent in bringing the rest of the class to a state of awakening and social engagement.

During whole class activities, Jacqueline would be on task and highly involved, being clearly prepared for class, often volunteering answers, and asking a lot of questions to her instructor, to clarify information or to requests more details. These interactions would more often than not take place in English, but would also help her classmates, as, in many occasions, it seemed that her questions allowed others in the class to also gain a better understanding, as if they had wanted to ask the same question, but did not dare to do so. Jacqueline's French was nevertheless fairly weak. It was difficult for her to form an entire sentence out loud, and her contributions in French would usually consist of two- to three-word answers. She was nonetheless unafraid of taking risks in front of the entire class, and to struggle through her utterances until getting them correct and across.

During small group activities, Jacqueline would maintain her highly social and enthusiastic profile, often serving as a leader in her groups, initiating and sustaining most discussions with her partners in the group. She would more often than not fall into English during group activities, but would be greatly engaged in the group learning dynamic, asking questions to her group partners, providing suggestions, making comments, and offering genuine encouragements. She would sometimes test hypotheses in the language in the middle of a group activity, with the help of her group partners or of the instructor, evaluating alternative forms of expressions.

Finally, one of Jacqueline's unique characteristics was her substantial reliance on her dictionary or on the textbook glossary. She would almost always come to class with a small French/English dictionary and would spend considerable time and attention

browsing through it, looking up words, sometimes at the cost of missing the point of an exercise or not finishing a task. The dictionary thus seemed to be a key instrument for her in her French learning, which was going to have an impact on the manner in which she approached the problem-based activity during the later curricular intervention.

Bernard

Bernard appeared as a social and motivated student, whose French seemed to be fairly strong, but whose academic rigor was to some extent questionable. Out of the twelve sessions of observation, Bernard only missed class once, but arrived late to class four times, once as late as half-way through class. When he arrived to class on time, he would go to sit at his table, often opening and checking his personal laptop, which he would frequently bring to class with him. Similarly to Jacqueline, but less systematically, Bernard was one of the very few students who would initiate social engagement with his classmates before the official beginning of class, asking them about their day, other classes and making funny comments or jokes.

During whole class activities, Bernard would not always seem to be prepared and ready for class, but would show a great interest and engagement in what was being addressed. He would frequently volunteer to provide an answer, and would attempt complex constructions in French. One of Bernard's outstanding characteristics was his great curiosity, as he would frequently ask questions to his instructor, with an intention to have more details about a specific cultural or linguistic aspect that was being talked about in class. Most of his questions were intended to gain more extraneous information about the language or the culture, rather than clarification or confirmation. He also came across as a creative student, eager to try alternative expressions in French, which he would keep track of in a pile of flashcards, bound together and that he would often bring to class with him

In small group activities, Bernard also displayed a high level of social and learning engagement with his group partners. He would tend to be the person in charge of initiating and sustaining the conversation, and would often brainstorm with his group partners. He would also contribute to make his classmates feel more relaxed by making jokes or funny comments, but would stay on task with them, attempting to use French exclusively, and often generating hypotheses about the language.

Daniel

Daniel was a fairly shy and introverted student in his French class, and his academic rigor was, like Bernard's, to some extent questionable. Out of the twelve observation sessions, he missed class three times and arrived late once. Nevertheless, when he would come to class, he would frequently arrive early, usually with his headset on, listening to his iPod. He would sit at his regular table and would wait for the class to start in silence, with his books opened and ready. Similarly to Charlotte, he would almost never engage in social interactions with his classmates during that time, and would neither greet them upon arriving in class, nor establish any eye contact with them.

In whole class activities, Daniel seemed fairly interested and engaged in learning French, although he would sometimes look bored, and would discretely yawn several times. He would often volunteer to provide answers to an exercise, and would be on-task during most of the in-class time. His form of learning engagement was active, rather than pro-active, but certainly not passive. He was a quiet student but he seemed to have a fairly strong command of French, as he would often provide complex answers when he was given a chance to talk. Socially speaking, the only person he seemed to connect with to some degree was Florence, who would sit right next to him during most classes. They did not seem to be friends or to really know each other that well, and it was probably more the adjacent position of their tables that motivated their interactions, but the only moments when Daniel and Florence seemed to be more socially engaged was when they

talked to each other, notably by whispering to one another, while the instructor was explaining something to the class or that another student was speaking.

During small group activities, Daniel showed that he was constantly on-task. He would rarely be the one initiating the group work, but he would significantly contribute to the group discussions and would help in sustaining the use of French. One of Daniel's unique characteristics, both during whole-class and small-group works, was his tendency to take extensive notes during class, which would have an impact on the way he handled the problem-based activity on which the later curricular intervention relied.

Florence

Finally, Florence was, similarly to Daniel, a very shy and introverted student, although her academic rigor was exemplary. Out of the twelve observation sessions, Florence only missed class once, and never arrived late to class. As soon as she would arrive in class, she would sit at her regular table, would pull out all her books and notes related to French, and would start getting busy organizing her notes, using sticky notes to keep track of important points in the textbook. For the 5 or 10 minutes she would have to wait before the class officially started, she would not engage in any social contacts with her classmates, but would get busy, working on her French, annotating her text and her notes.

During whole class activities, Florence would often volunteer to answer questions, but would talk with a very quiet voice, and would provide fairly minimal although almost always correct answers. Her French, although rare, seemed very good, and she would show her active listening and understanding by taking extensive notes and nodding at her instructor's or her classmates' contributions in class, as a form of acknowledgement and agreement. In some instances, she seemed to be a little bored in class, yawning or playing with her hair more than she would normally, but she would overall look interested and diligent in her French work.

In small group work, Florence would remain shy and introverted, even more so if she was grouped with other students who were as shy as she was (except for Daniel). She would be on-task during the whole activity but would not seem to initiate the actual conversation. She would keep nodding at her group members, acknowledging their contribution, and would contribute after several minutes, and always with a very quiet voice. Only when she was grouped with more social and more vocal students, such as Bernard, did she seem to be more talkative and to also contribute more to the group discussion.

With these profiles of the focal group students in mind, we will now present the results related to Phase 2 & 3 of the present study, during and after the curricular intervention. We will review the objectives and results of each of the two research questions which structured this study.

Phase 2 and 3 results

Results for Research Question #1

Brief review of purpose and analytical procedure

The first objective of this study corresponded to RQ#1:

RQ#1: Do significant patterns of L2 negotiation and co-construction of meaning exist in the discourse produced collectively by a group of Intermediate French II college-level learners working collaboratively to solve a complex problem and as they are immersed in a virtual learning environment? If so, what is the nature of these patterns and what do they reveal in terms of these learners' L2 critical thinking and problem solving skills?

To answer RQ#1, the data analysis was oriented towards a form of quantified discourse analysis of the focal group's collective discourse. In that perspective, the computer-generated logs of students' collective chat were transformed into quantitative data, following an investigator triangulation (with two coders) as well as a source triangulation method (using the support of secondary data sets). This data transformation

was conducted by the researcher and her research assistant through a coding procedure relying on Hull & Saxon's (2009) revised version of the Interaction Analysis model (IA model).

A non-parametric test of variance with repeated measures (Friedman's test) was conducted on this quantified data set, to determine whether specific levels of critical thinking abilities had been significantly impacted by the curricular intervention in the discourse produced by the focal group. Furthermore, descriptive statistics were analyzed to provide a better understanding of how the levels of critical thinking that were found to be impacted by the curricular intervention had been in fact impacted. Finally, a sequential analysis was conducted to determine whether significantly over- and under-represented discursive patterns existed in the focal group collective discourse.

We will now address in more details the results related to RQ#1.

Results from coding procedure with IA model

The data transformation procedure of the primary data set (the focal group's discourse), from a verbal to a quantitative data set, was conducted using Hull & Saxon's (2009) revised version of the Interaction Analysis model (IA model). Each unit of meaning in the focal group's discourse was coded according to one of the seven incremental levels of critical thinking presented in the IA model.

Coding at Level 1

Level 1 of the IA model corresponded to "new direction(s) to the group", and was further defined by Hull & Saxon (2009) as the "initiation by the group of a new activity". Indicators of Level 1 were (1a) statements or questions that caused the group to undertake a discussion on a totally new subject or (1b) that provided clarity to a previous instruction. The following excerpts from Day 2 of the activity are illustrations of Level 1 units of meaning. In (1a), Bernard asked the group, at the beginning of their conversation, what they should start talking about. Later in that same conversation, after the group

digressed for a while about who was part of their group, Jacqueline (1b) put the group back on track by reiterating Bernard's previous instruction, and led the group to start working on the task.

(1a)	Bernard:	Ou est-ce que nous commencons ?	Where do we start ?
(1b)	Jacqueline:	D'accord, nous commencons	Okay. Let's start

Coding at Level 2

Level 2 of the IA model corresponded to “sharing new information”, and was further defined by Hull & Saxon (2009) as “information [that] is provided [and] that has not been previously discussed”. Indicators of Level 2 were (2a) statements of observation or opinion, (2b) simple responses to a question or instruction, or (2c) definitions, descriptions, or identifications of a problem. The following excerpts from Day 2 of the activity are illustrations of Level 2 units of meaning. At that point in the conversation, students started sharing new information about themselves with the rest of the group. Daniel provided new information to the group by formally identifying a problem, i.e. the identity of the victim (2c). Jacqueline shared new information by observing that she was at home when the victim died (2a). She then asks Charlotte where she was during the murder: Charlotte's answer is new information and is a simple response to that question (2b).

(2c)	Daniel:	Ma fille Audrey est mort	My daughter Audrey is dead
(2a)	Jacqueline:	J'étais a ma maison quand Audrey a mort	I was at home when Audrey has dead
	<i>Jacqueline:</i>	<i>Charlotte, ou etais tu ?</i>	<i>Charlotte, where were you?</i>
(2b)	Charlotte:	Dans le train	In the train

Coding at Level 3

Level 3 of the IA model corresponded to “situated definition”, and was further defined by Hull & Saxon (2009) as “information [that] is validated through a socially-shared, distributed consciousness”. Indicators of Level 3 were (3a) statements of agreement, (3b) realization of agreement, (3c) corroborating examples, (3d) encouragements provided for a previously expressed idea, or (3e) basic questions of clarification. The following excerpts from Day 2 of the activity are illustrations of Level 3 units of meaning. (3a) is a very explicit statement of agreement. (3b) corresponds to Bernard’s realization, after Jacqueline problematic statement about her husband and son, that they are in fact on the same page and agree. (3c) corresponds to a corroborating example that Jacqueline provides to illustrate the fact that she thinks her son is a suspect. (3d) corresponds to a written onomatopoeia used by Daniel as a reaction and as an encouragement towards Jacqueline’s statement. Finally, (3e) corresponds to a clarification question that Daniel asks Bernard, consequently to his statement.

(3a)	Daniel:	Je suis d’accord avec toi	I agree with you
	Jacqueline:	<i>Mon mari est mon fil sont tres soupconne</i>	<i>My husband is my son are very suspected</i>
	Bernard:	<i>Tu est marie a ton fil ?</i>	<i>You is married to your son?</i>
(3b)	Jacqueline:	<i>Noooo, mon mari ET mon fil</i>	<i>Noooo, My husband AND my son</i>
	Bernard:	Oh !	Oh!
	Florence:	<i>Ton fils est un soupconne ?</i>	<i>Your son is a suspected?</i>
(3c)	Jacqueline:	<i>Je pense</i>	<i>I think so</i>
		Il etait tard pour diner	He was late for dinner
(3d)	Jacqueline:	<i>Ma famille n’est pas innocent</i>	<i>My family is not innocent</i>
	Daniel:	Oh la la	Oh la la
(3e)	Bernard:	<i>Je pense que j’etais au cafe de la poste</i>	<i>I think I was at the cafe</i>
	Daniel:	Tu penses?	You think?

Coding at Level 4

Level 4 of the IA model corresponded to “intersubjectivity/dissonance”, and was further defined by Hull & Saxon (2009) as “inconsistency [which] is discovered between a new observation and the learner’s existing framework of knowledge”. Indicators of Level 4 were (4a) identifications or statements of areas of disagreement, (4b) questions being asked or answered, (4c) restatement of someone else’s position, and (4d) clarifications of one’s own position without substantial changes to that position. The following excerpt from Day 3 of the activity is an illustration of Level 4 units of meaning, in an exchange between four members of the group (Florence, Jacqueline, Charlotte, and Daniel), which displayed all the different indicators of intersubjectivity and dissonances.

	<i>Florence:</i>	<i>Audrey est ma fille</i>	<i>Audrey is my daughter</i>
(4b)	Jacqueline:	Vraiment ?	Really?
(4a)		Mais elle est un Collins	But she’s a Collins
	<i>Florence :</i>	<i>Oui</i>	<i>Yes</i>
(4d)		Mais Danielle Collin a adoptee ma fille	But Danielle Collin adopted my daughter
	<i>Jacqueline:</i>	<i>Oooh</i>	<i>Oooh</i>
		<i>tu est sa mere</i>	<i>You is her mother</i>
(4b)	Charlotte:	Pourquoi les Collin adoptee Audrey ?	Why the Collins adopted Audrey?
(4b)	Daniel:	Parce que Florence avait l’air de plus se preoccuper de sa carriere	Because Florence looked like she was more concerned by her career
(4c)	Jacqueline:	Donc Florence n’avait pas la bebe	So Florence did not have the baby

Coding at Level 5

Level 5 of the IA model corresponded to “negotiation and co-construction through semiotic mediation”, and was further defined by Hull & Saxon (2009) as “higher mental functioning that attempts to bridge differences in situated definitions”. Indicators

of Level 5 were (5a) clarifications of someone else's position, (5b) re-propositions of ideas previously provided to the group, or (5c) statements that appeared new but contained elements from others. The following excerpt from Day 4 of the activity is an illustration of Level 5 units of meaning, in an exchange between Bernard, Jacqueline, and Florence, which displayed all the different indicators of negotiation and co-construction through semiotic mediation.

	<i>Benard:</i>	<i>Je juste trouve le journal de Lea Carron</i>	<i>I just find Lea Carron's diary</i>
		<i>Elle etait faire chanter les personnes</i>	<i>She was blackmail people</i>
	<i>Jacqueline:</i>	<i>Florence, tu fais chanter mon mari ?</i>	<i>Florence, do you blackmail my husband ?</i>
	<i>Florence :</i>	<i>Non,</i>	<i>No,</i>
(5a)		<i>Lea fait chanter Bernard et moi</i>	<i>Lea blackmails Bernard and me</i>
	<i>Jacqueline:</i>	<i>J'ai trouve un lettre pour 500 euros aussi a Jean-Pierre et Chantal</i>	<i>I found a letter for 500 euros too to Jean-Pierre and Chantal</i>
(5c)		<i>Donc Lea fais chanter Florence et Bernard et Jean-Pierre et Chantal</i>	<i>So Lea blackmail Florence and Bernard and Jean-Pierre and Chantal</i>
		<i>Donc, quoi est-ce que la tue?</i>	<i>So, what to kill her?</i>
		<i>Qu'est-ce que de Audrey ?</i>	<i>What of Audrey?</i>
(5b)	<i>Florence:</i>	<i>Elle était enceinte*</i>	<i>She was pregnant*</i>

Note. * idea presented by Jacqueline as new information earlier that day.

Coding at Level 6

Level 6 of the IA model corresponded to “testing tentative constructions”, and was further defined by Hull & Saxon (2009) as “testing new ideas developed through the course group”. Indicators of Level 6 were (6a) “what-if” questions or statements, or (6b) proposed behaviors that incorporated newly constructed ideas. The following excerpt from Day 6 of the activity is an illustration of Level 6 units of meaning, in an exchange

between Bernard, Jacqueline, and Florence, which displayed the two indicators of negotiation and co-construction through semiotic mediation.

	<i>Benard:</i>	<i>Marc Bovy a dit que il n'a jamais vu Audrey comme une client</i>	<i>Marc Bovy said he never saw Audrey as a client</i>
		<i>et il ne sais pas qu'elle est enceinte</i>	<i>and that he doesn't know she is pregnant</i>
(6a)	<i>Jacqueline:</i>	<i>Peut-etre il n'a pas besoin de voir Audrey comme une client pour mourir elle</i>	<i>Maybe he doesn't need to see her as a client to die her</i>
	<i>Florence:</i>	<i>Mais Marc Bovy a dit qu'il ne connaît pas Audrey</i>	<i>But Marc Bovy said he didn't know Audrey</i>
	<i>Jacqueline:</i>	<i>Marc Bovy n'est pas un suspect alors?</i>	<i>So Marc Bovy isn't a suspect?</i>
	<i>Benard:</i>	<i>Mais il semblait tres coupable</i>	<i>But he seemed really guilty</i>
	<i>Florence:</i>	<i>Oui, c'est vrai</i>	<i>Yes, that's true</i>
	<i>Jacqueline:</i>	<i>Nous avons besoin de savoir</i>	<i>We need to know</i>
(6b)		<i>Tout le monde, regardez a votre journals pour plus information</i>	<i>Everybody, look your journals for more information</i>

Coding at Level 7

Finally, Level 7 of the IA model corresponded to “reporting application of newly constructed knowledge”, and was further defined by Hull & Saxon (2009) as a “behavior provoked by the discussions, resulting in reports about activities in which a participant engaged”. Indicators of Level 7 were (7a) statements indicating that new ideas were being tried, or (7b) reports of attempts to implement a new concept or idea. The following excerpts from Day 8 of the activity are illustrations of Level 7 units of meaning.

<i>Benard:</i>	<i>Est-ce que nous savons comment l'incendie commencait ?</i>	<i>Do we know how the fire used to start?</i>
----------------	---	---

(7a)	Florence:	Un moment, je vais lire dans mon journal d'enquete	Just a second, I'll go and read my detective notebook
	<i>Florence:</i>	<i>Voila ce que j'ai ecrit pour le question 2</i>	<i>Here's what I wrote for question 2</i>
(7b)		« Nicole Bastin a commis le meurtre avec Elodie et Nicholas. Elodie et Nicholas sont les enfants de Nicole. Les Bastins ont une longue histoire avec Audrey »	“Nicole Bastin committed the murder with Elodie and Nicholas. Elodie and Nicholas are Nicole's children. The Bastins have had a long history with Audrey”

Inter-rater coding and reliability

The coding procedure of the focal group's discourse involved two coders. These coders were first in charge of independently coding the different units of meaning of this discourse. The inter-rater reliability rate for that independent coding procedure was calculated (see Table 4.1). The inter-rater reliability rates ranged from $\kappa = .336$ to $\kappa = .626$, and averaged at $\kappa = .490$. These rates were insufficient to guarantee reliability of coding and demonstrated that, despite the source triangulation, further triangulation procedures were required to obtain results that were satisfying in terms of reliability.

After this phase of independent coding, a second phase, corresponding to an investigator triangulation, was conducted where both coders compared their coding and discussed any non-congruent unit of meaning, until reaching an agreement. The inter-rater reliability rates between the final coding and Coder 1's initial coding ranged from $\kappa = .590$ to $\kappa = .809$, and averaged at $\kappa = .705$. The inter-rater reliability rates between the final coding and Coder 2's initial coding ranged from $\kappa = .531$ to $\kappa = .822$, and averaged at $\kappa = .681$. This second set of inter-rater reliability rates indicates stronger results, in terms of reliability. Moreover, it demonstrates that each coder's initial coding was evenly represented in the final coding, so that no one coder's coding overshadowed the other's. Finally, this second set of inter-rater reliability rates also shows that close to a third of the initial incongruently coded units of meaning were incongruently coded units of meaning

Table 4.1. Inter-rater reliability rates in the coding procedure of the focal group's discourse per unit of meaning (Cohen's kappa).

Days of collective interactions	Units of meaning		Reliability before collective coding	Reliability after collective coding	
	Frequency	Relative frequency	Coder 1 / Coder 2	Coder 1 / Final Coding	Coder 2 / Final Coding
D2	129	.15	.336	.590	.538
D3	123	.14	.569	.720	.591
D4	87	.10	.476	.679	.716
D5	99	.11	.347	.675	.531
D6	84	.10	.591	.777	.760
D7	105	.12	.448	.707	.716
D8	158	.18	.549	.724	.822
D9	92	.10	.626	.809	.781
	877	1.0	.490	.705	.681

were ultimately coded anew, that is to say that the discussion among coders led to the determination that, in these instances, none of the initial coding was appropriate and that a new one was required.

Thanks to the quantification of the focal group's discourse through the coding procedure (via the IA model) previously mentioned, statistical calculation could be conducted on this primary data set to answer RQ#1, which we will now present and discuss.

Brief review of IA model levels and days of curricular intervention

In order to better understand the statistical results presented in the next sections, let us briefly review two important variables in this study: the seven incremental levels of critical thinking abilities of the Interaction Analysis model (Figure 4.1), and the purpose of the eight days of curricular intervention (Figure 4.2).

Figure 4.1. Levels of critical thinking abilities in the IA model (Hull & Saxon, 2009)

Level	Title	Definition
Level 1	Direct instruction(s) to the group	Initiating new activity for the group
Level 2	Sharing new information	Information is provided that has not been previously discussed
Level 3	Situated definition	Information is validated through a socially-shared, distributed consciousness
Level 4	Intersubjectivity and dissonance	Inconsistency is discovered between a new observation and the learner's existing framework of knowledge
Level 5	Negotiation and co-construction via semiotic mediation	Higher mental functioning that attempts to bridge differences in situated definitions
Level 6	Testing tentative constructions	Testing new ideas developed through the course group
Level 7	Reporting application of newly constructed knowledge	Behavior is provoked by discussions resulting in reports about activities in which a participant engaged

Figure 4.2. Purpose of the eight days of collective interactions in the curricular intervention.

Step in activity	Days	Nature of social interactions	Task
Step 2	Day 2 – Day 4	Within the group	Exchanging and discussing information in the group, as found in personal portraits and in clues disseminated in the VLE
Step 3	Day 5 – Day 7	Within and outside the group	Exchanging and discussing information in the group, as found through interrogations/testimonies of other characters in the VLE
Step 4	Day 8 – Day 9	Within the group	Consensus-building: building of a viable reasoning in the group to explain all the circumstances of the murder

Impact of curricular intervention on levels of critical thinking abilities in the focal group's discourse

The first objective of these statistical analyses was to determine whether any specific level of critical thinking abilities, as displayed in the focal group's discourse, had been significantly impacted by the curricular intervention. For that purpose, a test of variance with repeated measures was conducted. This test was non-parametric in nature (Friedman's test), in order to account for the violation of the hypotheses of normality and homogeneity of variance in the distribution of the group's scores, due to the limited size of the sample ($N = 5$). Table 4.2 is a summary of the results obtained through this non-parametric test of variance with repeated measures.

Results on the Friedman's test showed that, out of the seven incremental levels of critical thinking abilities presented in the Interaction Analysis model (Hull & Saxon, 2009), the discourse produced by the focal group was significantly impacted by the curricular intervention at four of these levels:

Table 4.2. Impact of the curricular intervention on specific levels of critical abilities in the focal group's discourse.

	Levels of critical thinking abilities in the focal group's discourse (from IA model ¹)						
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
	<i>Direct instructions to the group</i>	<i>Sharing new information</i>	<i>Situated definition</i>	<i>Intersubjectivity & dissonance</i>	<i>Negotiation & co-construction</i>	<i>Testing tentative constructions</i>	<i>Reporting application of newly constructed knowledge</i>
N	5	5	5	5	5	5	5
χ^2	15.59	18.80	6.55	12.16	26.28	26.87	8.00
df	7	7	7	7	7	7	7
Asymp. Sig.	.029*	.009**	.477	.096	.000**	.000**	.333

Note. * $p < .05$. ** $p < .01$; 1) Hull & Saxon, 2009

- Level 1 (Direct instructions to the group): results indicate that there was a significant difference in the means of Level 1 utterances produced by the focal group across days of curricular intervention, $\chi^2(7, N = 5) = 15.59, p < .05$.
- Level 2 (Sharing new information): results indicate that there was a significant difference in the means of Level 2 utterances produced by the focal group across days of curricular intervention, $\chi^2(7, N = 5) = 18.80, p < .01$
- Level 5 (Negotiation and co-construction): results indicate that there was a significant difference in the means of Level 5 utterances produced by the focal group across days of curricular intervention, $\chi^2(7, N = 5) = 26.28, p < .01$
- Level 6 (Testing tentative constructions): results indicate that there was a significant difference in the means of Level 6 utterances produced by the focal group across days of curricular intervention, $\chi^2(7, N = 5) = 26.87, p < .01$

The other levels (Level 3: Situated definition; Level 4: Intersubjectivity and dissonance; Level 7: Reporting application of newly constructed knowledge) were not found to be significantly impacted by the curricular intervention. Results indicate that there was no significant difference in the means of Level 3, Level 4, or Level 7 utterances produced by the focal group across days of curricular intervention.

Due to the reduced sample size ($N=5$) and to the total number of possible pairwise comparisons (36), no reliable post-hoc test could be conducted to determine which days of curricular intervention were significant from each other for the four levels of critical thinking abilities which were found to be significantly impacted by this intervention, as the increase in Type I error could not be accounted for. To compensate for the absence of post-hoc test results, descriptive statistics on the focal group's discourse were calculated, intended to deepen the analysis of the results obtained through Friedman's test, which we will now present and discuss.

Descriptive statistics on the focal group's discourse

The second objective of the different statistical analyses conducted on the primary data set (the focal group's discourse) was to deepen the interpretation of the previous results by examining the different descriptive statistics. Table 4.3 is a summary of these descriptive statistics.

The means of the focal group's discourse were examined per day of collective interactions and per level of critical thinking abilities. Moreover, standard deviations of the focal group's discourse were also calculated and examined, in an attempt to better evaluate the variability amongst students in the focal group per day of collective interactions and per level of critical thinking abilities.

Descriptive statistics at Level 1

Level 1 (direct instructions to the group) of the IA model levels of critical thinking abilities was found to be significantly impacted in the focal group's discourse by the curricular intervention ($p < .05$). The evolution of the means and standard deviations of the focal group's discourse at Level 1 across days of curricular intervention are represented in Figure 4.3.

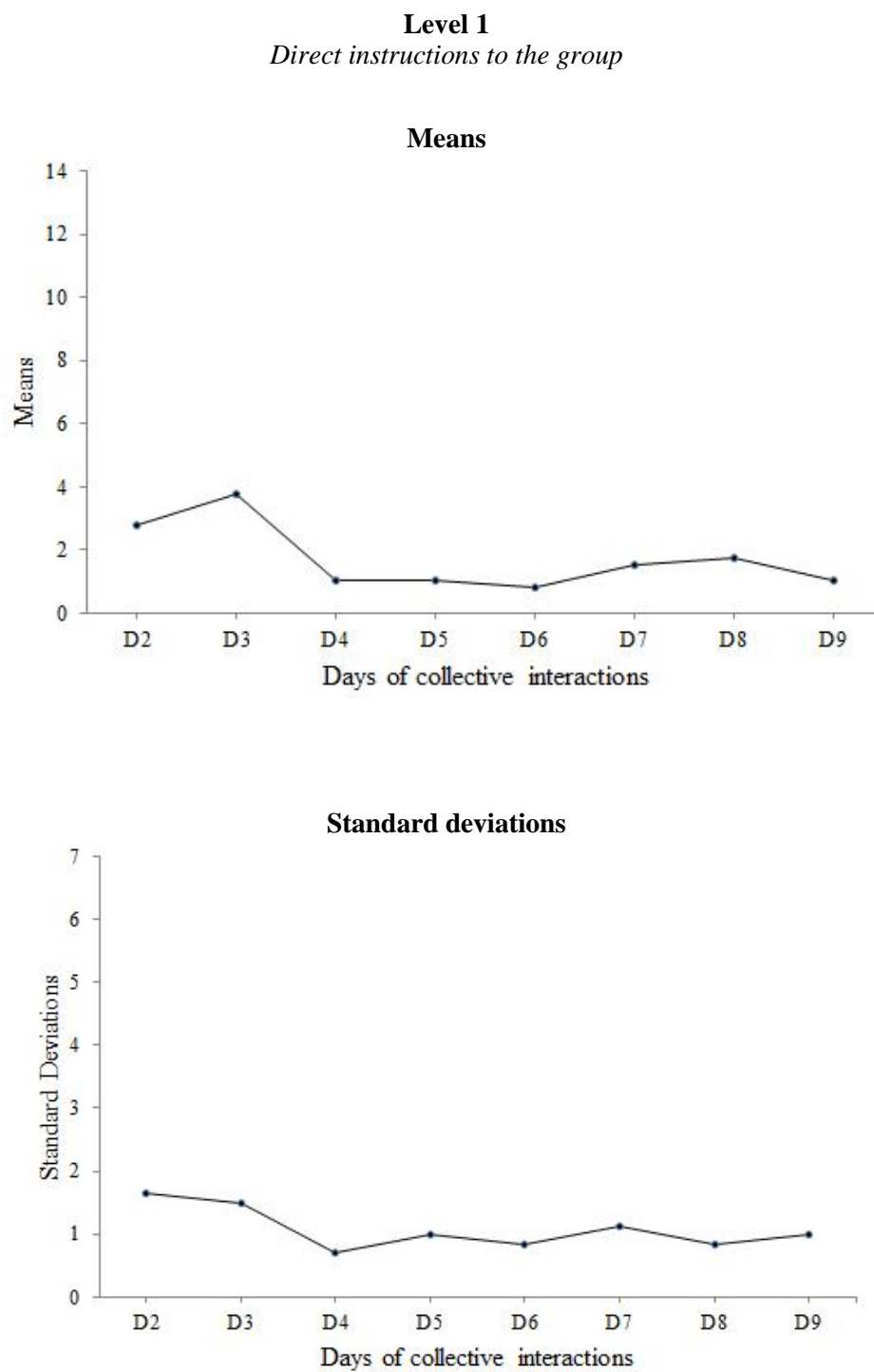
The means of the focal group's discourse at Level 1 indicate a slightly higher level of direct instruction to the group during the first two days of collective interactions. These first two days corresponded to the initial meetings and interactions of the focal group students, as well as to their collective organization on how to find new information in the VLE (by hunting for clues). It is thus not surprising to observe this slight increase, as the very nature of the tasks at Day 2 and 3 called for the initiation of new activities by the group. The lower and constant level of direct instruction found on the following days of activity also indicates that students' discourse only minimally served an organizational function for the group to handle the different tasks of the activity.

Table 4.3. Means and standard deviations per day of collective interactions and per levels of critical thinking abilities for the focal group's discourse.

Days of collective interactions	Levels of critical thinking abilities (from IA model ¹)													
	Level 1*		Level 2**		Level 3		Level 4		Level 5**		Level 6**		Level 7	
	<i>Direct instructions to the group</i>		<i>Sharing new information</i>		<i>Situated definition</i>		<i>Intersubjectivity & dissonance</i>		<i>Negotiation & co-construction</i>		<i>Testing tentative constructions</i>		<i>Reporting application of newly constructed knowledge</i>	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
D2	2.80	1.64	5.80	4.44	9.80	6.65	6.20	4.32	1.00	2.24	0.00	0.00	0.20	0.45
D3	3.75	1.48	4.75	2.95	9.00	3.67	10.75	4.66	1.25	1.30	1.25	0.43	0.00	0.00
D4	1.00	0.70	2.00	1.87	5.80	4.97	7.20	6.53	1.40	1.95	0.00	0.00	0.00	0.00
D5	1.00	1.00	2.20	1.10	7.00	5.24	5.20	3.83	3.60	3.21	0.80	0.84	0.00	0.00
D6	0.80	0.84	1.40	2.07	6.00	5.61	5.40	4.98	2.40	3.05	0.80	0.84	0.00	0.00
D7	1.50	1.12	1.75	1.48	7.75	2.28	7.50	3.64	6.00	5.52	2.75	1.64	0.00	0.00
D8	1.75	0.83	3.25	1.92	5.00	1.22	12.75	5.97	13.25	5.93	2.75	1.30	0.75	1.30
D9	1.00	1.00	0.60	0.89	4.40	3.29	7.20	3.19	4.40	4.39	0.60	0.90	0.20	0.45
Overall Mean	1.70	1.08	2.72	2.09	6.84	4.12	7.78	4.64	4.16	3.45	1.12	0.74	0.14	0.28

Note. * level impacted by curricular intervention at $p < .05$; ** level impacted by curricular intervention at $p < .01$; M: mean; SD: standard deviation; 1) Hull & Saxon, 2009

Figure 4.3. Evolution of focal group's discourse means and standard deviations at Level 1 (direct instructions to the group) across days of collective interactions.



Finally, the constant and low level of standard deviations of the focal group's discourse at Level 1 ($SD= 1.08$) also indicates that very limited variability existed in the group in contributing to this organizational discourse.

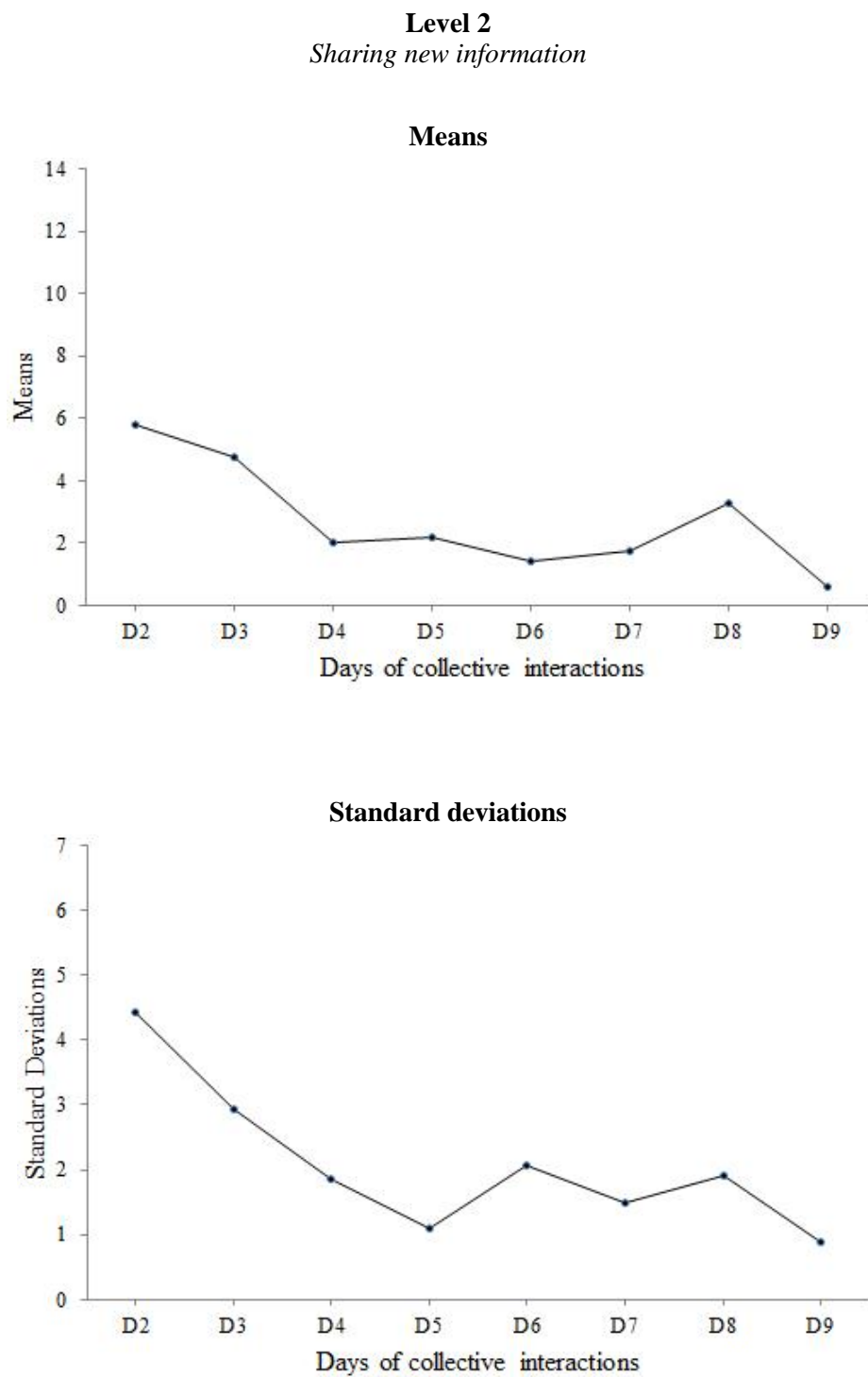
Descriptive statistics at Level 2

Level 2 (sharing new information) of the IA model levels of critical thinking abilities was found to be significantly impacted in the focal group's discourse by the curricular intervention ($p < .01$). The evolution of the means and standard deviations of the focal group's discourse at Level 2 across days of curricular intervention are represented in Figure 4.4.

The means of the focal group's discourse at Level 2 indicate a fairly steady decrease of information not previously discussed in the group's discourse, with higher levels of new information during the first two days of activity. Here again, these results are not surprising, inasmuch as the very nature of the tasks at Day 2 and 3 were designed for students to gather and share new information amongst themselves. These means indicate that this is precisely what the focal group students did on these days, while subsequent days were characterized by the construction of a discourse which relied less and less on the presentation of new information, but, rather, on the discussion of previously mentioned elements.

Nevertheless, standard deviations indicate that considerable variability was displayed among students in the group in contributing to sharing new information during Day 2 – Day 4, which then decreased to some extent. This result seems to indicate that some students might have been more important contributors of new information than others in the group's discourse during the first days of activity, but also, although to a lesser extent, during the rest of the activity. This specific result will be further discussed in the section dedicated to answering RQ#2.

Figure 4.4. Evolution of focal group's discourse means and standard deviations at Level 2 (sharing new information) across days of collective interactions.



Descriptive statistics at Level 3 and Level 4

Level 3 (situated definitions) and Level 4 (intersubjectivity and dissonance) of the IA model levels of critical thinking abilities were not found to be significantly impacted in the focal group's discourse by the intervention. Nevertheless, a look into the descriptive statistics at these two levels was deemed of interest since, despite this lack of significance, Level 3 and Level 4 comprised the highest means in the focal group's discourse during the overall curricular intervention ($M_{Level\ 3} = 6.84$; $M_{Level\ 4} = 7.78$). What these results indicate is that Level 3 and Level 4 utterances were constantly and highly present in the focal group's discourse, at all points of the curricular intervention, regardless of the problem-solving tasks at stake.

These results are important, notably at Level 3 (situated definitions), as they tend to corroborate results on *positive* negotiation of meaning and *grounding* (Brooks & Donato, 1994; Foster & Ohta, 2005; Jauregui, 1997; Van den Branden, 1997; Vandergriff, 2006), as discourse in episodes of negotiation of meaning among L2 learners primarily develops on the establishment of common ground among the interlocutors. Results from this study at Level 3 seem to validate Vandergriff's (2006) statement about the importance of grounding, in comparison with language correction which has more often been the focus of a predominant trend of research on L2 negotiation of meaning:

The concept of grounding shifts the focus away from miscommunication and learner deficiency that is at the core of acquisition-based negotiation research, to highlighting its crucial role in interactive talk where participants work together to co-construct discourse (p.112)

At Level 4, these results are also important, as they indicate that opportunistic dissonances, which we have considered crucial as the first step towards a collective process of negotiation of meaning, aiming at the eventual co-construction of new meaning, were indeed highly and constantly present during the entire problem-based activity, regardless of the specific task at stake.

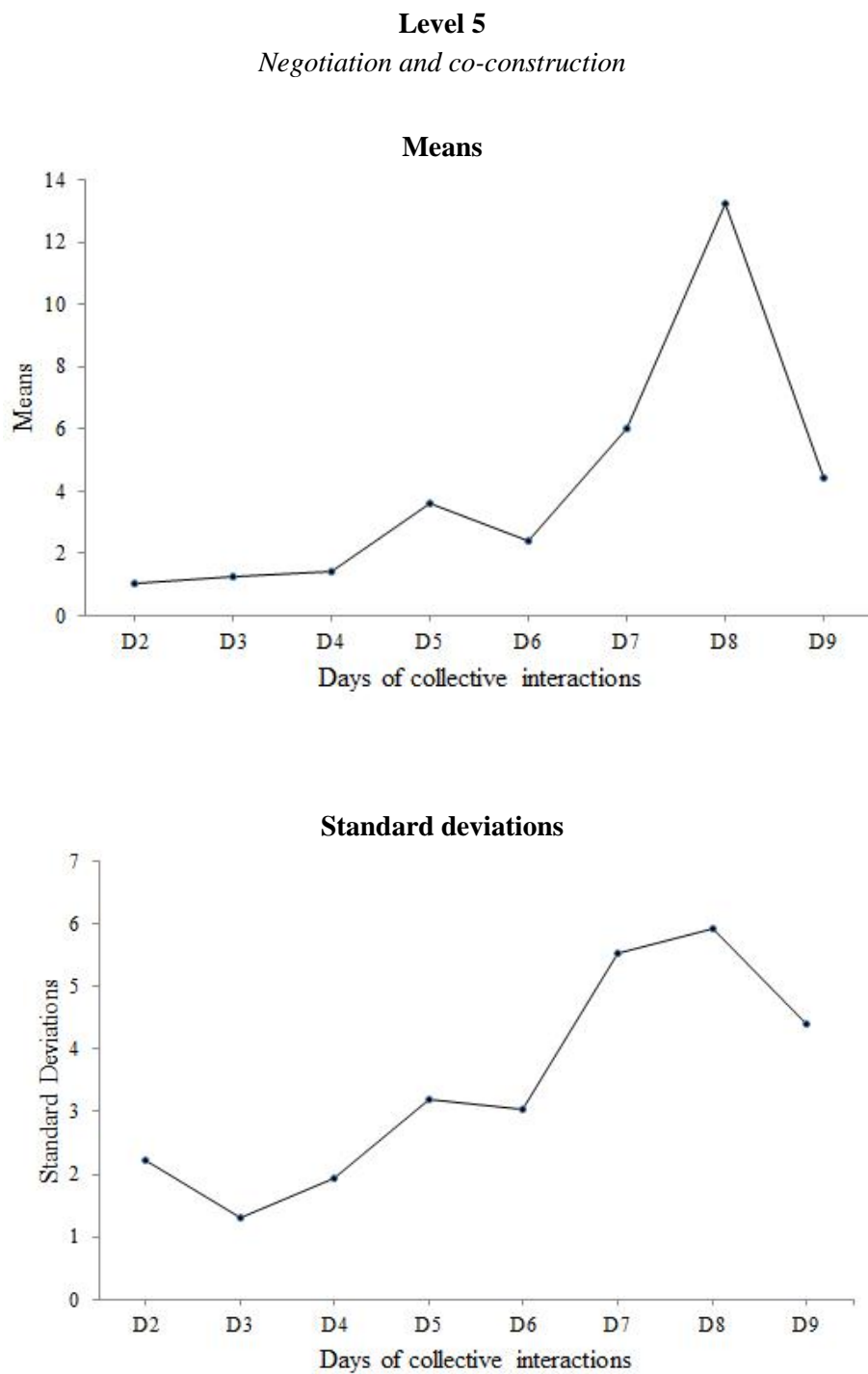
Nevertheless, it is also important to note that the standard deviations at Level 3 and Level 4 were also the highest during the overall curricular intervention ($SD_{Level\ 3} = 4.12$; $SD_{Level\ 4} = 4.64$). What these high levels of standard deviations indicate is that considerable variability existed among students in the focal group, in their production of utterances at Level 3 and Level 4. This specific result will be further discussed in the section dedicated to answering RQ#2.

Descriptive statistics at Level 5

Level 5 (negotiation and co-construction) of the IA model levels of critical thinking abilities is the level of particular importance for this study, as it centers on L2 negotiation and co-construction of meaning. Level 5 was found to be significantly impacted in the focal group's discourse by the intervention ($p < .01$). The evolution of the means and standard deviations of the focal group's discourse at Level 5 across days of curricular intervention are represented in Figure 4.5.

The means of the focal group's discourse at Level 5 indicate an increase in higher mental functioning and attempts to bridge differences in situated definitions (Hull & Saxon, 2009). With lower levels of negotiation and co-construction during the first three days of the activity, the group progressively increased its discursive attempts at bridging dissonances on Day 5, reaching a peak on Day 8, which corresponds to the day when students were involved in building collective viable reasoning (consensus-building task). The progression of these means at Level 5 indicates that as students from the focal group relied less and less on sharing new information (see results at Level 2), that is to say on a presentational function of their collective discourse, they tended to produce more and more analytical discourse which resulted from the many dissonances that appeared among them in their interpretation of the information they found and shared (see results at Level 3 and Level 4). The means at Level 5 thus seem to indicate that the function of the focal group's discourse to serve as a semiotic mediator increased across days of the

Figure 4.5. Evolution of focal group's discourse means and standard deviations at Level 5 (negotiation and co-construction) across days of collective interactions.



curricular intervention.

Nevertheless, we must note that the standard deviations at Level 5 also increased, with lower levels during the first three days of activity, followed by a considerable increase, until reaching a peak at Days 7 and 8. This steady and considerable increase of the standard deviations at Level 5 shows needs to be compared with the simultaneous increase in means. Results thus indicate that, as the collective discourse produced by the focal group tended towards higher levels of mental functioning, the variability among students in the group also increased, with more and more differences in contribution from students. In other words, some students made more sizeable contributions than others in the development of this analytical discourse. These asymmetrical contributions will be further discussed in the section dedicated to answering RQ#2.

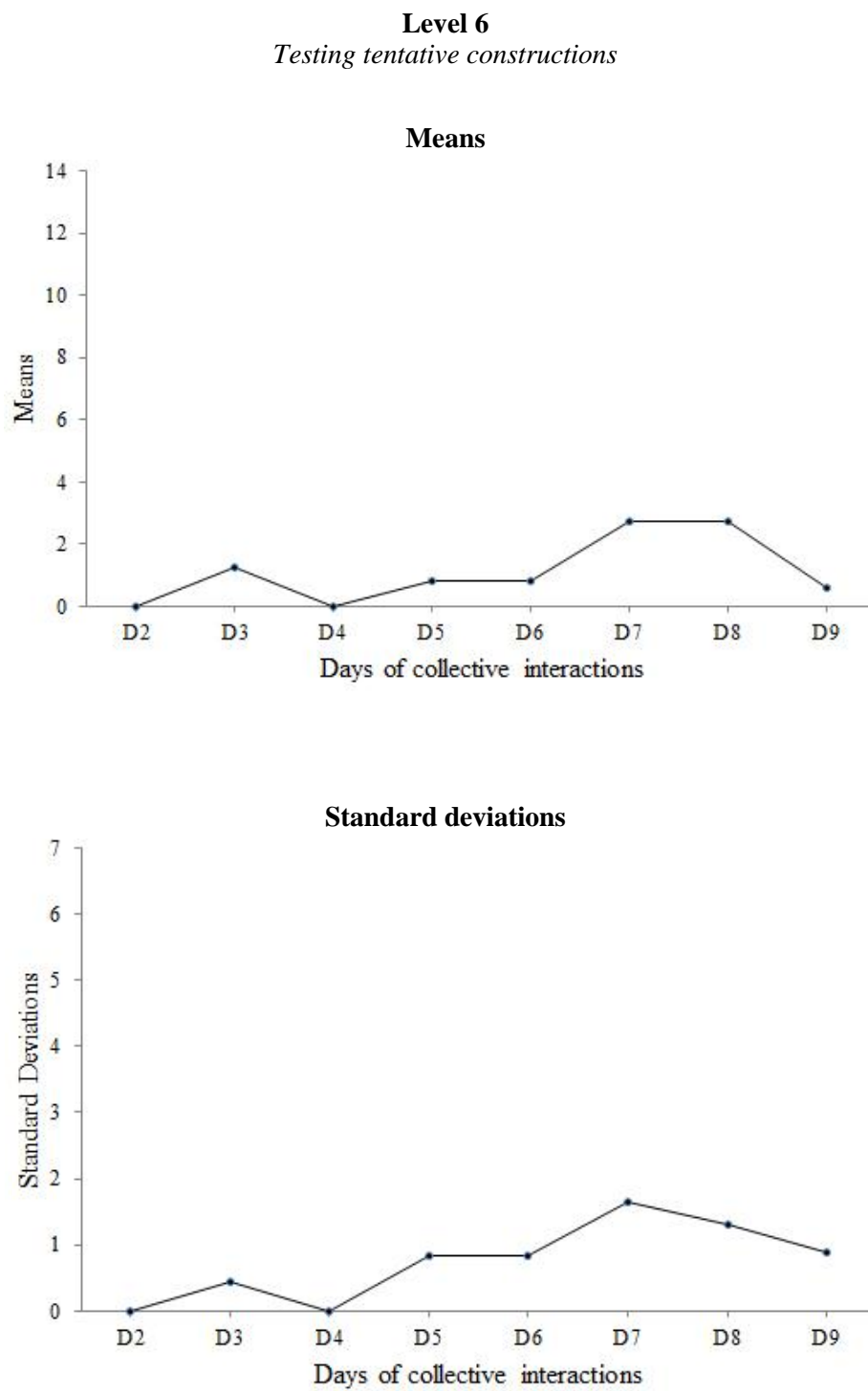
Descriptive statistics at Level 6

Finally, Level 6 (testing tentative constructions) of the IA model levels of critical thinking abilities was found to be significantly impacted in the focal group's discourse by the intervention ($p < .01$). The evolution of the means and standard deviations of the focal group's discourse at Level 6 across days of curricular intervention are represented in Figure 4.6.

The means of the focal group's discourse at Level 6 indicate a small increase of discussions aiming at testing tentative constructions in the group's discourse, with very low levels during the first six days of the activity, and slightly higher levels reached at Days 7 and 8, during the consensus-building phase of the activity. What these results seem to indicate is that the focal group's discourse did not extensively serve to generate hypotheses, nor served to test the viability of the collective reasoning being constructed, except at the moment of reaching a collective consensus.

Furthermore, the standard deviations at Level 6, which increased slowly but steadily during the activity, show that, although not considerable, some variability

Figure 4.6. Evolution of focal group's discourse means and standard deviations at Level 6 (testing tentative constructions) across days of collective interactions.



appeared among students in the group in terms of their contribution to the testing of tentative constructions. Some students thus seem to have contributed more than others, notably on Days 7 and 8, when the number of Level 6 utterances was also the highest.

Results on the sequential analysis of the focal group's discourse

The third objective of the different statistical analyses conducted on the primary data set (the focal group's discourse) was to establish, through a sequential analysis, whether significant discursive patterns existed in the focal group's discourse, by determining whether specific types of two-event interactions were over- or under-represented in this discourse (Jeong, 2005). Three possible discursive patterns could be found, based on the nature of the two-event interactions under study, as related to the seven incremental levels of critical thinking abilities from the IA model (Hull & Saxon, 2009):

- Discursive patterns corresponding to *plateaus*, when a unit of meaning of a given level was followed by a second unit of meaning at the same level. The following excerpt from the focal group's discourse is an illustration of such discursive plateaus, at Level 4 (intersubjectivity and dissonances), as happening on Day 4 of the activity:

(2)	Bernard:	<i>J'ai aussi trouve un billet de cinema que appartient a Anais</i>	<i>I found a movie ticket also who belongs to Anais</i>
(4)	Florence:	Qui est-ce que c'est Anais ?	Who's Anais?
(4)	Bernard	Je ne sais pas	I don't know
(4)		mais elle est la sœur de Lea	but she's Lea's sister
(4)	Florence:	Oui, le secret est que Bernard et moi sont ensemble	Yes, the secret is that Bernard and me is together
(4)		mais Bernard a une femme	but Bernard has a wife

(4)	Bernard :	Je crois que Anais et moi sont marie	I think Anais and me is married
(4)	Jacqueline :	Quoi ?	What?
(4)	Florence :	Lea est une amie de ta femme, Bernard ?	Is Lea a friend of your wife's, Bernard?
(4)	Bernard:	Je ne sais pas surement	I don't know surely

- *Direct* discursive patterns, when a unit of meaning of a given level was followed by a second unit of meaning at the next superior or inferior level. The following excerpt from the focal group's discourse is an illustration of such direct discursive patterns, as happening on Day 5 of the activity:

(2)	Florence:	Elodie est la docteur	Elodie is the doctor
(2)		et elle a donne Hallicoron a Marc Bovy	and she gave Hallicoron [a drug] to Marc Bovy
(3)	Jacqueline:	Oui !	Yes!
(4)	Florence:	Est-ce que Audrey a pris de Hallicoron ?	Did Audrey take Hallicoron?

- *Indirect* discursive patterns, when a unit of meaning of a given level was followed by a second unit of meaning at any other (but not next) superior or inferior level. The following excerpt from the focal group's discourse is an illustration of such indirect discursive patterns, as happening on Day 6 of the activity:

(2)	Benard:	Marc Bovy a dit que il n'a jamais vu Audrey comme une client	Marc Bovy said he never saw Audrey as a client
(2)		et il ne sais pas qu'elle est enceinte	and that he don't know she is pregnant
(6)	Jacqueline:	Peut-etre il n'a pas besoin de voir Audrey comme une client pour mourir elle	Maybe he doesn't need to see her as a client to die her
(4)	Daniel:	Mais qu'est-ce que nous pensons de l'incendie ?	But what are we thinking about the fire?

Both direct and indirect discursive patterns could thus be further examined in terms of whether the discursive patterns involved a transfer towards *superior* levels of critical thinking abilities, or, inversely, *inferior* levels of critical thinking abilities. Furthermore, all three categories of discursive patterns (plateau, direct, or indirect) were examined based on their over-representation or under-representation in the focal group's discourse, for each day of collective interactions.

Figure 4.7 is a summary of results of this sequential analysis, presented in terms of plateaus, then direct patterns (first superior, then inferior), and finally indirect patterns (first superior, the inferior).

Discursive patterns as plateaus

The sequential analysis first indicates that the focal group's discourse was primarily characterized by the highly significant over-representation of plateaus at all levels of critical thinking abilities (except for Level 7 – Reporting application of newly constructed knowledge), ($p < .01$).

A look into the evolution of these plateaus across the different days of the curricular intervention also indicates that, as students progressed in the problem-based activity, their discourse tended to be characterized by the formation of plateaus at higher levels of critical thinking abilities, while maintaining plateaus at lower or intermediate levels of critical thinking abilities. Regarding the four levels of critical thinking abilities that Friedman's test showed to be significantly impacted by the curricular intervention (Level 1: direct instructions to the group; Level 2: sharing new information; Level 5: negotiation and co-construction; and Level 6: testing tentative constructions), the plateaus found through the sequential analysis indicate what follows.

Figure 4.7. Results on sequential analysis: nature of the focal group’s discursive patterns in terms of levels of critical thinking abilities

Days of collective interactions Nature of discursive patterns	Discursive patterns found to be significantly															
	over-represented								under-represented							
	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9
Plateau at																
Level 1	**	**	**		**	**	**									
Level 2		**		**	**		*									
Level 3	*		*		**	**		**								
Level 4	**		**			**	**	**								
Level 5			**		**	*	**	**								
Level 6						**										
Level 7																
Direct transfer of discourse to Next superior level																
Level 1 → Level 2			*			**										
Level 2 → Level 3							**	**								
Level 3 → Level 4											*					
Level 4 → Level 5	*															
Level 5 → Level 6																
Level 6 → Level 7								**								
Next inferior level																
Level 7 → Level 6																
Level 6 → Level 5							*									
Level 5 → Level 4																*
Level 4 → Level 3											*			*		*
Level 3 → Level 2													*			
Level 2 → Level 1																

Figure 4.7. Continuation.

Days of collective interactions	Discursive patterns found to be significantly															
	over-represented								under-represented							
Nature of discursive patterns	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9
Indirect transfer of discourse to Superior level																
Level 1 → Level 3									*							
Level 1 → Level 4										**	*					
Level 2 → Level 4									*		*					
Level 2 → Level 5															**	
Level 4 → Level 6		*														
Level 5 → Level 7	**															
Inferior level																
Level 3 → Level 1									*							
Level 4 → Level 1									*							
Level 4 → Level 2									*		**					
Level 5 → Level 3															*	
Level 6 → Level 4				*												
Level 7 → Level 2							*									

Note. * $p < .05$, ** $p < .01$; Level 1: direct instructions to the group; Level 2: sharing new information; Level 3: situated definitions; Level 4: intersubjectivity and dissonances; Level 5: negotiation and co-construction; Level 6: testing tentative constructions; Level 7: reporting application of newly constructed knowledge.

Discursive plateaus at Level 1 (direct instructions to the group) can be found in 6 of the 8 days of collective interactions. If compared with the previously discussed means and standard deviations found at Level 1, this result indicates that, although students' discourse only minimally served an organizational function for the group to handle the different tasks of the activity, it was nonetheless characterized by a short yet concentrated attention of the group as a whole to the organization being discussed.

Discursive plateaus at Level 2 (sharing new information) can be found in 4 out of the 8 days of collected interactions, and in a more scattered fashion than the plateaus at Level 1. Plateaus at Level 2 were more prominently found on days when students were actively looking to collect new information, through clue hunting (at day 3) or through interviewing other students (days 5 and 6). If compared with the previously discussed means found at Level 2, this result indicates that, although the presentational function of focal group's discourse decreased as the activity progressed, any newly shared information would tend to become the center of attention in the group's discourse. Nevertheless, if compared with the previously discussed standard deviations found at Level 2, this result also indicates that, as some students contributed more than others to the sharing of new information, it is these students, as providers of information, who would thus tend to be mainly responsible for these discursive plateaus at Level 2.

Discursive plateaus at Level 5 (negotiation and co-construction) can be found in 5 of the 8 days of collective interactions, and most systematically during the last four days of collective interactions (at days 6 through 9). If compared with the previously discussed means found at Level 5, this result indicates that, as the focal group's discourse served more and more to bridge students' dissonances in the progression of the activity, discursive events of negotiation and co-construction would become the center of attention in the group's discourse. Nevertheless, it is important to keep in mind the increase in standard deviations found at Level 5, which showed that increasing variability emerged among students in their respective contributions to bridging dissonances. It is thus

possible that these Level 5 plateaus indicate that some students in the group would tend to have a more prominent role as negotiators and co-constructors of the group's discourse, as they dominated the formation of plateaus at Level 5.

Finally, discursive plateaus at Level 6 (testing tentative constructions) can only be found in one of the 8 days of collective interactions, on Day 7. If compared with the previously discussed means found at Level 6, this result indicates that, as the group's discourse minimally but increasingly served to generate hypotheses, as a result of only five days of collection, presentation, discussion, negotiation, and co-construction of information and dissonances did the focal group truly concentrate on testing the viability of their collective reasoning. Nevertheless, if we relate these results to the previously discussed increase in standard deviations at Level 6, it is possible that Level 6 plateaus indicate that the concentrated attention by the focal group on testing the viability of their collective reasoning covers disparities in contributions, with some students being more important hypotheses testers than others.

Direct discursive patterns

Although plateaus were the most prominently over-represented discursive patterns in the focal group's discourse, the sequential analysis also indicates that this discourse was characterized by some significant *direct* discursive patterns. Results show that direct discursive patterns of transfer towards the next *superior* level of critical thinking abilities tended to be significantly over-represented, while discursive patterns of transfers towards the next *inferior* level of critical thinking abilities tended to be significantly under-represented. These results thus show that, when a discursive plateau was exhausted, the focal group's discourse tended to progress towards the next higher level of critical thinking.

Of particular interest for this study are the significant direct discursive patterns involving Level 5 (negotiation and co-construction). That is, during the consensus-

building phase of the activity (at Day 8 and Day 9), the focal group's discourse displayed significantly over-represented transfers from Level 6 (testing tentative constructions) to Level 5 at Day 8, and significantly under-represented transfers from Level 5 to Level 4 (intersubjectivity and dissonances) at Day 9. This result indicates that, when involved in the construction of a collective viable reasoning, the focal group tended to respond to the different hypotheses generated by some students in the group by furthering the convergence of their collective and individual dissonances (from Level 6 to Level 5), rather than by further exposing and exploring their divergences (from Level 5 to Level 4).

Indirect discursive patterns

The sequential analysis also indicates that the focal group's discourse was characterized by some significant *indirect* discursive patterns. Results show that indirect discursive patterns of transfer towards both *superior* and *inferior* levels of critical thinking abilities tended to be significantly under-represented in the focal group's discourse.

Comparing these results with the ones on discursive plateaus and direct discursive patterns, it can be deduced that that focal group discourse very rarely transitioned away from discursive plateaus to erratic discursive patterns, moving unpredictably through the different level of critical thinking. On the contrary, the transition of their discourse out of a plateau tended to be more linear and progressive.

Summary of results answering RQ#1

The non-parametric test of variance with repeated measures (Friedman's test) indicated that the focal group's discourse was significantly impacted by the problem-based activity at four levels of critical thinking abilities: two lower levels (Level 1: direct instructions to the group; Level 2: sharing new information) and two higher levels (Level 5: negotiation and co-construction; Level 6: testing tentative constructions).

The descriptive statistics resulting from Friedman's test, and related to L2 negotiation and co-construction of meaning (Level 5) also indicated that the focal group's discourse was more prominently characterized by a considerable increase in discursive events of negotiation and co-construction of meaning across the days of collective interactions, with an important peak reached during the consensus-building phase of the problem-based activity. Nevertheless, the increase in standard deviations at Level 5 also indicated that, as the focal group's discourse tended towards more and more discursive events of negotiation and co-construction of meaning, the variability in the students' contributions also increased, thus showing that some students were much bigger contributors than others to the bridging of dissonances in the group.

Finally, the sequential analysis conducted on the quantified data set showed that the most prominent discursive patterns in the focal group's discourse were plateaus at all levels of critical thinking abilities (but the highest level). It was shown that, as the problem-based activity progressed, the focal group's discourse was characterized by the sustaining of discursive plateaus at lower levels of critical thinking abilities while developing newer discursive plateaus at higher levels of critical thinking abilities. Regarding negotiation and co-construction of meaning, the focal group reached and systematically maintained significant discursive plateaus at Level 5 during the second half of the problem-based activity, that is to say, during the consensus-building phase. Moreover, results on the sequential analysis indicated that the focal group's discourse progressed out of these discursive plateaus through significant, direct discursive transfers, from one level of critical thinking to the next superior one. These results suggest that the focal group's discourse displayed linear progressing patterns of evolution towards higher levels of critical thinking abilities.

Results for Research Question #2

The second objective of this study corresponded to RQ#2:

RQ#2: How do these learners individually perceive, experience, document, and express the impact of the specific problem-based virtual learning environment in which they were immersed on their L2 collective process of negotiation and co-construction of meaning? What does this perceived technological impact reveal in terms of these learners' L2 technology literacy skills?

To answer this question, the data analysis employed a qualitative analysis, influenced by instrumental case study and phenomenology. The primary set of data used to address RQ#2 consisted of the three sets of semi-structured interviews that were conducted before, during, and after the intervention with all five students from the focal group. This primary data set was further enriched by the analysis and triangulation of a secondary data set, composed of the on-screen video recordings of students' daily interactions, as well as the computer-generated logs of their individual notes, as taken in their multimedia *Detective Notebook*.

The emerging themes gathered through the qualitative analysis of these data sets were compiled and further reduced by cross-referencing them with the characteristics of the VLE (see definition of VLE in Chapter II) and its underlying pedagogical principles (i.e. the problem-based activity – see Figure 5 in Chapter III), as well as the different stages involved in the process of L2 negotiation and co-construction of meaning (see Figure 4 in Chapter II). The purpose of this reduction of themes was to capture the essence of the impact of the problem-based VLE on the students' process of L2 negotiation and co-construction of meaning as members of the focal group perceived and experienced it. The resulting portrait was also intended to inform a research exploring L2 learners' technology literacy skills.

Figure 4.8 is a summary of the themes which emerged in the three rounds of interviews, as reduced through a cross-referencing procedure involving the main characteristics of the VLE and its underlying pedagogical principles (i.e. the problem-based activity), as well as the main stages of the L2 negotiation and co-construction of meaning process. Each X in Figure 4.8 indicates that each given characteristic of the

problem-based VLE occurred at least once during the focal group students' interviews. We will now present these findings in more detail.

Perceived impact of avatars on social interactions and participation in the process of negotiation of meaning

In order to better understand how students considered that the problem-based VLE impacted their L2 negotiation and co-construction of meaning, in terms of their social interactions and participation, it is first important to understand how they considered collaborative learning in small groups and how they expected the intervention to take place. By understanding their expectations and anticipations, we will then be able to understand how certain aspects of the problem-based activity and VLE affected their social interactions and participation, most notably regarding the use of avatars, as mediators of their collective exchanges.

Anticipation of social interactions and participation through small collaborative groups in the VLE

A week before the implementation of the curricular intervention, during the first round of semi-structured interviews, students from the focal group were individually prompted to provide their personal opinion about social interactions in collaborative work in small groups, for learning purposes in general, and for the learning of French in particular. As they had received a one-hour training session on the basic functioning of the different technological tools at stake for the activity to come, they had had a chance to develop a first impression on the technology they were going to be using, and were also prompted to think about small group collaboration as they thought it was going to happen in this VLE. Their respective perceptions on this subject varied immensely.

Figure 4.8. Reduction of emerging themes: essence of the perceived impact of the problem-based VLE on students' collective process of L2 negotiation and co-construction of meaning.

	Stages of the L2 negotiation and co-construction of meaning process								
	Social interactions and participation with others			Dissonances		Arbitration and critical convergence			Thinking in French
Emerging themes in the focal group students' interviews	Anticipation of collaborative small groups	Assimilation of avatar identity	Anonymity induced by avatar	Malleability under pressure of dissonance	3D representation of space	Impact of information capital acquired in VLE on social dynamic	Arbitration as interconnection of information	Critical convergence and power relationships in the VLE	
Aspects of the problem-based VLE perceived to have an impact on L2 negotiation and co-construction of meaning									
Characteristics of the VLE									
• Immersive		X			X				X
• Multimodal				X		X			
• Social	X	X	X			X	X	X	X
• 3D representation of space					X				
• 3D persona representing learners (avatar)		X	X						
• Synchronous interactions				X				X	X
• Transfer of knowledge									
• Acting on the environment					X				
• Underlying pedagogical principles → Characteristics of the problem-based activity									
- Learner-centeredness									X
- Authenticity		X	X		X				
- Contextualization				X	X	X			
- Complexity				X		X	X	X	
- Multiple perspectives					X		X	X	
- Collaborative learning	X		X				X	X	
- Support of knowledge construction	X	X			X		X		

Jacqueline and Daniel regarded collaborative small group work in a very enthusiastic manner, considering it as something not only enjoyable but also, and more importantly, as a way to promote learning by enhancing cohesiveness through greater social proximity, leading to higher forms of social empathy among learners that they felt was beneficial to their learning of French. Charlotte and Florence were not as enthusiastic as Jacqueline and Daniel about collaborative small groups. Florence felt that personally, although she had no problem working in small groups and understood their purpose for the French class, whole-class teacher-led forms of instruction were more conducive to her learning. Charlotte, on the other hand, thought that collaborative small groups were fine, but that they could not prevent, any more so than whole-class settings, her being a shy person and getting extremely nervous when interacting in French, due to what she saw as her weaknesses. Finally, Bernard was openly resistant to collaborative small groups: “*je déteste group works*” (“I hate group works”), he even said sarcastically, considering that the collaborative-group aspect of the curricular intervention was going to be a real challenge for him. He considered that only individual learning in isolation was conducive to his French learning, and that, in all academic subjects, collaborative small group works tended to be a waste of his time, as he felt they were confusing social spaces where nothing tangible could really be accomplished. Nevertheless, he admitted that what he considered as a lack of success of collaborative small groups could be due to his ideological resistance to them and his consequent lack of active engagement.

What is important to notice is that no student commented on or anticipated the avatar-mediated nature of their upcoming interactions, and thus probably did not perceive it as something that would eventually condition their social interactions. More specifically, although Charlotte, Bernard, and Daniel mentioned their previous experiences using avatars in virtual worlds under the form of role-playing video games, such as *The Sims*, none of them mentioned that the use of a virtual persona could have the potential to impact their social interactions or their learning process.

“I am my avatar”

Half-way through the curricular intervention, as students from the focal group participated in the second round of semi-structured interviews, they finally considered the avatar-mediated nature of their social interactions more explicitly. All of them unanimously expressed that they had automatically and instinctively equated their own person to the character they each represented in the story, but also, and more importantly, to the avatar representing them in the VLE, as they admitted referring to him/her as “I”.

This natural and instinctive assimilation of their person into an alternative and different virtual persona was considered by all, and most notably by Daniel, as a means to better connect with the story, the activity, and their group partners, by increasing their capacity for suspension of disbelief which they felt was necessary to enhance their social interactions in the problem-based activity. At a linguistic level, they also thought that this assimilation in identity allowed easier and more efficient ways to communicate with each other in French, as they stated that it allowed them to use direct first-person accounts, rather than indirect third-person ones.

Avatars as a source of social anonymity: the human face
behind avatars

Students’ perceptions of the impact of avatars on their social interactions in the problem-based activity varied, but all had in common the fundamental awareness of the anonymity induced by these virtual personas in their social exchanges. Although they were all curious to discover which one of their classmates hid behind each avatar, all of them (but Bernard) stated that they did not feel the need to put a real human face on each avatar.

On the contrary, Jacqueline saw in this anonymity the potential for endorsing a different identity, which she felt was an interesting addition for learning French. More

importantly, she highlighted the fact that the use of an avatar had considerably affected her motivation, in the following:

When you're doing things physically, you get more embarrassed when you mess up. Doing it virtually, I didn't feel any anxiety doing all these things I wasn't super confident doing. If we were to go and do it physically now, I feel I'd be more prepared.

By lowering her inherent anxiety to expose herself and her imperfect command of French, the anonymity granted by the use of the avatar was experienced by Jacqueline as an opportunity for the creation of learning conditions that she saw as more conducive to taking risks and could eventually lead to a better transfer of skills.

In this same perspective, but surprisingly so considering her position on collaborative small groups, Florence stated that the anonymity provided by her avatar made her more comfortable and thus more eager to participate. What made her feel more comfortable, was the mediation of discourse through chat, which she felt allowed her to maintain synchronous and instantaneous communication in French, without having to cope with the stress inherent to face-to-face interpersonal exchanges, notably regarding pronunciation. She thus considered that avatars were key agents in sustaining and improving social interactions in the group, and that these sustained social exchanges were crucial in her French learning.

Charlotte found this anonymity perfectly natural and in adequacy with her everyday digital life, which she felt was constantly mediated by a virtual persona, although not necessarily represented in three dimensions, and characterized by the physical absence of those with whom social interactions are maintained (notably in social networks, such as *Facebook*). She felt that it really helped her French learning, but considered it awkward to be using an avatar in an academic setting, as if she considered that the classroom was remote from all the technological progress made by the digital age.

Daniel and Bernard, on the other hand, were more reserved regarding the impact of the avatar on their social exchanges in the group. At first, Daniel found it weird to some extent not knowing to whom he was actually talking. By the end of the activity, though, during the third round of interviews, he concluded that this anonymity was very positive in his social exchanges with others, as it helped prevent any pre-conceived judgment of and by the people with whom he was working. He considered that this anonymity had enhanced social interactions by making them prejudice-free and by consequently improving the establishment of a trust bond among group partners.

Bernard, on the other hand, had a much more negative impression of this mediation, all along the curricular intervention, finding that it was difficult for him to use an avatar as he needed to put a human face on his group partners to better connect with them. Rather he felt that he had simply been talking to a machine during most of the activity. It is the loss of facial expressions induced by using these virtual personas that concerned him the most, and made him doubt his group partners, as well as whether they were actually paying attention to what was being discussed, which he felt was to some extent a social impairment. Bernard simply did not feel that the use of avatars answered his social needs in the learning process, as he analyzed his own learning style and described that “being there physically help[ed him] be there mentally”.

Perceived impact of the problem-based VLE on dissonances in the negotiation of meaning process

The second stage of the collective process of negotiation and co-construction of meaning consists of a series of pressures, constraints, alternatives, and conflicts appearing among interlocutors, as dissonances arise in their discourse exchanges and in their social interactions.

In order to better understand how students considered that the problem-based VLE impacted their L2 negotiation and co-construction of meaning, in terms of their

reactions to arising dissonances in the group, it is first important to understand what they considered the role of technology for learning to be in their French learning. By understanding their previous technological habits and expectations, we will then be able to better understand the way in which they considered that dissonances arising in the group were affected by certain aspects of the problem-based activity and of the VLE, most notably by the alternative tools for learning and by the three-dimensional representation of space.

Students' expectations: technology for learning as a provider of ready-made answers

During the first round of interviews, students were first specifically asked to provide their own definition of technology. All five of them defined it, in essence, as “anything electronic, intended to make one’s life easier and more efficient”. Students were then more specifically asked about their use of technology for the learning of French. With the exception of Florence, who did not mention using anything specific, all the other students declared technology to be of three main tools when working on their French homework: online dictionaries, online translators, and grammar or conjugation reference websites. The following statement by Jacqueline is a fair representation of the essence of how all the students (except for Florence) described their use of technology for French learning purposes:

I use technology for French for a lot of verbs, that aren't in the book and that I can't find in the dictionary. I use *conjugation.com*. It's really helpful and it's fast. Sometimes, I use *Google Translate* if I don't want to spend 45 minutes trying to solve a paragraph. I'll type it in and then it'll say what it means, that way I can finish my homework.

It is the idea of technology for learning, not only as a time-saver, but also as a provider of ready-made answers that particularly emerged from the students' responses. What primarily appeared in these students' technological strategies for learning French was a certain level of indiscriminate and uncritical use of the internet capabilities, as a

source of what they considered to be mainly prescribed knowledge, under the form of a precise conjugation termination, of a one-on-one word translation, or of an entire paragraph translated in a literal and automatized manner. Congruent with this finding, and when prompted to expand on her expectations regarding the technology that was going to be used during the problem-based activity, Charlotte expressed that technology could help her to learn French. She continued by giving an example of how she pictured that help: “If we do exercises on the computer, and you type your answer and it responds back ‘this is wrong’ or ‘this is right’, I think it’ll help putting words together”.

Technology, in that sense, was perceived by anticipation as a corrector of students’ output accuracy, as a true-false automatized grader of the sort of closed-item grammatical activities that students were used to doing in their traditional classroom. The potential for alternative forms of learning intended to promote dissonances among students was thus not anticipated by the students.

Some more critical views of the use of technology were nevertheless expressed, notably by Daniel, who mentioned the lack of reliability of certain sources he tended to use, such as *Wikipedia*, and the consequent need to question them. Bernard was the one who demonstrated the most critical perspective towards the use of technology for learning French, when he expanded on his expectations regarding the technological tools that were going to be used. He openly stated being hesitant about how learning could take place in such a technological environment, and was particularly concerned by the fact that a foreign medium was going to be used. This, therefore, raised the possibility for him that not all technological media functioned the same, based on their underlying cultural anchor, and that the foreignness of the medium could be, in and of itself, a source of dissonances. Nevertheless, his critical concerns specifically targeted his ability to translate, which he felt was what learning French consisted of, and was thus something he perceived as being the biggest upcoming challenge in the problem-based activity, as mediated by the VLE.

In conclusion, what students' technological habits and expectations showed is that most of them were unaware of the possibility of considering technology as a setting for L2 negotiation and co-construction of meaning, through the manifestation of opportunistic dissonances for the benefit of their French learning. Rather, they tended to see it mainly as a source of unchallenged prescribed linguistic knowledge, capable of providing them with ready-made answers. With the exception of Bernard, who openly expressed critical views towards the capacity of technology to promote learning and the challenge that a foreign medium could represent, students in the focal group were enthusiastic at the idea of using technology but did not appear to possess pre-existing L2 technology literacy skills.

Developing malleability under the pressure of dissonances
in the problem-based VLE to create or reconstruct meaning

Dissonances in students' interactions during the intervention were perceived by some students to be impacted in the problem-based VLE by the tools for learning, or perceived lack thereof. Jacqueline and Bernard were the two students who repetitively addressed this point in their interviews, commenting on the lack of access to a "traditional dictionary" (i.e. an online dictionary) during their immersion into the problem-based VLE. Both of them felt at first that this lack of dictionary was a great source of negative dissonances. This finding was not surprising since, as mentioned earlier, notably in Jacqueline's profile, using a dictionary was a frequent and important learning act for these two students in the French classroom. In the activity, a French/English glossary of over 200 entries, built in the VLE as a corpus of the words, expressions, and grammatical information directly relevant to the activity and the story, was made available and accessible to all students. On-screen video recordings showed that both Jacqueline and Bernard made extensive use of it. Both students nevertheless showed acute signs of resistance to the dissonances arising from the absence of their

habitual tool for learning French. Despite the glossary, Bernard was highly concerned about the accuracy of the French he produced, and Jacqueline was afraid of missing something in her understanding of the story and of other people. Both of them also felt that the time pressure imposed by the instantaneity of chat interactions tended to amplify their worries.

For Jacqueline, the frustration induced by not being able to rely on a dictionary, while being immersed in the problem-based VLE, was very high, so much so that half-way through the activity during the second round of interview, she interestingly compared what she was experiencing to a cultural shock:

It just feels that you're literally thrown into this entire world, with only a couple of key words that you really, really know, and the rest, you just have to – or iffy about – and people are – you're trying to solve this problem and people are saying things to you and you are not sure what they mean and it's – it's frustrating. It's a culture-shock, I think.

What she ended up doing, she mentioned, was overcoming her frustration and lack of understanding by taking some perspective and using the broader context around the word or expression that had caused her dissonances, as provided by the multimodality of texts, to attempt a guess as to what it could mean.

When prompted to describe his frustration and the way in which he handled this problem, Bernard explained that working around his negative reaction to the lack of dictionary paradoxically turned into a positive experience:

I'm always that guy who, if I don't know a word, I'm just looking it up in the dictionary. What it [the problem-based VLE] does is that it makes you have to think for yourself rather than, in a school setting, you have your book, your notes, and things to look back at. But I like that you have to think for yourself, that you have to think on your feet, rather than rely on a book. I actually have to think about my pool of vocabulary when I'm trying to do something. It's making me have to actually think about what I'm going to say. I have to simplify, I have to find the best alternative to what I was going to say that was super drawn out in English, and how to condense it into French. Maybe it might not be condensed, but it gets to the point. The other day, I didn't know what 'an affair' was in French, so I just put that they were making love in French. That

way, to me, it makes sense. I don't know if it's correct, but it makes sense to me.

In both Jacqueline's and Bernard's cases, the impact of the VLE on their individual dissonances, inasmuch as it prevented them from accessing a "traditional dictionary", was first perceived to be emotionally negative, as they described this experience as highly frustrating. It nevertheless ultimately had a perceived positive impact on the way they individually handled the dissonances arising in the group, as it compelled them to develop alternative strategies and some malleability under the pressure of these dissonances. To compensate for the lack of ready-made prescribed definition and structure provided by a dictionary, Bernard moved away from translating and undertook rather the creation of discourse and meaning, anchored in his own linguistic resources, while Jacqueline attempted to reconstruct meaning by bridging the gaps in her understanding with the cues provided by the surrounding multimodal context.

Dissonances and the three-dimensional representation of space

The second reported impact of the problem-based VLE on students' dissonances concerned the three-dimensional representation of space in the VLE. Charlotte and Florence mentioned that they first had some technical difficulties with the three-dimensional representation of space, inasmuch as they felt that moving around could be a challenge at first, and could consequently impede their development of a sense of spatial orientation.

But once better acquainted with the manipulation of the space, Charlotte highlighted the importance of this three-dimensional representation in her attempts to better handle the different rising dissonances in the problem-based activity. What Charlotte, as well as Daniel and Bernard, mentioned was that this three-dimensional representation of space was a crucial visual anchor, which helped them in managing dissonances inasmuch as they felt that they undertook an experiential understanding of

the story by visiting the different locations. Charlotte more specifically mentioned the relative spatial position of each building in the VLE, and how traveling through the town helped her gain a sense of how close or how distant these buildings were to one another, and the consequent implications of such relative spatial distance for the understanding of the story. Imagining the same activity on paper or in a face-to-face setting, Charlotte and Daniel concluded that this sense of authenticity on which their experiential understanding of space relied would be lost.

Daniel furthered his point by mentioning that this experiential aspect induced new forms of learning French for him. By developing the impression of being immersed in “his own world”, he felt that he was part of a new learning atmosphere which had significantly revived his interest in the learning of the language, and, consequently, his will to fully engage in the resolution of dissonances and of the complex problem at stake in the activity.

Conclusion on impact of the problem-based VLE on dissonances

In conclusion, students in the focal group revealed that they had a pre-conception of technology for learning French that was, to a great extent, incongruent with the potential to develop L2 negotiation and co-construction of meaning. They did not consider technology as potentially supporting the rising of opportunistic dissonances, but, as an automatic provider of ready-made linguistic answers that they would use habitually and indiscriminately. In that sense, it can be argued that students from the focal group had no tangible pre-existing L2 technology literacy skills.

During the curricular intervention, the different dissonances that arose in the group, as students progressed in their interactions through chat, were perceived to be impacted by the problem-based VLE in two ways.

First, Jacqueline and Bernard were challenged in their pre-existing learning style, relying on the extensive use of a dictionary, by the lack of access to such a tool for learning (despite the accessibility to a glossary). Both students demonstrated a form of resistance towards the pressure of the dissonances they were experiencing (as associated to the accuracy of their L2 comprehension and production), as well as to the time pressure they felt was induced by the chat. Their resistance took the form of a high level of frustration, likened by Jacqueline to a feeling of a cultural shock. These findings are crucial as they are related to focus-on-form and to chat affordances. Both students nevertheless ended up developing malleability towards these dissonances, by adopting new learning strategies, such as taking more into account the context provided by the multimodality of texts provided by the VLE, or finding alternative ways of creating meaning, rather than relying on translation.

Second, the three-dimensional representation of space in the VLE provided students like Charlotte, Daniel, and Bernard with a visual and spatial anchor that allowed them to further experientially explore the different dissonances they were encountering, and to thus be affected in their negotiation of meaning by the very space in which they were immersed. These findings are important regarding the overall research on L2 negotiation of meaning, insomuch as they indicate that *grounding* was also supported by the three-dimensional representation of space in a VLE.

Finally, in view of these results and of the variety of dissonances, as induced by certain aspects of the VLE, it is important to put into perspective the non-significant results obtained through statistical analysis at Level 3 (grounding through situated definitions) and Level 4 (intersubjectivity and dissonances), insomuch as they seem to be contradicted to some extent by what students mentioned in their interviews. Descriptive statistics (means) had also indicated that students had constantly produced a high number of utterances at Level 3 and Level 4 across the different days of activity. What can be argued is that the IA model had no indicators that could account for the specific types of

grounding (Level 3) or dissonances (Level 4) that were related to aspects of the VLE, as students mentioned in their interviews.

Perceived impact of the problem-based VLE on arbitration and critical convergence

The third stage of negotiation of meaning consists of a process of arbitration of the different dissonances arisen in the discursive exchanges. It is a stage where dissonances are sorted through by means of a variety of social and cognitive procedures. The outcome of this arbitration stage consists of the actual co-construction of new meaning, as the interlocutors reach a critical convergence, that is to say, a point at which the arbitrated dissonances assemble in a structure which is perceived as viable by the individual and/or the group.

In order to better understand how students considered that the problem-based VLE impacted their L2 negotiation and co-construction of meaning, in terms of their arbitration of dissonances and their subsequent critical convergence, it is important to relate it to the social dynamic of their group. We will now present how students considered that their arbitration process and their subsequent critical convergence were affected by certain aspects of the problem-based activity and of the VLE, most notably by the multimodal clues disseminated in the VLE.

Arbitration and the perceived impact of information capital, as acquired in the VLE

Students in the focal group were prompted during the second and third interviews to reflect on the social dynamic of their group, as well as on their own role in that group. All five students provided an unexpected answer by considering that the VLE had an impact on their group's social dynamic.

According to the students, the role of leader in the group was first and foremost determined by the amount of information one would have collected in the VLE, primarily

under the form of multimodal texts disseminated in the environment (i.e. clues) and collected at Step 2 of the activity, but also testimonies collected with other characters/students during interrogation time at Step 3 of the activity (see Figure 4.2). All the students thus equated leadership ability with the acquisition of an opportunistic capital of information to share with the group. They felt that leadership was determined by the conditions under which information had been gathered from the VLE, and was consequently the role assumed by the person who had acquired the biggest capital of information.

All five students agreed that, during the entire activity, Jacqueline had assumed this role, and all of them justified their choice (including Jacqueline herself) by saying that she was the one who had collected the most information. This point was confirmed in the computer-generated logs of students' Detective Notebook, which showed that Jacqueline had gathered 15 clues, Charlotte and Daniel 8 each, Florence 6, and Bernard 4. Conversely, students also felt that one who had not been able to acquire much information was simply constrained to assume a role of follower. It is in that sense that Charlotte and Bernard considered themselves as followers in the group, which was at odds with their otherwise leader-like every day social roles, by confessing that they tended to be more leader-like in their real life. Florence and Daniel, on the other hand, considered themselves as active helpers in the group. Daniel also confessed assuming a more leader-like role in his everyday life, while Florence conversely mentioned being usually more passive in a group's dynamic. From this qualification by students of their perceived social role at the arbitration stage of their L2 negotiation of meaning process, a first interpretation can be proposed related to the statistical results presented earlier, regarding the widening of variability in standard deviations among students at Level 5 (negotiation and co-construction). That is, it can be argued that the difference in engagement reflected by the variety of these social roles further mirrors the widening

variability in their production of Level 5 utterances in the overall discourse they produced.

What is also important in these findings is that all these students expressed that they perceived that the VLE had a direct impact on their social dynamic and role, for the process of arbitration of dissonances, by way of the capital of information it could lead them to acquire. It was the quantity of information that one would consequently be able to share with the rest of the group that they felt determined their social function in the group. None of these students expressed having considered the quality, rather than the quantity, of the type of information they had to share in assessing the group dynamic. No discrimination was expressed by any of the five students on the relevance of information contained in the clues collected. Moreover, none of the students considered that social roles could be traits of character or a particular social ability, and they also did not consider that it could be impacted by the conditions of the language used to establish those social interactions (an L1 or an L2). These results tend to demonstrate that no tangible L2 technology literacy skills were at work as the focal group was involved in the arbitration phase of their L2 negotiation of meaning process.

Arbitration as interconnection of information and
management of disagreements: perceived success and
failure

As students felt that the heart of the problem to be solved resided in the information contained in the clues, disseminated in the VLE, they expressed that the arbitration process in their negotiation of meaning centered on their ability as a group to connect the different pieces of the puzzle that these clues represented. In essence, all five students equated the arbitration process to a collective procedure of interconnection of information, as first individually interpreted, then relayed to the rest of the group, and, if disagreement arose, had further discussions.

In that respect, Daniel and Charlotte mentioned that the organization of their notes and deductions in their *Detective Notebook* had a positive impact on their ability to better arbitrate their dissonances with the rest of the group. Nevertheless, this process of interconnection was not experienced the same by all students. The perceived success or failure of interconnection of information was expressed by all five students in terms of how they had experienced disagreement in the group's dynamic.

Florence, Daniel, and Jacqueline talked about it as a positive experience, highlighting the fact that it was what helped them the most in making sense of the story. Florence declared that creating interconnections was easy, and felt she contributed to maintaining its establishment by restating or repeating key elements, to make sure that all group members were on the same page. She considered disagreements as simple events of simultaneous interpretations: "When there's a disagreement", she said, "the other person tries to explain why a certain point doesn't necessarily mean what that person thinks it means". Daniel had a more critical view on the group's process of arbitration of dissonances and on disagreements, which he felt had taken place as a series of questioning and defending:

I don't feel that we agree a lot because we always have a lot of questions. We'll agree on something and then someone will bring another point, and then we'll just start asking question after question, so we don't necessarily come to the same conclusion. Some of us do, but sometimes, we're divided. So we defend ourselves using the clues that we found and explain why it would make sense

This point was not mentioned by Florence in her interviews, but the analysis of her *Detective Notebook* personal notes, as well as of her on-screen video recordings, revealed that she was the first contributors of questions in the arbitration stage of the group's negotiation of meaning process, testing her group members' propositions and asking them to provide evidence to support their claims.

Jacqueline, as the leader in the group, considered disagreements in the group's attempts to interconnect information as something crucial and highly positive to ensure the future validity of their final reasoning:

My group members, they're good about not always saying "yeah, yeah! We agree, we agree!". They're good about being like "No, this is what I think", which is helpful because you need people to be like "No! this is why it's different, because I have this fact and this fact", and you can't just have people agree with you, otherwise you're going to come to the wrong conclusion. Because we only have fragmented clues, so you need each other to put the clues together, and if everybody's agreeing with you all the time, then you're just going to go way off into a different direction.

She perceived the group's dynamic in the stage of arbitration as balanced and deprived of all power relationship. She did not consider, as will be presented in the next section, that some group members' contributions had taken ascendancy over others' in the arbitration phase.

These findings on disagreement in the group tend to corroborate the statistical results previously presented, regarding the impact of the curricular intervention on the group's discourse at Level 5 (negotiation and co-construction), as students themselves also seem to have perceived and experienced this impact.

Charlotte and Bernard, on the other hand, had a more negative perception of this arbitration process, feeling that exchanges in the group were not conducive to the interconnection of information they felt was needed. Their appreciation of the arbitration stage can be related to the social role they felt that they were fulfilling in the group, that is to say one of followers, who did not or could not actively contribute to the management of the group's dissonances. Charlotte described what she felt was a typical exchange amongst them, resembling a type of free and linear association of ideas that she thought did not really lead them anywhere:

It was kind of hard because some person would say something and then that would trigger a thought of someone else. So then they'd say something, and then you'd go on that subject but then the subject you were talking about would just get left hanging there.

Bernard had an even stronger opinion about how he felt the group struggled to establish that interconnection. During the second interview, half-way through the activity, he characterized the group's discursive attempts at arbitrating their dissonances as a sort of "verbal diarrhea" of disconnected information which, he felt, only took shape when someone would finally stop the discursive process to ask the group "So? What does it mean?". Related to the social dynamic in the group, Bernard considered that the crucial agent of interconnection was Jacqueline, who he felt was the person who provided solutions to the group, addressing their dissonances and solving their disagreements by approaching them from multiple angles.

What is important in these findings is that the perception of the success or, inversely, failure of the arbitration phase in the group's process of negotiation of meaning seemed to be directly related to the social role each student assumed in the group's dynamic, which, as we previously showed, had been determined by the capital of information acquired and detained by each of them from the VLE. Finally, the power relationships at work in the group, and which we will address next, were not perceived by any of the students in terms of its potential impact on the final reasoning.

Critical convergence and power relationships in the problem-based VLE

During the third interview, students were prompted to reflect on the final collective reasoning they had established, and whether they felt that it was viable. All five students were adamant and unanimous in manifesting that they felt their final reasoning was strong and logical, supported by meaningful evidence, and plausible as a solution to the problem. They were also prompted to reflect about whether they felt that they had been heard by their group members in the establishment of this final reasoning, and all five of them also answered positively.

Nevertheless, when later prompted to reflect on their personal thoughts about the end of the story they would have discovered at that point, all of them, except for Jacqueline, confessed that they had a different idea than the one the group had presented and defended. As mentioned above, the entire focal group agreed that the leader in the group was Jacqueline, as she was the one who had managed to collect the most information by gathering the most clues. She was also considered, notably by Bernard, as the key agent in getting the group to connect information by encompassing the multiplicity and diversity of dissonances and perspectives in the group.

But what the rest of the group did not consider, express, or perceive in the interview responses was the power relationship that was established as the consequence of the group social dynamic, and weighted on the orientation of their final reasoning (that is to say, on their critical convergence). By triangulating the on-screen video recordings as well as the computer-generated logs of each student's *Detective Notebook*, it was revealed that as the group had entitled Jacqueline with the role of leader, her voice became predominant in the establishment of the group's reasoning and led other students' voices to some extent to be silenced. A look into Daniel's on-screen recordings, for instance, indicated that on many occasions, he would start typing a comment in the chat, intended to oppose the orientation of the reasoning being constructed by the group, notably Jacqueline, but would decide not to send it and ended up erasing it. These findings were congruent with the asymmetrical relationship of the group, found earlier in the statistical analysis of the group's standard deviations at Level 5 (negotiation and co-construction of meaning) of the Interaction Analysis model, but it was never overtly expressed by anyone in the group, and was probably unnoticed by most. Power relationships in the group were shown to be well at work in their L2 process of negotiation of meaning, as revealing of the mutuality of rapport taking place among students as independent thinkers.

Thinking in French in the problem-based VLE

The asymmetrical relationship discovered in the group, but unnoticed by the students, thus poses the question of whether students' critical thinking abilities had been impacted by the intervention, in terms of their sustainability. To better examine this issue, students were asked during interviews to reflect on how they perceived their ability to think in French, as indicated through their inner voice. This subjective index of emergence and sustainability of L2 critical thinking abilities was intended to counter-balance the index of *retention*, which was predominantly used in traditional research on L2 negotiation of meaning, in an attempt to demonstrate L2 acquisition. Conversely, in this study, the objective for these students was to try to define if the L2 negotiation and co-construction of meaning process, as supported by the curricular intervention, had led to the emergence and sustainability of critical thinking abilities, reflected in their ability to (co-)construct new viable meaning in the target language.

Sustainability of critical thinking abilities and the inner voice

During the first round of interviews, students were prompted to explain if they felt they were able to think in French, and, if so, to describe this process. Whereas Daniel and Florence felt thinking in French was something they were simply not able to do at that point, Charlotte, Jacqueline, and Bernard answered that they felt they could, from time to time. In describing this process, these three students characterized it as an automatic translation process in their mind, as their inner voice would spontaneously translate a given English word into a French word that they knew. When Daniel was encouraged to describe how he thought thinking in French functioned, since he said he had not experienced it, he also aligned with this view, and hypothesized that it consisted of processing words from English to French.

At the end of the activity, during the third interview, students were prompted to reflect on whether they felt that the functioning of their inner voice had changed with the intervention and, if so, to describe what they felt was now happening. Their experiences and accounts varied.

Charlotte and Jacqueline described the functioning of their inner voice during the activity and at the end of it in a similar manner to what they had mentioned before the intervention, that is to say, as a one-word spontaneous translation from English to French. What they both mentioned, though, was that they felt that the frequency of these spontaneous translations had increased during the activity, when they were constantly surrounded with French, as well as outside of the French classroom, even after the French context had disappeared. In that sense, it can be argued that, although these findings are fairly positive, Charlotte and Jacqueline did not seem to have sustainably anchored tangible L2 critical thinking abilities, or at least did not show evidence of them.

On the other hand, Daniel mentioned experiencing sporadic changes in the way his inner voice functioned during the activity, and related it to “not having to think”. He described the following:

There was a moment when I was interrogating one of the people, for some reason, I was thinking in French, I'm not sure why. But it was cool because I didn't really have to go from English to French when I was asking her the questions. I was just able to just ask her straight on, which was really nice because then it was easy to just write everything that I found out from her, without really having to think much.

Similarly, Florence stated that she had felt a change occurring in the way her inner voice was functioning during the activity, with instances of sustained moments when “[she] didn't have to think how to say something”. Nevertheless, she interestingly explained that these sustained moments would systematically be interrupted as soon as she turned to assessing the correctness of her French writing, at which point her inner voice would resume to be thinking in English. This last point was similarly expressed by Bernard. These findings thus seem to indicate that focus-on-form, as it was considered by most

researchers to be the essence of what comprises L2 negotiation of meaning, can be counter-conducive to the development of sustainable L2 critical thinking abilities. These L2 critical thinking abilities seemed to have been better promoted, according to these students, by the curricular intervention implemented in the present study, which rather relied fundamentally on positive and opportunistic dissonances, as developing among L2 learners working together to co-construct meaning.

Finally, Bernard was the one who gave the most radical account of changes in the way he felt his inner voice functioned during the activity and subsequently in reaction to it. Bernard thus seemed to be the student who most sustainably developed tangible critical thinking abilities in the L2. What the following excerpt shows is the evolution of Bernard's epistemological grounds for the learning of French, from a pre-existing conception that relied heavily on one-on-one translation, to a newer epistemological framework based on the interpretation of the language and the construction of meaning.

You've memorized your whole language in English, so you should just be able to memorize another language later, right?. But I've gotten out in the mindset of 'oh! *Je* is *I*, and '*moi* is *me*'. I've been trying to relate 'no! *je* is *je*', even if it means '*I*'. Does it make sense?. I'm trying not to think 'oh! How do I say 'I'm going to the store', like 'je... going... aller'". I'm trying to just equate that "*je*" is "*je*" and why it's "*je*", rather than having that underlying translation there. I'm just trying to look at "*je*" and know that it means "*I*" without actually thinking "*I*" but thinking "*je*". Does that make sense?

Conclusion on the impact of the problem-based VLE on L2 critical thinking abilities

In conclusion, students considered that the problem-based VLE had an impact on their overall process of critical thinking in French. The changes in the functioning of their inner voice, as students considered they were impacted by the curricular intervention, were categorized in three ways: (1) a simple increase in frequency and rapidity of inner translation from English to French, (2) the emergence of some monitor-free moments of language production, where the inner L1 was momentarily silenced, but would re-emerge

as soon as they would revert to focus-on-form, and (3) a more fundamental transformation of epistemological foundations, where thinking in French was not equated to translating, but rather to meaning making.

CHAPTER V

DISCUSSION

This study investigated the construct of L2 negotiation and co-construction of meaning to inform research on L2 learners' critical thinking and problem solving abilities, since these skills were shown to be paramount objectives that education should promote for the advancement of societies. It also examined the impact of a Virtual Learning Environment, as perceived by a focal group of five L2 Intermediate-Mid level students of French, on their process of L2 negotiation of meaning. The purpose of this study was also to contribute to inform research and classroom practices on Second Language Acquisition and Foreign Language education, by investigating the nature of the discursive patterns of L2 negotiation and co-construction of meaning emerging in this focal group's discourse. It also served to inform research on Computer-Assisted Language Learning, by examining the inherent potential of VLEs, as innovative technology for learning, as they contributed to the L2 negotiation and co-construction of meaning process of these students.

In the following discussion, we will first summarize the findings and interpretations reached for each research question that has guided this study. Then we will provide a more integrated picture of these results, as they synergistically contributed to establishing a complete and nuanced portrait of students' L2 negotiation and co-construction of meaning process as impacted by the problem-based VLE. Next, we will briefly state the theoretical and methodological contributions made by this study, before discussing in more detail the implications of its results, both for stakeholders in relation with the L2 classroom (L2 practitioners, administrators, and instructional designers) and for future research on L2 negotiation of meaning. We will finally state the inherent limitations of this study.

Summary and interpretation of findings related to RQ#1

RQ#1 asked the following:

Do significant patterns of L2 negotiation and co-construction of meaning exist in the discourse produced collectively by a group of Intermediate French II college-level learners working collaboratively to solve a complex problem and as they are immersed in a virtual learning environment? If so, what is the nature of these patterns and what do they reveal in terms of these learners' L2 critical thinking and problem solving skills?

Discursive patterns of critical thinking abilities

As demonstrated by the statistical results of this study, the discourse produced collectively by the focal group was affected by the curricular intervention to different degrees. Based on the seven incremental levels of critical thinking abilities of the Interaction Analysis model (Hull & Saxon, 2009), the focal group discourse was characterized by three different patterns. First, it was marked by the significant *decrease* across days of activity of utterances serving lower levels of critical thinking abilities (Level 1 utterances functioning as direct instruction to the group, and Level 2 utterances functioning as the sharing of new information), indicating that as the activity progresses, students resorted less and less to lower levels of critical thinking abilities. Second, it was marked by the significant *increase* across days of activity of utterances serving higher levels of critical thinking abilities (Level 5 utterances functioning as negotiation and co-construction of meaning, and Level 6 utterances functioning as tests on their tentative constructions), indicating that as the activity progressed, students resorted more and more to higher levels of critical thinking abilities. Third, it was marked by the absence of significant patterns across days of activity of utterances serving medium levels of critical thinking abilities (Level 3 utterances functioning as situated definitions, and Level 4 utterances, functioning as intersubjective dissonances), as well as utterances serving the highest level of critical thinking abilities, (Level 7 utterances functioning as reports on application of newly constructed knowledge). These non-significant results indicate that,

despite the progression of the activity, students maintained their use of medium levels of critical thinking abilities, as well as of Level 7 utterances, consistently throughout the activity.

The lack of significance of the focal group discourse at Level 3 (situated definition) and Level 4 (intersubjectivity and dissonances) was an unexpected result, further challenged by two types of findings. First, the descriptive statistics (means) obtained at Level 3 and Level 4 indicated that a high number of Level 3 and Level 4 utterances were present in the focal group discourse. Nevertheless, these means did indicate that they remained fairly constant throughout the activity, which seems to explain the lack of significance. Second, alternate findings also emerged from the other data set used in this study (RQ#2 data set). Students indicated that they felt that disagreements among focal group members had characterized the social interactions of their group during their L2 negotiation of meaning process. This finding thus seems to challenge the lack of statistical significance found at Level 4. Moreover, students also explained, regarding the three-dimensional representation of space in the VLE, that their exploration of the VLE had allowed them to better ground their understanding. Here again, this finding seems to challenge the lack of statistical significance found at Level 3.

These discrepancies in findings seem to indicate that episodes of situated definitions (Level 3) and of intersubjectivity and dissonance (Level 4) did occur in the overall process of L2 negotiation of meaning experienced by the group, but that the group's discourse did not capture the variability of these episodes. It can also be argued that no particular aspect, task, or phase of the curricular intervention was more prominently conducive to the occurrence of these episodes, but, rather, that the activity as a whole promoted the constant emergence of situated definitions and dissonances in the focal group students.

Patterns of discursive plateaus and linear progression

As indicated by the results of the sequential analysis, the discourse produced by the focal group during the curricular intervention was also found to display significant sequential patterns. That is, it was primarily characterized by the significant over-representation of discursive plateaus at all levels of critical thinking abilities, except at the highest level (Level 7 – reporting application of newly constructed knowledge). More specifically, the group's discourse was found to initially display few plateaus at lower levels of critical thinking abilities, but was shown to gradually encompass more discursive plateaus at higher levels of critical thinking abilities, as the activity progressed. Results also indicated that the discursive plateau which was sustained the longest without interruption in the group's discourse across days of activity (four days, out of eight days of interactions) was the one at Level 5 (negotiation and co-construction of meaning), arising half way through the activity and sustained until the end. This result from the sequential analysis was consistent with what was shown by the means at Level 5, that is, a steady increase in the number of Level 5 utterances produced by the group, with a considerable peak reached during the consensus-building phase of the activity.

Furthermore, the sequential analysis indicated that a second type of discursive sequences was significantly over-represented in the focal group's discourse, namely, direct discursive transfers towards the next superior level of critical thinking abilities. Conversely, the sequential analysis indicated the significant under-representation of all other discursive sequences: direct transfers towards lower levels and indirect transfers towards both higher and lower levels of critical thinking abilities. These results indicated that when a discursive plateau was exhausted, the focal group discourse tended to evolve towards the next higher level of critical thinking, with their discourse advancing progressively and linearly, rather than erratically and inconsistently.

Variability among students

Although the discursive plateaus found in the focal group discourse seem to indicate that the group functioned rather homogeneously, with students aggregating their individual contributions to the same level, the analysis of the standard deviations indicates otherwise. Based on the analysis of these standard deviations, it appears that greater variability existed among students in the production of the group's discourse and at different levels of critical thinking abilities, suggesting that greater complexity existed in the group dynamic.

Variability among students for lower levels of critical thinking abilities was shown to be as follows: very little variability among students for Level 1 utterances (direct instruction). This suggests that all students contributed somewhat equally (although very minimally) to the creation of organization discourse. Greater variability among students, however, was found for Level 2 utterances (sharing new information), with considerable discrepancies among students at the beginning of the activity, and, to a lesser extent, during the rest of the activity, in their respective contributions of new information to the group.

Variability among students for higher levels of critical thinking abilities also seems to indicate a more complex situation in the group. Variability among students for Level 5 utterances (negotiation and co-construction) was found to have increased steadily and considerably as the activity advanced, indicating that, as the group's discourse progressed towards higher levels of critical thinking abilities, disparities among students also appeared, revealing increasingly unequal contributions to this progression. Variability among students for Level 6 utterances (testing tentative constructions) was found to be less important than for Level 5, with a slight increase in variability among students as the activity continued. But for both Level 5 and Level 6, the peak in variability among students seemed to correspond to the consensus-building phase of the activity. This finding suggests that the consensus-building part of the curricular

intervention was a particularly sensitive phase in the group's L2 negotiation and co-construction of meaning process, and prompted the emergence of higher levels of critical thinking abilities in the group. During this phase, tensions among group members and subsequent discrepancies also appeared in the group dynamic.

Summary and interpretation of findings related to RQ#2

RQ#2 asked the following:

How do these learners individually perceive, experience, document, and express the impact of the specific problem-based virtual learning environment in which they were immersed on their L2 collective process of negotiation and co-construction of meaning? What does this perceived technological impact reveal in terms of these learners' L2 technology literacy skills?

Impact of the 3-D graphic representations in the VLE

Social, motivational, and linguistic impact of the avatar

The students in the focal group felt that the avatar, as a three-dimensional graphic representation and mediation of themselves in the VLE, was the key component in the VLE that impacted their L2 negotiation and co-construction of meaning process at a social, motivational, and linguistic level. This impact was something they had not anticipated prior to the curricular intervention.

It was first and foremost considered to have a positive impact on motivation by lowering students' anxiety and enhancing their self-confidence, as well as on the establishment and sustaining of dynamic social interactions among them that was conducive to learning. The temporary assimilation of identity that students experienced between the avatar and themselves seemed to serve a function of increased suspension of disbelief, inasmuch as it led to a higher sense of credibility of the story and of authenticity of the problem. Furthermore, endorsing their avatar's identity served a linguistic function, since it allowed students to express themselves in a simplified and more direct manner in French.

Moreover, the inherent anonymity induced by the use of an avatar was also perceived as something positively impacting their social interactions, inasmuch as this anonymity seemed to create social circumstances that were more conducive to collaboration and social exchanges, such as prejudice-free and trust-based relationships, protective comfort allowing for eagerness of active engagement, a stronger sense of connection among partners in a group, as well as a replication of authentic mediated social contacts, as born with the digital era. In that sense, the use of avatars was perceived by most students in the focal group as a key component in the establishment of social realism under the form of virtual social presence, that is to say in creating a “degree of salience [or] awareness of another person in an interaction and the consequent appreciation of an interpersonal relationship” (Minocha & Roberts, 2008; see also Edirisingha, et al., 2009; Lee, 2004). Students’ accounts support the idea that the mediation of their social interactions by avatars contributed to make them experience the weaving of a stronger and deeper social fabric amongst them, empowering them in their interactional use of the language. We might consider that this perceived social presence also indicated a deeper form of acknowledgement of one another in the group, which could partly explain the high yet non-significant results found for Level 3 utterances (situated definitions) in the group’s discourse. These findings also mirror Feldon & Kafai’s (2008) findings about the perceived meaning and function, both personal and social, ascribed by students to their avatars in VLEs.

Nevertheless, these findings need to be interpreted carefully, as one of the students felt that the anonymity induced by the avatar could lead to potential social and learning losses due to the absence of human facial expressions. This mirrors Jauregui’s (1997) and Lee’s (2008) results, which highlighted the importance for L2 learners of non-verbal cues in episodes of L2 negotiation of meaning, and the subsequent threat that the lack of such cues can represent for some students in sustaining and maintaining communication and social contacts. We should thus wonder if certain discursive aspects

of the L2 negotiation of meaning process could have turned out differently (for instance, with a significant evolution of students' dissonances at Level 4), had the group been able to count on non-verbal cues in their L2 negotiation of meaning process.

Impact of the 3-D space on authenticity and grounding

Students in the focal group also felt that the three-dimensional graphic representation of space in the VLE impacted their L2 negotiation and co-construction of meaning process, by increasing their perceived authenticity of the task, as well as their grounding process, that is to say, the process by which they shared common information, (Clark & Brennan, 1991; Vandergriff, 2006). Similar to the use of avatars, students considered that the 3-D representation of space contributed to their suspension of disbelief by increasing their sense of immersion. What student accounts revealed was that this 3-D representation of space served a function of visual and spatial anchor in their L2 negotiating and co-constructing of meaning process by creating a sense of immersion which increased the sense of authenticity of the language task, notably by allowing them to further experientially explore the different dissonances they were encountering. Students thus felt that they were affected in their negotiation of meaning process by the very space in which they were immersed.

These findings are important regarding the overall research on L2 negotiation of meaning, inasmuch as they indicate that *grounding*, which was shown to be crucial in the L2 negotiation of meaning process (Brooks & Donato, 1994; Foster & Ohta, 2005; Jauregui, 1997; Van den Branden, 1997; Vandergriff, 2006), can also be promoted by the three-dimensional representation of space in a VLE. It can also be argued from our findings that the VLE's authenticity was only as good as it was perceived and operationalized by learners themselves in this act of suspension of disbelief, upon which their social interactions relied. In that sense, our findings corroborated Greeno's (1994) warning about affordances in CMC, as being inert properties that can only be conducive

to learning through their activation by learners, via their active participation and their perceived impact of these properties on their motivation and their learning.

In view of these results, it can be argued that more variation may have occurred than appeared in the focal group's discourse. Perhaps certain episodes of grounding or dissonances may have occurred and may have been resolved individually, with students finding viable confirmations or explanations in the 3-D space of the VLE that eliminated the need to address certain topics with the rest of the group.

Impact of the chat-based synchronous interactions and the multimodality of text

Students in the focal group also perceived that the immediate nature of the communication process, as induced by the synchronous nature of the chat-based interactions in the VLE, impacted their L2 negotiation and co-construction of meaning process by increasing their perceived dissonances, thus leading them to adapt their learning strategies to the need of the task. This communication process made them aware of their production of the language was intended for an audience (mainly, their group members), rather than simply their instructor, and was expected by this audience to contribute to the resolution of the problem they were trying to solve. In that sense, students highlighted the sense of purpose that they felt such a communication process created in their production of French.

Nevertheless, some students felt that the immediate nature of their synchronous interactions through chat created a form of supplementary pressure, which they felt increased their dissonances in the L2 negotiation of meaning process. They considered that this need for immediacy prevented them from focusing on the form of the language, as they would usually, thus challenging their pre-existing learning strategies. These findings were particularly important as they offer a comparison between the way students' conceived the use of technology before and after the curricular intervention.

Indeed, students' accounts prior to the curricular intervention indicated that they considered technology for L2 learning as a source of unchallenged prescribed linguistic knowledge, providing them with ready-made answers. These accounts indicate that they were unaware of the possibility for technology to be a source of opportunistic dissonances, as experienced during the curricular intervention.

To remedy this high level of perceived dissonances, these students explained that they were driven by the chat affordances (synchronicity, presence of an audience, purpose of their L2 usage) to modify their learning strategies, notably by focusing on the content rather than the form of the language. This shift from focus-on-form to focus-on-content was made possible in two ways: by using the context provided by the multimodality of the texts embedded in the VLE or by finding alternative ways of creating meaning, which did not rely on translation.

These findings are crucial as they are related to both focus-on-form and chat affordances. What can be argued is that, despite the extensive focus-on-form investigations conducted by the Cognitivist-based research on L2 negotiation of meaning, no study to our knowledge has highlighted the potential negative impact of synchronous interactions, as initially perceived by these students, on L2 learning. Moreover, it can also be argued that these students' initial resistance consisted of their attempt to reproduce the original conditions in which they were used to learning French, indiscriminatingly from what the task at hand required them to accomplish. These findings thus raise the issue of the importance of the learning environment as set by L2 instructors, and the extent to which these environments are interpreted by students as being normative for the manner in which an L2 should be learned. Conversely, their testimonies seem to indicate that the VLE's chat impacted their L2 negotiation of meaning process by compelling them to develop flexibility in how they handle dissonances and by adopting new learning strategies, notably relying on the context provided by the multimodality of the texts embedded in the VLE.

Perceived and unperceived impact of the VLE on L2
technology literacy skills and social dynamic

An unexpected finding emerging from students' accounts of their perceived impact of the VLE on their L2 negotiation and co-construction of meaning process indicated a direct association of the social dynamic in the group with the students' L2 technology literacy skills. This finding was that students considered that the relatively active or passive role played by each of them was determined primarily by the quantity of information available in the VLE. In that sense, they experienced the VLE to be the primary determiner of their social function in the group, by way of the information capital that it would lead them to acquire. This finding needs to be compared with the point discussed earlier regarding students' use of technology for their L2 learning. As we established that students tended to indiscriminately use technology as a source of unchallenged knowledge, it seems that this mindset towards technology carried over to the VLE during the curricular intervention. By associating leadership with the quantity rather than quality of information collected in the VLE, students seemed to have assumed that increased quantity of information meant increased accuracy and relevance, an unjustified assumption as the clues in the activity had been purposefully designed to contain irrelevant or inaccurate information.

This seems to indicate that students displayed some signs of emerging L2 technological literacy, insomuch as the arbitration phase of the L2 negotiation of meaning process, as impacted by the VLE, led them to “access, manage, integrate, evaluate, and create information” (ACTFL, 2011). Nevertheless, the overall lack of discrimination in the quality and relevance of texts used for these purposes, as well as for the establishment of social roles in the group, seems to indicate that their immersion in a problem-based VLE did not contribute a great deal to the development of their L2 technology literacy skills.

Finally, it was also determined that power relationships were well at play in the group during the arbitration stage of their L2 negotiation of meaning process, with some students' presence and contributions taking ascendancy over others'. It was thus found that students served asymmetrical social functions in the group, notably visible through instances of self-censure operated by some students in reaction to the ascendancy of others. This finding can contribute to explain the increasing variability among students found for Level 5 utterances of their discourse (negotiation and co-construction). Nevertheless, it is also important to note that students did not perceive this asymmetry, and thus did not consider that it had impacted the final critical convergence of their L2 negotiation and co-construction of meaning process.

Conclusion on integrated findings

As became visible in the summary and interpretation of results for RQ#1 and RQ#2, the findings emerging in this study were synergistic in nature, that is, the results obtained in answering one research question also served to further the response for and interpretation of the other research question. This synergy of results and extended interpretations, corresponds to the type of benefits derived from conducting a mixed methods study, and were confirmed by this study. Among these integrated findings, it is important to note that both strands of the study indicated that the L2 negotiation and co-construction of meaning process was at the same time promoted and impacted by the more complex context within which it was occurring.

Impact of the social context

We demonstrated that the social context had a crucial impact, insomuch as the asymmetrical relationship among students in the focal group, probably skewed some aspects of the group's L2 negotiation of meaning process. It can be argued that significant results for Level 4 utterances in the group discourse (intersubjectivity and dissonances) may have been found, had the students who felt compelled to censure

themselves further voiced their dissonances. This, in turn, can be a possible explanation of the lack of significant results obtained in the treatment of RQ#1 regarding Level 4 utterances.

Impact of the virtual context

We also demonstrated that the virtual context had a crucial impact, insomuch as the 3-D graphic representation of both the learners (as avatars) and space were highly noticed by the students. Thanks to their avatars, they felt a sense of social presence which made them more eager to collaborate with others; moreover, they were also more willing to take risks in the language, feeling protected by the anonymity of their avatar. This can serve to explain how certain students, who displayed a rather introverted character in their L2 classroom prior to the curricular intervention and were hesitant to actively engage, proved to become active contributors in their group and participated in the progression of the discourse produced by the group towards higher levels of critical thinking abilities. This enhanced engagement of certain students is a possible answer for the significant increase in higher levels of critical thinking abilities unveiled in the treatment of RQ#1, notably for Level 5 (negotiation and co-construction) and Level 6 (testing tentative constructions) utterances. The 3-D representation of space, on the other hand, as it helped students anchor their situated definitions and unveil dissonances, might have contributed to the development of a parallel trend of negotiation of meaning, happening individually rather than collectively for some students, which is another possible explanation of the lack of significance obtained in the treatment of RQ#1 at Level 3 (situated definitions) and Level 4 (intersubjectivity and dissonances) utterances in the group discourse.

Impact of the linguistic context

Finally, we also demonstrated that the more global linguistic context within which the L2 negotiation of meaning process occurred had an impact on this very process. The

intensity of the linguistic context, as perceived by students, was due to the immediacy and the synchronicity of the group's interactions through chat, the multimodality of the texts embedded in the VLE, as well as to the increased production of L2 by students in the group increased through a sense of authenticity of the task and the environment that led them to realize the purposefulness of their own L2 and the need to contribute to the task. Due to the intensity of this linguistic context, some students undertook fundamental modifications of their L2 learning strategies, which relied less on focus-on-form and more on the function of their discourse, allowing them to take more risks in the language and to force them to find alternative ways of understanding or creating meaning. These findings can be another possible explanation for the progression of the discourse produced by the group towards higher levels of critical thinking abilities.

Benefits of mixed methods for integrated findings

In sum, the data suggest that the global yet detailed and rich context, within which the L2 negotiation of meaning process of the focal group took place, whether social, virtual, or linguistic, served a crucial function in the development of this very process. These integrated findings confirm the imperative need for research to fully take into consideration the overall context of episodes of L2 negotiation of meaning (Brooks & Donato, 1994; Jauregi, 1997; Swain & Lapkin, 1998).

Finally, this study considerably benefitted from the adoption of a mixed methods approach to research, by allowing the different emerging findings to talk to each other and lead to a more complete and nuanced portrait of the L2 negotiation and co-construction of meaning process, as it happened for the focal group during the ten days of curricular intervention, as they were immersed in a VLE and engaged in a problem-based activity.

Contributions

As presented in Chapter I and Chapter II, this study undertook to investigate the construct of L2 negotiation and co-construction of meaning to better inform a research on L2 learners' critical thinking and problem solving abilities. For that purpose, it contributed to the study of L2 negotiation and co-construction of meaning at two levels: a theoretical level and a methodological level. Related to its theoretical contributions, this study was innovative inasmuch as it anchored the study of L2 negotiation of meaning in a paradigm shift, and embedded it in the use of innovative forms of technology for learning. As related to its methodological contribution to research on L2 negotiation of meaning, this study was particularly innovative inasmuch as it adopted a new analytical model, as well as mixed methods approach to research.

Theoretical contributions

This study contributed to the study of L2 negotiation and co-construction of meaning by first and foremost acknowledging the deep influence of the theoretical focus adopted by research in L2 education on the concrete focus adopted in L2 classroom practices, considering that the emphasis put by research on specific aspects of L2 learning (such as the retention of L2 morpho-syntactical features and L2 learners' deficiencies, as represented in the predominant trend of research on L2 negotiation of meaning) could be considered to have had a direct influence on what had been taking the priority on most L2 classrooms' agenda (focus on grammar, right-or-wrong exercises, and evaluation of L2 students' errors). Consequently, this study innovatively adopted an alternative theoretical framework of investigation of the construct of L2 negotiation and co-construction of meaning, anchored in a Socio-Constructivist paradigm and aimed at informing both research on L2 learners' critical thinking and problem solving abilities and L2 classroom practices. Resulting from this paradigm shift, this study's main theoretical contribution

consisted in offering a new definition of the construct of L2 negotiation and co-construction of meaning, corresponding to the following:

L2 negotiation and co-construction of meaning is the subjective and alternatively collective and individual process by which learners produce and exchange discourse and meaning which is “affected, negotiated, [arbitrated], and reconstructed as a result of conflict in social interactions”, as well as in individual perceptions (Jeong, 2003, p.28).

Furthermore, this paradigm shift also contributed to the progression of research on L2 negotiation of meaning within the realm of Computer-Assisted Language Learning (CALL), by embedding its occurrence and its investigation in an innovative form of technology for learning which was considered to inherently align with its underlying Socio-Constructivist paradigm, namely a Virtual Learning Environment (VLE). Following the need advocated by many researchers to re-orient research in CALL (Blake, 2008; Felix, 2005a; 2005b; 2005c; 2008; O’Rourke, 2005; Saarenkunnas, Kuure, & Taalas, 2003) by focusing on students’ perceptions and experiences of the VLE, rather than its decontextualized affordances, this study permitted to treat students’ online interactions as a complex combination of contexts and phenomena (Saarenkunnas, et al., 2003), and contributed to CMC and CALL theories by offering a new valid definition of VLEs, corresponding to the following:

Virtual Learning Environments (VLEs) are inherently immersive and multimodal social spaces, physically and authentically represented in a three-dimensional Web 2.0 platform, and designed with fundamental underlying pedagogical objectives, intended to allow learners to transfer knowledge to real situations, by permitting them to synchronously engage with other learners through their own virtually-represented persona called *avatar*, and to act on the very environment in which they are immersed.

Methodological contribution

Related to this new theoretical orientation in the study of L2 negotiation and co-construction of meaning, the present study operationalized the above mentioned paradigm shift by using a new analytical model, in an attempt to overcome the limitations

of the more predominant TIRR model (Varonis & Gass, 1985). Rather, the Interaction Analysis model (Gunawardena et al., 1997; 1998; 2000; 2006; Hull & Saxon, 2009) was utilized as an analytical tool to gain access into the different functions of the discourse produced by L2 learners inasmuch as they were representative of different levels of critical thinking abilities. This new analytical model, although initially designed to evaluate critical thinking abilities in an L1 and in asynchronous discourse, was shown to be functional for the evaluation of these same abilities in an L2 produced synchronously. We will thus argue that this study also innovatively contributed to the study of L2 negotiation and co-construction of meaning by highlighting the existence of this promising analytical model, which future research should further explore and exploit.

The last major contribution made by this study to research on L2 negotiation of meaning consisted of the adoption of a mixed methods approach, combining both quantitative and qualitative data, to allow for an integrative and synergetic form of investigation, which the use of one single type of data would not have permitted. This study thus contributed methodologically to the field of mixed methods research, notably by utilizing an innovative embedded mixed methods design (Creswell & Plano Clark, 2007), predominantly qualitative in nature, yet relying on quantitative data as one of the two primary data sets. The use of this innovative mixed methods design can be considered to contribute to the enrichment of a mixed methods design nomenclature.

Implications

Implications for L2 practitioners

First, I would encourage L2 practitioners to promote the use of problem-based tasks, as represented by the problem-based activity implemented in this study, as results showed that it reached the learning goals that it intended to attain (i.e. promoting L2 negotiation and co-construction of meaning), and allowed for the creation of a learning environment that was beneficial for L2 learning. As demonstrated by the different results

of this study, L2 negotiation of meaning was supported all along the problem-based activity, as students' discourse displayed a steady and significant increase in the number of utterances they produced that revealed higher-order critical thinking abilities. More generally, it is students' overall discourse which was shown to have steadily progressed towards higher levels of critical thinking abilities with the highly significant over-representation of discursive plateaus, first at lower levels of critical thinking abilities, but displaying more and more discursive plateaus at higher levels of critical thinking abilities.

Second, I would also more specifically bring L2 practitioners' attention to the consensus-building task embedded in this problem-based activity, and highlight the fact that results in this study showed that it was the phase in the problem-based activity that most significantly led to higher levels of critical thinking abilities and instances of L2 negotiation and co-construction of meaning in the focal group. I will thus argue that this study contributed to help L2 practitioners find concrete ways of promoting the development of these paramount skills, as examples of simpler consensus-building task are provided in this study (see Pilot Study #2 in Chapter III).

Third, I would also provide a word of caution to L2 practitioners, regarding the over-representation of prescriptive types of instruction in the L2, notably through focus-on-form or closed-item exercises or tests, as this study showed that some students had been considerably influenced by the learning environment in which they were used to learning French prior to this study, and demonstrated high level of resistance when they were confronted with a new task that required them to adopt alternative learning strategies. Our findings indicated that these students, instead of directly adapting to the new requirement of the task, first spent considerable efforts and time trying to replicate the learning conditions that had always known, even when they proved to be inappropriate. This proved us that students can have a tendency to consider, without questioning it, that the learning environment which they are provided for their L2

learning is the way in which an L2 should be learned. In view of these findings, it is thus important that L2 practitioners provide their students with learning objectives related to problem-solving, requiring different and deeper L2 learning strategies.

Fourth, I would suggest that the validity of this study's findings emerging from the use of the Interactional Analysis model (Hull & Saxon, 2009) for the evaluation of an L2 rather than an L1 discourse, in synchronous rather than asynchronous communications was a beneficial result for L2 practitioners. Indeed, I would strongly recommend that this analytical model not be limited to be used for research purposes, but rather, that it serve as a template for the development of rubrics allowing L2 practitioners to create alternative forms of assessment, aimed at evaluating their students' emerging critical thinking and problem solving skills.

Finally, I would encourage L2 practitioners to further invest in the integration of technology in their classroom, notably in learner-to-learner forms of interactions and in forms of communication that provide anonymity to the students. As indicated by the results of this study, the anonymity granted by the avatar in the VLE had a positive perceived impact on students' social, motivational, and linguistic experiences, and led them to be willing and eager to take more risks in the target-language. Moreover, their learner-to-learner discursive collaboration, through chat-based interactions, was shown to be fundamental in their appreciation of and progression in the activity.

Implications for L2 administrators and instructional designers

With these results and practical implications for L2 practitioners in mind, we will argue that further practical implications can be drawn from this study, which are of interest for L2 administrators and instructional designers of L2 educational technology.

The amount and complexity of technology designed and utilized for this study, although shown to have had a positive impact of the students' L2 learning, required a

level of technical engagement from part of the researcher that is simply unrealistic for an L2 practitioner, who will very likely lack both the time and the technical resources to invest in such a project for his/her students. This research project contributed to have a concrete understanding of the practical needs required to implement the type of curricular intervention presented in this study, and it is in that sense that it has practical implications for L2 administrators and instructional designers of L2 educational technology. We will argue that the implementation of such curricular projects in the L2 classroom can only happen through the joint efforts of L2 administrators, in their willingness to modify the Intermediate-level curriculum to accommodate such pedagogical interventions, and instructional designers, in charge of developing L2 educational technology, as based on the needs communicated by L2 administrators and/or L2 practitioners.

This study thus implies that more direct partnership and collaboration should be established between practitioners, administrators, and instructional designers, so that such curricular projects do not simply remain experimental projects used for research purposes, using technology as a “cool tool”, but get a legitimate place and technical support in the Intermediate-level L2 curriculum, so that technology be integrated to support learning in the L2 classroom (ACTFL, 2011). It is thus important that L2 administrators communicate their needs for the L2 classrooms to instructional designers since pedagogical projects such as the one presented in this study can be considered as valid alternative to otherwise more traditional textbook-based activities. It is thus possible to consider that L2 administrators have a role to play in communicating to the designing industry (including traditional textbook publishers) their need for such innovative and immersive forms of technology, as this industry possesses the means and resources to develop pedagogical products at a much bigger and cost-efficient scale than smaller projects, like the one in this study, could ever offer.

Implications for future research

Finally, we will suggest that this study holds several implications for future research. We will first generally explain why replication studies are needed in future research, and will then present more specific venues for correlated studies, attached to the study of L2 negotiation and co-construction of meaning and VLEs.

Replication studies

First, this study showed, via a case-study investigation, that a focal group of 5 Intermediate-Mid students of French, working collaboratively on a problem-based task could produce an L2 discourse beyond lower levels of critical thinking abilities, but actually at higher levels of critical thinking abilities, notably at the level of ability to negotiate and co-construct meaning by arbitrating (Level 5) and testing (Level 6) dissonances in the L2 (Swain & Lapkin, 1998; Van den Branden, 1997). Nevertheless, due to the small sample size of this study, future research will be needed to replicate it at a larger scale, examining the discourse produced by several groups of L2 learners engaged in the same type of learning task, to allow for a confirmation or disconfirmation of these results.

Moreover, the present study focused on a specific population of L2 learners, namely a sample of L2 learners of French at the Intermediate-High level of reading and writing proficiency. Consequently, the results presented in this study can only be claimed to be applicable for this specific sample of students, as part of this specific population. Future research will be needed, which further examines the construct of L2 negotiation and co-construction of meaning, as indicators of L2 critical thinking abilities, with different populations of L2 learners, in terms of the nature of their L2, and of their reading and writing proficiency level. It will be notably important that future research notably determines if languages displaying a writing system that is different from the students' L1 (notably less commonly taught languages) allow for L2 learners who have

been enrolled a similar amount of time in L2 classes, to demonstrate the same type of critical thinking abilities in the target language.

Correlated studies

Four more specific aspects of this study call for future research, as based on the inconclusive, contradictory, or incomplete nature of the results obtained in this study: (1) the lack of significant impact of the curricular intervention of the focal group's discourse at Level 4 (intersubjectivity and dissonances); (2) the discourse produced by students but not published in the chat, (3) the lack of perception by students of the power relationships happening during the arbitration phase of their L2 negotiation of meaning process, and (4) the lack of significant emergence of L2 technology literacy skills.

Dissonances

First, this study's results displayed contradictions in its quantitative and qualitative results regarding the medium level of critical thinking abilities related to intersubjectivity and dissonances (Level 4). It was found in the statistical analysis that the focal group's discourse had not been impacted by the curricular intervention at this level, yet findings emerging from the students' interviews revealed that many instances of dissonances had been experienced by the students amongst themselves, as well as as a consequence of certain features from the VLE (notably the lack of traditional dictionary or the three-dimensional representation of space). What we concluded was that the Interaction Analysis model used to analyze the group's discourse could not account for these instances of dissonances. We will thus suggest that future research further investigate these specific dissonances to be able to better determine the extent to which such technological aspects of the learning environment as its three-dimensional representation contribute to the emergence and arbitration of dissonances in L2 negotiation of meaning episodes.

Published and unpublished discourse

Second, the use of multiple data sources in this study allowed gaining a better access into access the focal group's discourse. Additionally, the on-screen video recordings permitted to recontextualize this discourse by recreating the entire interactional context into which it was developing, thus allowing to better indicate what each student's intentions were at any given moment of the discourse. Nevertheless, these on-screen video recordings also revealed that parts of the discourse produced by some of the students in the group did not appear in the computer-generated logs of their chat, since language was produced and typed, but never sent to the group. For reliability and validity purposes, these self-censored utterances were not taken into consideration in the discourse analysis conducted for this study, but it is important that future research considers these utterances as discourse that is actually produced, albeit not published. We will thus suggest that future research conducting a discourse analysis similar to the one performed in this study take into full consideration the distinction between published and unpublished discourse produced by L2 learners, and further explore the nature and function served by the latter.

Power relationships in L2 negotiation of meaning

Third, and related to this unpublished part of the discourse produced by some students, this study determined that an asymmetrical power relationship existed among students in the group, which serves to explain, in part, why these utterances were produced, but remained unpublished. It was shown that one of the students took ascendancy over the rest of the group, contributing to lead others in the group to censure themselves. Nevertheless, it was also determined through interviews that this asymmetrical power relationship was unperceived by the students themselves, who rather considered that they had been fully heard during the arbitration of their collective dissonances. We will suggest that future research should further explore these

contradictory results on power relationships in the L2 negotiation of meaning process, notably by relying on on-screen recordings, as produced in this study, and by implementing a think-aloud protocol during interviews, with students watching and commenting on these recordings.

L2 technology literacy skills

Finally, one of the main objectives of this study was to contribute to inform a research on L2 technology literacy skills, as exhibited by L2 learners. This study determined that students in the focal group hardly had any pre-existing L2 technology literacy skills, notably in the indiscriminate use they made of certain online resources for their French learning, such as online translators. The curricular intervention implemented for this study, although relying on the need for students to decipher between relevant and irrelevant information, presented in a multimodal manner, proved to have very limited effect on their development of L2 technology literacy skills, as students unanimously considered that what counted the most was the quantity of information, not its quality, usefulness, or relevance. We will thus suggest that more research is needed to determine the sort of pedagogical activities that more efficiently contribute to the development by L2 learners of these L2 technology literacy skills, in order to inform classroom practices on what tasks to implement that are conducive to this development.

Limitations

Limitations in interpretation of this study's results are related to several aspects of this study.

First, this study was conducted as a case-study on a focal group of five students. Considering the reduced size of this sample of participants, results cannot and should not be generalized to the population of L2 learners as a whole. Results in this study should be considered as applying to the specificity of the context in which the study took place.

Only inferential rather than causal or correlational conclusions can be drawn for any other population sharing similar demographic characteristics.

A second limitation needs to be mentioned related to the short duration of the curricular intervention upon which a considerable part of this study relied. This curricular intervention consisted of a ten-day problem-based activity. Results obtained in this study were thus inherently circumstantial and can only be claimed to be relevant to the particular setting in which the study took place.

Finally, the inter-rater reliability rates displayed by this study were considered satisfying due to the triangulation procedure conducted to ensure fundamental validity and reliability of results. Nevertheless, it is fair to admit that these rates held limitations insomuch as they indicated that agreement amongst coders were adequate but not as powerful as could be required to establish stronger claims about the study.

Conclusion

In conclusion, this study was successful in finding evidence that supported its initial rationale, namely, that by adopting a Socio-Constructivist approach to the study of L2 negotiation and co-construction of meaning in the investigation of a discourse produced collaboratively by L2 learners, claims could be made about the abilities displayed by these students to demonstrate critical thinking and problem solving abilities. By focusing on the function of their discourse, rather than its forms, as well as on the construction of this discourse, rather than its correction, it was thus possible to better evaluate L2 students' abilities rather than their deficiencies. Furthermore, by taking into full consideration the complex and complete interactional context in which these students constructed this discourse, this study permitted to demonstrate that the theoretical affordances of an innovative form of technology for learning (namely, a VLE) did in fact contribute positively and in a multitude of ways to the linear and progressive evolution of students' discourse towards higher levels of critical thinking abilities. The benefits of this

VLE were proven to be conditioned by two fundamental components: the existence of a soundly designed pedagogical project underlying the use of the 3-D platform, and the activation of this VLE's affordances by the students themselves, as actively engaged in the purposeful language task at stake.

Finally, results showed that the problem-based activity, as developed according to designing criteria for Socio-Constructivist learning environments, reached the learning goals that it intended to attain, and allowed for the creation of a learning environment that was beneficial for L2 learning. As demonstrated by the statistical results of this study, L2 negotiation of meaning was supported all along this curricular intervention, as students' discourse displayed a steady and significant increase in the number of utterances they produced that revealed higher-order critical thinking abilities of negotiation and co-construction of meaning, as well as of testing tentative constructions. More generally, it is students' overall discourse which was shown to have steadily progressed towards higher levels of critical thinking abilities, with the highly significant over-representation of discursive plateaus, first at lower levels of critical thinking abilities, but displaying more and more discursive plateaus at higher levels of critical thinking abilities as the problem-based activity progressed.

APPENDIX A

INTERVIEW PROTOCOL FOR SEMI-STRUCTURED INTERVIEW #1

Foreign language background, prior knowledge, and learning style

1. Is French the only foreign language you have learned so far?
 - a. If not, what other foreign language(s) have you learned? For how long?
2. How long have you been learning French? When did you start?
3. Why did you choose to learn French as a foreign language?
4. What are your personal learning goals with French? What would you like to be able to do with French?
5. How do you like learning French?
 - a. What do you like about it?
 - b. What don't you like about it?
6. How do you feel about small group work in general? In the French class?
7. Have you ever felt that you could think in French?
 - a. If so, can you tell me how it works for you? Can you give me an example of a situation when you felt you were thinking in French?
 - b. If not, how do you imagine it works? Is it something you would like to be able to do?

Attitude towards the use of technology in life and for learning purposes

8. What do you consider 'technology' is?
9. Do you usually use a lot of technology in your life?
 - a. If not, why is that?
 - b. If so, can you give me examples of the type of technology that you use and the frequency at which you use them?
10. Have you ever used technology to learn French?

a. If so, when and how did you use it?

11. How do you feel about using technology for learning purposes?

12. Have you ever used a virtual learning environment?

a. If so, which one? What did you think about it?

b. If not, how do you imagine it is?

APPENDIX B

INTERVIEW PROTOCOL FOR SEMI-STRUCTURED INTERVIEW #2

First impressions and experiences about the virtual learning environment

1. What are your first impressions about the technology we have been using for the activity so far?
2. How do you like using it?
 - a. What do you like about it so far?
 - b. What don't you like about it so far?
3. Tell me about using an avatar.
4. How does it feel to interact with other avatars rather than real human beings?
5. How would you compare being in your usual classroom and being in this virtual environment when it comes to learning French?
6. When I observed the interactions of all the avatars with the virtual environment, I noticed that you directly call yourself by the name of your character (1st person) rather than talking about your character in 3rd person. Can you tell me more about that?

First impressions and experiences about the process of negotiation of meaning

7. How would you compare working alone with working with others on the story. What did you think was the same? Different?
8. What would you say your role has been in your group so far?
9. Do you feel that your team agrees a lot? Can you remember an episode when you all agreed? Can you tell me more about it?
10. What happens when you disagree or when someone in the group disagrees? Can you remember an episode when that happened? Can you tell me more about it?

11. How hard or how easy has it been to interview in French other characters that are not in your team? Why is that?
12. How hard or how easy has it been to be interviewed by other characters that are not in your team in French? Why is that?
13. How do you feel that your understanding of the story has evolved so far? What would you say made it evolve that way?

APPENDIX C

INTERVIEW PROTOCOL FOR SEMI-STRUCTURED INTERVIEW #3

Overall conclusions, impressions, and appreciations of the activity

1. Overall, how did you like the Cinet activity?
 - a. What did you like about it?
 - b. What didn't you like about it?
2. Overall, and compared with more traditional activities that you usually do in the French class, what do you feel that you gained for your learning of French (if anything)?

Conclusions on the collective process of negotiation of meaning

3. How hard or how easy was it to work as a team in French?
 - a. In your interactions with your teammates, what helped you in your understanding of the story?
 - b. What did not help you?
4. How hard or how easy was it to reach a consensus as a group? Why was it hard/easy?
5. How hard or how easy was it to make yourself heard by your teammates when deciding on this consensus? Why was it hard/easy?
6. How did you feel personally about the viability of the scenario your group presented?
7. How hard or how easy was it to try to solve a complex problem in French?
 - a. What would you say helped you the most?
 - b. What would you say was the hardest?

8. How did you go about understanding certain words, sentences, paragraphs, or ideas, when there were words, expressions, or structures you did not know and that were not in the Vocab section that I provided you?
9. Can you remember specific moments of frustration you had during the activity? Why were you frustrated? How did you overcome your frustration?
10. Did you feel that there were moments when you were thinking in French? If so, can you tell me how it worked and how it felt?
11. Looking back at the 10 days of activity, what role(s) would you say you played in your group? (You can choose one or several words among the following list of propositions, or you can use a completely different word to define your role in the group – leader, follower, helper, negotiator, diplomat, active, passive)
 - a. Why do you feel that way?
 - b. Do you feel that your role has evolved? How so? When?
12. Would you say it's a role that you usually play in your real life? How was it to play that role in French?
13. What role(s) do you feel that your teammates had in your team?

Conclusions on the impact of the virtual learning environment on the process of negotiation of meaning

14. How do you feel that being in this virtual environment helped you make sense of the story? Did not help you make sense of the story?
15. What do you feel you learned in French or about French by being in this virtual environment?
16. How did it feel to work through an avatar? With other avatars?
17. Would you say there were moments when you would forget that you were in a French class?
 - a. If so, when? And where did you feel you were?

18. Imagine that you're going to France for a study abroad next semester. What would you say, in what we did during this activity, can help you with being immersed in the target language when you interact with French people in France?

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