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Impact on the knowledge construction process of multimedia online interactions in audio-graphic conferencing systems: the case of adult distance learners of French

Thesis

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Impact on the knowledge construction process of multimodal online interactions in audio-graphic conferencing systems:

the case of adult distance learners of French

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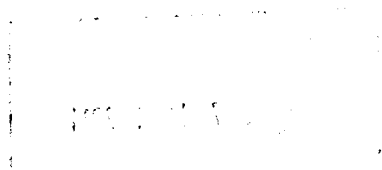
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Declaration

I declare that this thesis represents my own work, except where due acknowledgement

is made, and that it has not been previously submitted to the Open University or to any other

institution for a degree, diploma or other qualification.

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Acknowledgement

List of abbreviations

Cognitive moves

I	initiations
IC	initiation continuity
I-IC-R-RC-F	five part exchange; initiation-initiation continuity-response-response continuity-feedback
IC-R-F	three part exchange; initiation continuity-response-feedback
IC-R-RC-F	four part exchange; initiation continuity-response-response continuity-feedback
I-R-RC-F	four part exchange; initiation-response-response continuity-feedback
IRF	initiation-response-feedback system
R	response
RC	response continuity

Negotiation functions

IFR	information request
IF	inform
AC	acceptance
CO	corroboration
CC	comprehension check
EXR	explanation request
EX	explanation
DS	disagreement
RA	rapid agreement

EXPR	exploratory request
CL	clarification
AG	argument
RJ	rejection
AS	assertion
CH	challenge
JS	justification
CS	concession
CSS	consensus building
RFR	reflective request
TS	testing
SU	summary
MGR	meta-cognitive request
MCS	meta-cognitive statement
AR	application request
AP	application

Phases

Ph1   phase 1 of meaning construction (Sharing and comparing information)

Ph2   phase 2 of meaning construction (Dissonance and inconsistency/Quick consensus building)

Ph3   phase 3 of meaning construction (Negotiation and co-construction of meaning/Deep conflict and consensus building)

Ph4   phase 4 of meaning construction (Testing tentative constructions and judgment of the relevance of the newly constructed knowledge)

Ph5   phase 5 of meaning construction (Agreement statement and application of newly

constructed meaning)

Tools

A   audio tool

A+C   audio tool+ chat tool cluster

A+WB   audio tool + whiteboard tool cluster

C   chat tool

WB   whiteboard tool

YN   the yes and no tool (also: vote button)

Transcriptions

G1   group 1

G2   group 2

St   student

T   time

T1   tutor 1

T2   tutor 2

Others

CMC   computer Mediated Communication

L2   second language

OU   the Open University

SAGC synchronous audio-graphic conferencing

SP   spontaneous

T's IV tutors' invitation

ZPD   zone of proximal development

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Abstract

Online researchers suggest that synchronous audio-graphic conferencing systems provide different mediational tools that create different mediated educational interactions that support the collaborative process of meaning construction. However, the existing literature does not indicate whether the quality of multimodal online interactions as well as the affordances of use of the synchronous medium can effectively enhance this process.

This thesis brings together two lines of research. The first develops a methodological framework for the presentation and analysis of multimodal online interactions that draws on socio-constructivist understanding that the process of meaning construction is social and individual. The second is concerned with the analysis of online multimodal discussions; it examines the interrelationship between the different mediational tools of communication and the different affordances of their simultaneous and single use that may hinder or promote the collaborative process of meaning construction. The design of this research focuses on interaction patterns and examines the extent to which online discussions, mediated by the different tools of communication, reach high levels of collaborative meaning construction.

This study assumes the knowledge construction process to be empirically observable through analysing online interactions and students' perceptions of the learning experiences. It examines, through interviews, questionnaires and video recordings of online tutorials, the quality of online learning experiences of two different UK Open University tutorial groups learning French.

Results show that: participants make different multimodal choices which lead to the creation of different patterns of multimodal interactions and online exchanges that affect differently participants' engagement in the collaborative meaning construction process; the single and the simultaneous use of the different tools of communication create different

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affordances for participants to perform different interactive and communicative roles; the multimodal competencies of students and tutors, the tutors' styles and task design play an important role in supporting the collaborative meaning construction process.

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Chapter One

Introduction

1.1. Introduction

During the two last decades, online language learning has seen the introduction of web conferencing tools that consist of a combination of technologies for real-time communication and interaction using multiple media and modes. Synchronous audio graphic conferencing (SAGC) comprises such tools used for interactive online language teaching. SAGC describes internet based applications for tutorials combining shared graphics with real time, online, audio and chat discussions. SAGC is meant to solve the major issue in the first synchronous chat based systems of distance language education, that is the problem of lack of exposure to oral and to visual interactions (Hampel and Hauck, 2005; Heins et al., 2007; Compton 2009; Wang, 2009; Bower, 2011). Hampel (2003) who has pointed to the development and practice of speaking skills as a major challenge facing language teaching at a distance, stated that "Synchronous audio-graphic conferencing offers a way of overcoming the distance between students and giving them the opportunity to practise their oral skills and communicate easily with their tutor and with other learners in the target language" (p. 22).

Hence, SAGC is very important and an aspect of synchronous online language learning at the UK Open University (OU). In this instance, the objective of using such a tool is to provide a synchronous interactive learning environment in which distance students would improve their communicative speaking skills in the target language through oral and written interactions.

Besides the use of SAGC, to create an interactive online learning environment, social constructivism is the current language learning theory implemented at the OU for online language teaching. This theory puts weight on interactive and collaborative learning (Hampel and Hauck, 2004). The major assertion of socio-constructivist theory is that learners are not passive recipients of knowledge. Rather, learning is an active individual and a social process of collaborative communication and negotiation where learners collaboratively construct their knowledge. Socio-constructivist researchers (Lantolf, 2000; Doolittle and Hicks, 2003) further suggested that the social and individual processes of knowledge construction are mediated by all the elements that are present in the learning environment. Hence, a dominant characteristic of this theory is the emphasis on the importance of the creation of opportunities for collaborative construction of knowledge through mediated socio-educational interactions (which will be defined in Chapter Two, section 2.3.1) among learners for effective learning to take place. It is argued that the multimodality of SAGC provides opportunities for the creation of mediated socio-educational interactions for collaborative meaning construction. This study seeks then to check the extent to which the provided socio-educational mediated interactions offer the social and cognitive support necessary for the collaborative meaning construction process to take place.

In this chapter, I start by explaining the main aims and objectives of the present study. I present the research questions around which this thesis revolves. Finally, I describe the structure of the present thesis.

1.2. Aims and objectives

Concepts like mediated socio-educational interaction and collaboration (which will be defined in Chapter Two, section 2.3.3) are key in online communication. It is suggested that

online conferencing systems provide different mediational tools that create different mediated social interactions that facilitate learning. Lamy and Flewitt (2011) stated that "in computer-mediated contexts, mediational tools include participants, tasks, physical settings, institutional and cultural assumptions, time frames and language as well as technology" (p. 72). Similarly, Bower (2011) stated that web-conferencing systems, such as SAGC tools, allowed a range of rich-media tools to be integrated, offering previously unavailable possibilities for mediation. Such new mediational tools offered various opportunities for students to engage in mediated multimodal interactions that would facilitate collaborative knowledge construction. Thus, there seems to be a common agreement among online researchers that web conferencing environments such as SAGC are a good fit for promoting the type of student-centred and collaborative learning that is central to the socio-constructivist theory of learning.

Studies carried out to investigate types and patterns of interaction generated in SAGC have reported an increase in the quantity of participation and interaction compared to asynchronous and face-to-face contexts of instruction. In this regard, it is argued that audio and video-graphic conferencing promote authentic exchange as well as high level interactions. Wang and Sun (2001), Hauck et al. (2008), and Guichon (2010) argued that audio and video conferencing tools fostered spontaneous communication and interaction, authentic language production, and thus provided new opportunities for collaborative language practices and learning in distance education. This encouraged a socio-constructionist learning style as argued by Stickler and Hampel (2010), who assert that web conferences:

> [i]ncreasingly integrate interactive tools, allowing a shift in emphasis towards online collaboration and a change in focus towards more student centeredness and less teacher control [...] in the field of foreign language learning where there is no "natural" immersion in the new language, virtual environments can

foster this collaboration and construction of knowledge and encourage realistic practice around more authentic purposes. (p. 51)

However, research that focuses on the impact of the use of online communities in general on interaction opportunities is generally based on quantitative ways of measuring participation (Sing and Khine, 2006). The results obtained through quantifying participation and interaction seem collectively to have caused us to lose sight of the point that not all interactions are conducive to collaboration and that quantity does not guarantee quality. So the view which says that interaction is important does not however hold that all forms of interactions are equally productive for socio-constructivist language development purposes. Besides, my review of the literature (see Chapter Two) shows that current studies did not provide enough knowledge about the extent to which online learning in SAGC meets the theoretical socio-constructivist expectations, in terms of the creation of opportunities for the collaborative meaning construction process to take place. It makes good sense, therefore, to try to understand the contribution of the emerging socio-educational multimodal interactions for enhancing the collaborative meaning construction process. This process is defined as a social and collaborative process in which different perspectives are exchanges, negociated and then incorporated. Hence, it is defined as the social creation of new shared agreed upon understandings within contexts of instruction by exchanging, negotiating and incorporating different concepts and opinions. (For detailed definition see Chapter Two, section 2.3). In particular, there is a need to investigate the impact of students' modal choices on this process.

Furthermore, providing tools for synchronous multimodal interactions does not automatically result in an efficient and constructive interaction in online learning settings, as many different factors may affect the quality and the quantity of interactions taking place (O'Dowd and Ritter, 2006; Hauck, 2007; Hauck and Youngs, 2008). For instance, the use of

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SAGC tools brought "affordances" (which will be defined in Chapter Two, section 2.6.3) that offer opportunities as well as challenges for tutors and students to develop new skills necessary to communicate and co-construct meaning in such multimodal educational settings. The uses of each communication tool as well as the simultaneous use of a variety of mediational tools create affordances for meaning construction in the context of web-conferencing. As early as 1998, Kress drew our attention to the fact that the use of new multimodal technologies requires "high levels of multimodal competence" (p. 65). He defined multimodal competence as the ability to express ideas across a wide range of representational systems or modes including "words, spoken or written; image, still and moving; musical [...] 3D models [...]". (2003, p. 15). Hence, there is a common agreement that the use of the different tools offers different affordances for online communication. The concept of affordances is defined as the constraints and possibilities offered by the use of the different communication tools provided by by conferencing systems (Fuller discussion is provided in Chapter Two, section 2.6.3).

In this regard, Norris (2009) introduced the important concept of modal density which refers to the simultaneous use of a mix of modes to convey communicative messages. She explained that modal density can be achieved either through modal complexity or modal intensity. Modal Complexity is achieved through the use of a combination of tools where emphasis is on all of them. Modal Intensity is achieved through the use of a combination of modes where emphasis is on one specific mode.

In this line of thought, Örnberg Berglund (2009) has shown that the way the different tools of communication were used, worked together, interacted and influenced each other created different affordances for mediation through web conferencing. Furthermore, Hampel et al. (2005, p. 22) argued that "The success of the SAGC-based type of learning depends on all participants' awareness of the potential uses and abuses of the special affordances available

to everyone". Bower (2010, p. 63) explained that the use of synchronous web conferencing was complex due to many reasons: "Firstly, there are several tools to master; secondly, different tools need to be selected depending on communication requirements; thirdly, the affordances of use of tools in combination requires consideration; and fourthly, decisions about how to use tools often need to be made in real time". He further argued: "Failure to understand one subtle feature of a tool or its use can have a crippling impact on the learning episode, amplifying the importance that users have developed technical and collaborative competencies in synchronous multimodal learning environments" (2010, p. 63).

The ideas echoed by the different researchers were the importance of the affordances offered by the use of different tools of communication offered by SAGC. Besides, the way students understood the potential affordances of use of tools was argued to have a big impact on their socio-educational interactions and online learning experience in general.

However, as is explained in the next chapter, while an increasing number of studies focused on the use of specific tools in the online language learning, many were descriptive and most dealt with the affordances of use of individual tools rather than the affordances of the simultaneous use of different tools. Besides, while some studies focused only on the impact of learners' modal choices on their interaction opportunities, others focused only on the analysis of the quality of online interactions from a socio-constructivist point of view. This implies that research into what occurs during the learning process in audio and video conferencing, with particular reference to modal choices of learners (Örnberg Berglund, 2009; Hauck, 2010) and the collaborative meaning construction process is still lagging behind. As a result, there is a need for a shift in the direction of research from a focus on the analysis of participation rates to the study of the affordances of use of multimodal communication tools and their possible impacts on online interactions and the collaborative meaning construction process in the context of synchronous video and audio conferencing.

In view of the above reasoning, I hypothesize that the use of each individual tool and the simultaneous use of the different tools could result in different types of affordances that may influence the way students engage in the collaborative process of meaning construction. Moreover, I hypothesize that online interactions should be analyzed as a means of gaining insights and understanding of the impact that the affordances of single and simultaneous use of tools might have on the process of meaning construction. Hence, the main aim of this study is to examine the impact of students' mediational multimodal choices on the quantity and quality of multimodal online interactions and their engagement in constructive discussions that facilitate collaborative meaning construction. In particular, the thesis revolves around two important objectives.

The first objective of this thesis is to increase understanding of the affordances of use of multimodal communication tools that support the shared construction of meaning in synchronous audio-graphic conferencing settings. The decision about the type of knowledge that needed to be studied required a long process of thinking and exploration. The limited current research on knowledge construction processes in online environments is devoted to the study of grammar, vocabulary, writing skills, reading skills, and argumentation. The main questions that preoccupied me and which finally highlighted the point to me was the following: in this particular context of synchronous audio-graphic conferencing, what do students need to learn? Why do they meet online? Which type of knowledge should we focus on? Students do not meet online to learn just grammar, vocabulary or develop their writing and reading skills. The pedagogical material used at the Open University indicates that students meet online to practise all of the mentioned competencies. Language learning processes range from learning new words, phrases, reading comprehension to writing compositions. However, there is a difference between knowing and understanding the meaning of what we know. Understanding meanings requires a high level of comprehension.

Knowing something is essential, but knowing what it means moves us to a level where we can act to support, change, redirect, and challenge others' understandings. Understanding the meaning of what we know enables us to express ideas and formulate opinions related to life in Francophone countries. Learners need to understand how to use the language, not only know the target language in terms of knowing grammatical rules or how to say things in the target language. They rather need to understand the meaning of what they know. Hence, meaning construction is the process of discovering and generating acceptable understandings and lines of reasoning underlying assumptions and bodies of knowledge. Because ideas are not individual achievements but are rather socially created and built, new social understandings are developed, carried forward and passed on through the exchange of personal perspectives and interpretations and understandings for collective negotiation and debate at the aim of reconstructing personal ideas and the creation of collective shared understandings.

The aim of online language learning at the Open University is not to drill and practise specific elementary facts or procedural skills but the development of social and autonomous learning skills. This led me to believe that there should be more focus on meaning construction rather than any individual competence cited above. Hence, online environments are claimed to have the potential to provide students with the opportunity to engage in interactive collaboration in which the learning benefits of speaking, listening, and writing are combined with the benefits of being able to respond to, build on, and challenge others' ideas. When engaged in constructive discussions, learners work together to solve linguistic as well as intellectual problems and/or construct knowledge about the language through questioning, proposing possible solutions, disagreeing, repeating, and managing activities. Language mediates this process as a social tool to communicate with each other and as a cognitive tool to process and manage the construction of new meanings. Thus, online learning may be conceptualized as an ongoing meaning construction process. Hence, it is important that

students are equipped with not only language writing skills, reading skills, and concepts and artefacts (grammar and lexis) but also with skills of meaning construction that would allow them to formulate their own opinions on matters of individual and collective importance. Therefore, it can be conceptualized that the aim of online teaching and learning is to assist learners in their needs to develop strategies of meaning construction. As information needs to be processed and translated into knowledge through the meaning construction process, this study hence focused on understanding this process in the case of online language learning through SAGC.

Thus, this study draws on one of the prominent socio-constructivist understandings that new skills and ideas are not individual achievements, but are developed, carried forward and passed on through interaction and collaboration mediated by the different affordances, in this case of the use of the conferencing system. I hypothesize that the way students use these different tools of communication influences the quality of their collaborations and engagement in constructive discussions for meaning construction. This study seeks then to investigate whether the use of audio-graphic conferencing systems increases learners' opportunities to construct meaning collaboratively during online discussions. Focus is on the impact of the modal choices that participants make on engagement in constructive discussions that might facilitate or hamper the meaning construction process. Specifically, the aim is to see how meaning construction occurred in the conditions of "modal density" (Norris, 2009) where a mix of different modes is being simultaneously used.

In this research, "constructive discussion" is defined as instances of collaboration where students use different mediational tools to create zones of proximal development (for a detailed definition of zones of proximal development or ZPD, see Chapter Two section 2.3.2) for the exchange and negotiation of information that lead to the construction of newly agreed-upon meanings. Interaction is defined as the active involvement of learners in the process of

collaborative meaning construction, i.e., the specific patterns and quantity of communication. Collaboration is defined as the process whereby students work together to create agreed upon new understandings, realize shared goals and objectives (for a detailed definition of collaboration, see Chapter Two, section 2.3.3). Thence, collaborative interaction is defined as the process through which collaboration, information sharing, negotiation and co-construction of meaning occur in a socio-constructivist learning environment.

The second objective of this study is to develop a methodological framework for the description and investigation of the impact of online multimodal interactions on the collaborative meaning construction process from the socio-constructivist perspective of learning. The literature shows the lack of models for the representation and analysis of the impacts of multimodal online interactions on meaning construction through SAGC. This view is not new and has already been echoed by Wang (2004)

> [E]stablished theories and empirical studies on the traditional forms of interaction can shed light on CMC-based interaction but cannot encompass the entirety of this emerging activity. New theories and empirical studies are needed in order to understand CMC-based interaction. (p. 376)

The description and representation of multimodal data continue to intrigue researchers (Develotte et al., 2011; Mirza and Lamy, 2010). In their recent work on the analysis of multimodal data generated in video-conferencing contexts, Lamy and Flewitt (2011) pointed to the lack of research to how the different channels and modalities work together, they stated that some of these tools represent "new" challenges for analysis, in terms of a distinct difference between face-to-face conversations and online conversations. They explained that the way the different tools were used, individually or simultaneously, offered different

potentials for meaning construction. In their view, "[t]he range of media available for communication varies, sometimes restricted to typed text, sometimes accompanied by audio and/or visual exchange, resulting in screens of very different design that offer different potentials for meaning making" (Lamy and Flewitt, 2011, p. 73). Hence, there is a need for models that show how different tools of communication work together and influence the way students engage in interaction to construct meaning together. There is an urgent need for a methodology to transcribe and analyze synchronous multimodal interaction from a socio-constructivist perspective.

In sum, this research seeks to determine (1) the impact of the affordances of combined and individual use of communication tools on patterns of online multimodal interactions generated in synchronous conferencing and whether they are likely to increase levels of interactions and, (2) whether these multimodal interactions meet key characteristics of socio-constructivist learning environments with regards to the collaborative meaning construction process: mediation, ZPD, collaborative construction of newly agreed-upon meanings.

1.3. Research questions

This study attempts to find answers to the following research questions:

- What are the patterns of online multimodal interactions?

- What is the effect of the affordances of the individual and the simultaneous use of communication tools on patterns of online multimodal exchanges?

- Do multimodal online synchronous interactions in audio-graphic conferencing support the meaning construction process and if so to what extent?

- How do students and tutors perceive their experiences of online multimodal interactions in SAGC in terms of participation opportunities and adequacy of learning support?

1.4. The structure of the thesis

This thesis contains six chapters. The current chapter explained the aims and objectives of this PhD and positions the study within a socio-constructivist framework of language learning.

The second chapter reviews the existing theoretical and empirical work on which the research is based. It demonstrates that online learning mediated by different tools of communication is fundamentally social in nature. The chapter starts with a consideration of key elements of the socio-constructivist approach as explained by Vygotsky (1978/1981) and the way they relate to learning, in particular language learning. The socio-constructivist perspective is then related to studies of online learning and multimodal online interactions generated in audio-graphic conferencing. With attention focused on synchronous online discussions, key aspects of the collaborative meaning construction process, affordances of SAGC, and gaps in the literature are identified, showing the relevance of the research questions raised by this thesis. The chapter finishes by defining our research questions.

The third chapter starts by describing the data and procedures of data collection. Then, it explains my procedures towards the development of the methodological framework for the

transcription of multimodal online interactions as well as the analysis of the affordances of use of different tools of communication from a socio-constructivist point of view.

The fourth chapter shows how the methodological framework is implemented in this study. It shows how data from the online tutorials is analyzed and the results obtained.

The fifth chapter deals with the analysis of interviews and questionnaires to elucidate participants' perceptions about their overall online experiences.

Finally, the sixth chapter deals with the interpretation and the discussion of the results of the present study. The limitations of this thesis are enumerated.

1.5. Conclusion

To sum up, there are no other empirical investigations in the literature which evaluate the construction of meaning in SAGC and the impact of the different multimodal mediational tools on the meaning construction process. This study therefore attempts to fill a gap by addressing significant issues in SAGC with due focus on the impact of students' multimodal choices on the collaborative meaning construction process.

Chapter Two

Review of the literature

2.1. Introduction

The pedagogic design of online language teaching has been greatly informed by the socio-constructivist view of learning, particularly the importance of mediational tools. The mediational tools are significant in that they allow groups of people to learn together using various equipments in different settings rather than rely solely on their experience and cognitive development. In this regard, the present study adopts a socio-constructivist view of learning. It seeks to examine the impact of the affordances of multimodal online interactions generated in audio-graphic conferencing systems on the meaning construction process.

In this chapter, the theories and the empirical studies conducted to date are reviewed. I start by examining the key concepts of socio-constructivism and their applicability to language learning and particularly to online language learning. This necessitates a definition and understanding of the concepts of 'knowledge', 'interaction', 'collaboration', and 'meaning construction' within a socio-constructivist approach. I then proceed to a critical review of some empirical research that attempted to examine the affordances of online multimodal interactions in the context of multimodal web conferencing. I finish by raising the research questions that need to be investigated in this study.

2.2. Constructivists' and socio-constructivist perspectives on knowledge and interaction

There are two different versions of constructivism but they commonly agreed that learning is an active process of knowledge construction. One of the common threads of cognitive constructivists and socio-constructivists is the idea that development of understanding requires the learner actively to engage in knowledge construction. Jenkins (2000) argued that: "The development of understanding requires active engagement on the part of the learner" (p: 601). Brooks and Brooks (1993) stated that: "The theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective" (p. vii). Thus, constructivists have shifted the focus from knowledge as a product to knowing as a process. Cognitive constructivism and social constructivists argue that knowledge is the result of social as well as individual processes of learning. However, the role of social interaction and the ways in which it relates to second language learning are interpreted differently by the two constructivist theories. Cognitive constructivists believe that learning is individual then social. However, socio-constructivists believe that social learning precedes individual learning. In order to gain a better understanding of the concepts of 'knowledge' and 'interaction', it is worth examining the way these two concepts emerged and evolved differently from cognitive and social constructivist points of view.

Cognitive constructivism is a form of realism where reality can only be known in a personal and subjective way. This view holds that knowledge is a subjective interpretation imposed by the individual on the world. Knowledge does not exist outside of the learner, it exist inside his/her mind. Doolittle and Hicks (2003) explained that cognitive constructivism disregarded the social context in which the learning process occur and referred specifically to knowledge construction as an internal process and that each individual constructs individually

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his/her own meanings. In this direction, von Glaserfeld (1995) argued that knowledge is not passively received but built up by the cognizing subject. Cognitive constructivists argued that we can understand the learning process better by first understanding how the human brain processes and learns new information.

The establishment of the epistemological basis for cognitive constructivism is largely attributed to the work of von Glaserfeld who was greatly influenced by Piagetian theories on the nature of knowledge and cognitive development. Piaget focused on the active role of the individual in learning. He considered children's active construction of their own understanding as fundamental to their cognitive growth, and viewed peer interaction as a potent source of progress (Piaget, 1932). He explained that: "All knowledge is tied to action, and knowing an object or an event is to use it by assimilating it to an action scheme" (Piaget, 1967, pp. 14-15). He considered learning as a product of self-organization which according to Payne involved:

> [a] product of self-organization involving an iterative process whereby interaction in an experiential world produces a state of mental dissonance in the individual, to be resolved by adaptation or cognitive changes entailing the coordination of inner experiences with outer experiences, within the specific community which would restore the individual to a state of equilibrium. (2009, p. 233)

Furthermore, Piaget believed that our understandings of reality are constantly being revised and re-constructed through time and with respect to exposure to new experiences. He further argued that:

[w]hat remains is construction as such, and one sees no ground why it

should be unreasonable to think it is the ultimate nature of reality to be

in continual construction instead of consisting of an accumulation of

ready-made structures. (1970, pp. 57-58)

Accordingly, interactions between the cognitive processes and environment are considered as sources of perturbations or cognitive conflicts and opportunities for mutual adaptation that lead to changes in individual interpretations of experiences from the world (von Glaserfeld, 1989). Interaction is considered then as the source of cognitive conflicts and cognitive change. Hence, cognitive constructivists view learning as an active, creative, and interactive process and view knowledge as something children must construct and less like something that can be transferred (Florin, 1990).

Constructivists believe that, because individuals make meaning based on their prior experiences, anything they produce is considered as knowledge. Von Glaserfeld (1998) introduced the concept of viability of knowledge to replace the concept of truth in constructivism. According to Von Glaserfeld (1998), viability of knowledge is relative to a context of goals and purposes.

While from cognitive perspectives knowledge is generally represented in terms of cognitive structures that are acquired and organized in memory, social constructivists generally regard learning as the appropriation of socially derived forms of knowledge that are not simply internalized over time but are also transformed in idiosyncratic ways in the appropriation process (Hicks, 1995). This is to say that while cognitive constructivists stress heterogeneity of thoughts as individuals actively interpret social and cultural processes, highlighting the contributions that individuals make to the development of these processes,

social constructivists emphasize the homogeneity of thought among the members of the community engaged in a collaborative work.

Social constructivists have taken von Glaserfeld's concept of viability further, defining viability as that which fits the social context, not only the individual's schemes and interpretations. It is through checking out our understandings and perspectives with others that individuals develop a sense of the viability of ideas. Knowledge hence is always connected to the situations in which it was constructed. It exists not only in people's minds as argued by cognitive constructivists but "Is spread across its component parts, some of which are in the mind and some in the world much as the final picture on a jigsaw is spread across its component pieces" (Brown and Palincsar, 1989, p. 399).

From this viewpoint, the ideas and thoughts identified within the mind of individuals are the products of interactions with the social context. Socio-constructivists contend then that knowledge exists as a social entity, not just as an individual possession and that the essence of human knowledge is that it is shared. From this perspective, mental functioning of the individual is not simply derived from social interaction; rather, the specific structures and processes revealed by individuals can be traced to their interactions with others. Socio-constructivism hence has brought out how knowledge construction and appropriation are as much a function of the immediate context of social interaction as of individual cognitive processes. Vygotsky (1981) rejected the conventional separation between the social and psychological aspects of cognition and development and considered the learning process as both social (inter-mental) and individual (intra-mental). He argued that inter-mental learning (in which the process is mediated by other persons and cultural artefacts and signs) precedes intra-mental learning in which the capacity is carried out by the individual acting via psychological mediation (Lantolf, 2000). He believed that we organize our thinking through the organization of the artefacts present in the learning environment. The socio-cultural view

of learning can be broadly stated as a process of "enculturation into a community of practice" (Cobb, 1994, p. 13) whereby guided social participation in shared knowledge construction, mediated by technical and/or psychological tools, provides learners with support to increase the potentiality of cognitive growth, and lead to transformations in individual understandings with the appropriation of the shared knowledge (Lantolf, 2000). In this way, Vygotsky's semiotic theory provided a link between psychological processes within the individual and cultural forms of behaviour between individuals and suggested that "the internalization of cultural forms of behaviour involves their reconstruction on the basis of sign operations" (Vygotsky, 1978, p 57). Accordingly, through these mediational means, or 'sign operations', external social interactions become 'internalized', i.e. reconstructed internally, as psychological processes or ways of thinking. From a Vygotskian perspective, cognitive development is studied by examining the processes that one participates in when engaged in shared endeavours and how this engagement influenced engagement in other activities.

Constructivists from different persuasions agree that learning is an active process of knowledge construction. I now move on to consider how knowledge construction is considered by them.

The notion of knowledge construction underpins the conception of online conferencing at the Open University (OU); hence it is central to the current research. To create any kind of knowledge, for instance meaning, learners need to go through different steps. This is in keeping with the fundamental socio-constructivist view which states that the social, the physical and the cognitive are parts of the same larger processes that also underlie second language (L2) development (Atkinson, 2002). Thus, meaning construction is a comprehensible process made up of different interactive constructs, namely collaboration, mediation, zone of proximal development (ZPD) and internalization (these concepts are defined in the coming section 2.3). They are potential clues that can be used as an indication of students' engagement

in collaborative meaning construction. Thus, in order to understand and provide a theoretical as well as a methodological framework for the examination of the concept of the meaning construction process in this study, it is necessary first to look at what this process entails.

2.3. Meaning construction process as knowledge construction process

The very first important theme in Vygotsky's hypothesis is that individual development, including higher mental functioning, has its origins in social sources (Wertsch, 1991). It has been stated that every function in the cultural development of the child appears twice: first in the social and later in the psychological and that "All higher psychological functions are internalized relationships of the social kind, and constitute the social structure of personality" (Vygotsky, 1960, pp. 197-198).

Knowledge is then created among people in their collaborative meaning-making. Learning is hence viewed as a meaning-making process which takes place in social interaction when participants collaborate to carry out learning activities to attain a shared goal. Learning activity is a matter of constructing new understandings and meanings within contexts of instruction. The concern is not with the transmission of known facts but with the construction of personally meaningful knowledge. Karppinen (2005) clearly stated that constructive learning means that learners accommodate new ideas into their prior knowledge. He added that this process of constructing knowledge is a process of meaning-making, not of knowledge-reception. Knowledge construction is then seen as a social and collaborative process in which different perspectives are exchanged, negotiated and then incorporated (Pea, 1993). Solomon (1993) explained that this exchange of ideas and negotiation of meaning affect the individual's cognition as well as the group's distributed cognitions as participants transmit, negotiate and transform their ideas and create new knowledge. Socio-constructivists'

theoretical insight rested on the premise that individuals learn better when their knowledge is challenged, reformed, and elaborated through interaction with others (Mercer, 1994). When challenged, individuals discuss and criticize others' contributions, modify them, and/or present alternatives. By doing so, learners are pushed to work collaboratively to test multiple perspectives and create an agreed upon new knowledge (Chan, Burtis, and Bereiter, 1997).

It becomes clear that collaboration serves as an instrument for thinking because in the process of explaining, clarifying, elaborating, and defending our ideas and thoughts we engage in cognitive processes such as integrating, elaborating and structuring (Brown and Palinscar, 1989; Jonassen et al., 1995). Therefore, it is in the process of articulating, reflecting and negotiating that learners engage in a meaning-making and hence learning. Learning is thus an active process in which individuals co-construct meaning by sharing concepts and opinions and negotiating by analyzing, discussing, and evaluating the shared knowledge, and experiencing new situations and applying newly constructed knowledge. Viewed from this perspective, collaborative work is hence considered to involve both externalization and internalization processes through which meanings constructed between people in the inter-mental plane are taken in, transformed, and turned into personal meaning-making systems by an individual.

So far, the meaning construction process is defined as a system made up of different constructs that are interactive, interrelated and interchangeable. A change in one element causes a change in the rest of the elements. For a successful transfer of socially newly constructed knowledge from the inter-mental to the intra-mental planes to be possible, the different constructs need to operate together. Thus, to examine and analyze the meaning construction process, there is a need to understand its underlying core elements and the way they relate to each other.

2.3.1. Mediation and mediated social interaction

The second main Vygotskian theme identified by Wertsch (1991) is that human action is mediated by tools and semiotic signs where "The semiotic means include: language; various systems of counting; mnemonic techniques; algebraic symbol systems; works of art; writing; schemes, diagrams, maps and mechanical drawings; all sorts of conventional signs and so on" (Vygotsky, 1981, p. 137). The semiotic means are both the tools that facilitate the co-construction of knowledge and the means that are internalized to aid future independent problem-solving activity. In the same line of thought, Leontiev (1981) called this process appropriation and stated that:

> [c]hildren cannot and need not reinvent artefacts that have taken millennia to evolve in order to appropriate such objects into their own system of activity. The child has only to come to an understanding that it is adequate for using the culturally elaborated object in the novel life circumstances he encounters.
>
> (1981, p. 63)

This is to say that learning is considered as a semiotic process attributable to participation in socially mediated activities. They function as a mechanism through which the transformation of constructed knowledge from inter-mental to intra-mental functioning occurs. As assumed by Vygotsky (1978), effective learning occurs through collaboration in mediated activities, and with support from people and objects present in the learning environment.

Socio-constructivism emphasizes then mediated social interaction as the source for knowledge construction. Mediated socio-educational interactions provide opportunities for the

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social and individual planes of psychological activity of learners to interact. This idea is better

explained in the description of the following construct.

2.3.2. Zone of proximal development (ZPD)

Vygotsky (1978) argued that learners work together to co-construct knowledge through

agreement between the different cognitive patterns within an individual's brain and consensus,

which is an agreement between the different cognitive patterns of different individuals. He

further explained that learners acquire new strategies and knowledge as they engage in

collaborative activities and internalize the effects of working together. Learning triggers

internal developmental processes that operate only when the child interacts with people and

objects present in the environment. In support of this perspective, Vygotsky (1981) introduced

the construct of the zone of proximal development (ZPD) which he defined as the difference

between what a person can achieve when acting alone and what the same person can

accomplish when acting with support from someone else and/or cultural artefacts. He argued

that to understand the relationship between development and learning we must distinguish

between these two developmental levels: the actual and the potential levels of development.

The actual refers to what the child can accomplish and demonstrate alone. Potential levels of

development are what children can do with assistance, under adult guidance or in

collaboration with more capable peers. The ZPD is regarded as a better, more dynamic and

relative indicator of cognitive development than what children accomplish alone.

Although Vygotsky framed all the key constructs of his theory in terms of children,

different researchers have shown (Ravenscroft, Wegerif, and Hartley, 2007) that it can be

applied to situations involving a learner and a more experienced peer or the teacher.

ZPD is thus defined as the site where the social forms of mediation develop. It is more appropriately conceived as the collaborative construction of opportunities for individuals to develop their mental abilities (Lantolf, 2000). The ZPD is established between the learner, tutor, and the learning environment which form a "dynamic whole" (Duffy and Cunningham, 1996. p: 185). I may say that rather than a solitary process, the zone of proximal development are zones where learners collaborate through articulating ideas, sharing information, negotiating meaning through socially mediated interaction and hence co-construct new shared knowledge with support from the tutor and more advanced peers. This support from the tutor is known as scaffolding. In the field of teaching and learning, a fundamental concept is essential for the creation of the ZPD. This concept is known as scaffolding. Donato (1994) explained that "Scaffolded performance is a dialogically constituted inter-psychological mechanism that promotes the novice's internalisation of knowledge co-constructed in shared activity' (p. 41). Jonassen (1994) argued that the collaborative process of knowledge construction requires articulation and reflection on knowledge which involves both internal negotiation and social negotiation under the guidance of the tutor and peers. According to Vygotsky's zone of proximal development, scaffolding is an integral part of the collaborative knowledge building and meaning construction process. Research on scaffolding in language learning has shown how learners working together reach a higher level of performance by providing assistance to one another (Brooks, 1992; Donato, 1994; Ohta, 1995; Ohta, 1997; Ohta, 1999). It is defined as the support provided by peers, teachers or reference sources such as dictionaries which enable students to perform increasingly well (Yang and Wilson, 2006). However, Duffy and Cunningham (1996) argued that the sources of scaffolding are not limited to the tutor or expert peers, but encompass the affordances of the whole learning environment which include "any artifact in the environment... as well as the cultural context" (1996, p.183). Bonk and Kim (1998) stated that: "Scaffolding is a teaching method that provides the learner

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with support or assistance to complete a task or solve a problem that would not have been mastered without help" (P. 70). In this regard, Hammond and Gibbons (2001) interpreted scaffolding as high challenge and high support. To put it differently, teachers need to set up tasks which challenge students' current capacity and provide them with support to enable them to perform at this new level. Teachers need great skills in assessing and then exploiting their students' ZPD.

2.3.3. Collaboration

Collaboration is the process whereby students work together to realize shared goals and objectives (Mangenot and Nissen, 2006). Collaborative knowledge construction is the creation of knowledge as a social product (Bereiter and Scardamalia, 1996). Distributed cognition is defined as cognitive processes that are distributed across multiple members of a social group who think in conjunction using available culturally provided tools and implements (Salomon, 1997). Hutchins (1995) affirmed that cognition is situated in socio-cultural environments that affect knowledge construction therefore cognition processes do not occur solely 'inside' the individual. Collaboration therefore allows learners to share ideas, negotiate them and co-construct new knowledge of theories and concepts (Hmelo-Silver, 2004; Palincsar and Herrenkohl, 1999) and shared meaning (Roschelle, 1996). When collaborating, learners distribute the cognitive load among group members as well as support each other taking advantage of the distributed expertise within the group (Pea, 1993). They discuss and integrate each other's perspectives, synthesize their ideas, and co-construct the meaning of tasks. Hence, it has been argued that integration occurs when individual learners operate on the basis of the reasoning of their learning partners while working together (Nastasi and Clements, 1992).

2.3.4. Internalisation

As is explained earlier, successful learning involves a shift from collaborative inter-mental activity to autonomous intra-mental activity. Internalisation of social interactive processes happen in the zone of proximal development (ZPD) (Vygotsky 1978; Wertsch 1985), the interactional space within which a learner is enabled to perform a task beyond his or her own current level of competence, through assisted performance. So, the convergence of thinking with culturally created mediational artefacts occurs in the process of internalisation, or the reconstruction on the inner, psychological, plane, of socially mediated external forms of goal-directed activity. Internalisation is, then, the process through which a person moves from carrying out concrete actions in conjunction with the assistance of material artefacts and of other individuals to carrying out actions mentally without any apparent external assistance (Lantolf, 2000). From this socio-constructivist perspective, as learners participate in activities, they internalize what they have learned from working together (Palincsar & Herrenkohl, 1999; Vygotsky, 1978).

2.4. The interrelationship between the constructs of the meaning construction process

As is explained above, the core notions underlying meaning construction process are the concepts of mediation, collaboration, ZPD and internalization. The examination of the different concepts shows that they are interactive, tightly interrelated, and influence each other. They are in a relationship of complementarity. If meaning construction is to take place, the different elements need to operate together. For instance, the zone of proximal

development cannot be created if learners do not interact and if support (scaffolding) is not provided by more experienced learners or teachers. Guided participation in shared meaning construction mediated by technical and/or psychological tools provides learners with support that enables higher potentiality of cognitive growth, and leads to transformations in individual understandings with the appropriation of such shared knowledge. When collaborating, learners work together to build new active, responsive and common understandings and meanings through sharing and negotiating information. When sharing and negotiating information, learners exchange ideas, explore issues, take positions, build on each other's ideas (Pawan et al., 2003) and scaffold each other (through explaining, agreeing, disagreeing, arguing), negotiate (solve communicative problems), reflect on and re-evaluate these positions, and subsequently reach higher-level understandings which might result in construction of new shared knowledge (Kamhi-Stein, 2000; Lapadat, 2002; Pena-Shaff & Nicholls, 2004).

Therefore, instances of meaning construction are marked by the presence of exchanges where participants share information, explore issues, question, check, clarify, challenge and integrate the shared information.

I conclude by saying that what counts as evidence of learning in this tradition is the co-construction of new meanings through collaborating in the zone of proximal development where learners are provided with different mediational tools and scaffolding that support the collaborative construction and its internalisation. This has implications as far as the analysis of the meaning construction process is concerned. The analysis of this process implies the analysis of the different elements all together, without which an understanding and exploration of this process is deemed impossible.

Different language learning researchers made claims about the importance of the notions underlying meaning construction processes to language learning. The next section highlights these claims.

2.5. Socio-constructivism and language learning

Language learning is one of the most impressive mental operations of the human mind in view of the complexity of grammatical structures, the size of the mental lexicon, and the multiple functionality learners of any language are confronted with. Language learning theories have drawn on and been influenced by different learning theories, including behaviourist and cognitive theories of learning. They have been the main influences on materials and curriculum design in recent decades. The limitations of these approaches have become apparent because of their emphasis on objectives and transmitting information rather than developing learning strategies, skills and competencies. Consequently, social-cognitive approaches which focused on knowledge as something that should be constructed rather than transmitted, hence adding a cognitive as well as a social apprenticeship to the learning process, have been increasingly implemented in the design of learning and teaching approaches. Language learning is therefore described as an interactive and a dynamic process, in which new meanings are constructed when learners are placed in a collaborative social context of exploration rather than in a context of mere formal instruction. In this context, Lantolf and Pavlenko stated that socio-constructivist theories of language learning supported their belief that it was the use of language for communication which leads to language development (Lantolf and Pavlenko, as cited in Larsen-Freeman, 2003). Larsen-Freeman (2003) pointed out that language learning is always connected to an action and a purpose. In the same line of thought, van Lier's (2000) ecological view of second language learning considered interaction and negotiation of meaning to be at the core of the language learning process. He stated that for negotiation of meaning to take place, learners should be involved in interactions and collaborations where they share the same purpose rather than just a generic conversation.

Many language learning researchers agreed on the applicability of the socio-constructivist approach to teach and learn languages. It has been argued that social constructivism is able to bring about changes to the epistemology of the learning of science, mathematics, and foreign language learning as well. Knowledge construction can be a useful theoretical framework to help transform the epistemology of L2 learning (Lantolf, 2000). They suggested that simple training in structural and vocabulary knowledge would not result in real linguistic competence and language proficiency. The development of skills and strategies of language processing, learning competencies and skills of meaning construction are needed for effective learning to take place.

Therefore, second language learning researchers have advocated the expansion of its theoretical framework of research to the socio-cultural perspective and emphasized the integration of collaborative learning into L2 learning. Language learners need individually and collaboratively to construct the meaning of words, phrases, sentences and texts. Learning involves an active process in which "learners construct meaning by linking new ideas with their existing knowledge" (Naylor and Keogh, 1999, p.93).

For instance, it is argued that learners are able to ultimately enhance their lexical ability through generating, sharing and improving their conceptual artefacts (e.g. grammatical rules or meaning of words) by interactional moves (Chen, Wen and Looi, 2009). These authors stated that: "learners may improve their ideas in essay-writing or text-comprehension through brainstorm-and-inquiry approaches, so that their syntactic ability as well as lexical ability can be improved at the same time" (2009, p. 337).

Another example given by language researchers is reading. Social constructivists considered reading, like learning, as a social practice where "the social context affects when you read, what you read, where you read, who you read with and, of course, why and how you read" (Yang and Wilson, 2006, p. 366). Luke and Freebody (1990) pointed out that making

meaning is another essential reading resource where it is not enough to just hear or see the words on the page. The readers also have to make efforts to interpret and make sense in their own minds of what the writer says, which is intra-mental dialogue in Vygotsky's terms. In listening to the author's words and discussing them with their peers, students need to construct their own representation of the author's message, which is inter-mental dialogue (Lewis and Slade, 1994).

Meaning construction with the aim of allowing learners to develop greater flexibility and awareness on communicative and linguistic learning levels needs is the basis for L2 learning.

2.6. Mediated multimodal interactions in online environments

Before starting our critical review of research that is relevant to the present study, it is helpful to start by clarifying the meaning of educational online conferencing as well as how it fits with socio-constructivist based pedagogy.

2.6.1. Definition of computer Mediated Communication (CMC)

CMC used to be defined as the "communication that takes place between human beings via the instrumentality of computers" (Herring, 1996, p. 1). This instrumentality provides access to different modes of communication and interactions distinct from face-to-face encounters. Wang (2004a) stated that it encompassed the following characteristics and can be:

- Text-based, oral, and/or visual,

- Either synchronous (real time and simultaneous interactions such as synchronous CMC) or asynchronous (subsequent interactions like asynchronous CMC, blogs and forums).

- Be one to one, one to many, or many to many.

- Learner to learner, learner to instructor, or learner to native speaker.

- Time and place dependent or independent.

With the introduction of audio-graphic and videoconferencing, CMC now embraces much more content and depth than text-based asynchronous interaction alone. Audio and videoconferencing are multimodal allowing text, audio, video communication and application sharing (Harrington and Levy, 2001, p. 21).

2.6.2. CMC and socio-constructivism

Social interaction is central to synchronous conferencing pedagogy. Online researchers agree that better possibilities for greater interactivity between students, and between tutors and students can be achieved using these systems than asynchronous conferencing. These new possibilities have been linked with increasing interest in social constructivist pedagogy, which focuses on social interactions to build knowledge together in groups. Jonassen et al. (1995) suggested that potential for increased opportunities for collaboration and mediated social interactions among learners has connected computer-mediated communication to socio-constructivist pedagogy.

Arnold and Ducate (2006) explained that the fact that many educators see CMC as a valuable type of educational technology that fits with socio-constructivist pedagogy is partly due to certain inherent features of the medium, which affect and shape participants'

interaction. On one hand, there have been many reports of successful implementations of asynchronous conferencing as well as synchronous chat conferencing in relation to the promotion of knowledge construction processes. Asynchronous chat conferencing often engages participants in intensive information exchanges (Anderson and Kanuka, 1998; Pawan et al., 2003), in-depth information processing (McKenzie and Murphy, 2000), critical thinking (Newman et al., 1995; Newman et al., 1996) and engagement in argumentation processes (Hendricks, 2002; Doolittle and Hicks, 2003; Pena-Shaff and Nicholls, 2004) that facilitate collaborative knowledge construction (Gunawardena et al., 1997; Anderson and Kanuka, 1998; Kamhi-Stein, 2000; Sengupta, 2001).

SAGC systems are increasingly implemented in online language teaching. A common idea runs across all of them which is the importance of the multimodality of the new audio and video conferencing systems for the creation of better opportunities for increased levels of interactions and collaborative meaning construction. Researchers (Hampel and Hauck, 2004; Guichon, 2009; Wang and Chen, 2009; Mirza and Lamy, 2010; Bower, 2011) suggested that audio and video conferencing provide unique opportunities for collaboration and constructive discussion in distance language learning. It is stressed that new multimodal technologies create new environments with different features for the exchange and construction of knowledge. Hampel (2003) suggested that multimodal online conferencing systems may be particularly suited to provide the socio-cognitive support and mediated social interactions seen as fundamental to learning. Multimodality theory helps to understand the complex nature of mediated online interaction generated in audio-conferencing. Kress and van Leeuwen (2001) defined multimodality as:

> [t]he use of several semiotic modes in the design of a semiotic product or event, together with the particular way in which these modes are combined – they

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may for instance reinforce each other [...], fulfill complementary roles [...] or be hierarchically ordered. (2001, p. 20)

Synchronous audio-graphic conferencing corresponds to such a definition due to the fact that it offers various ways of combining different modes of communication within one medium that may have implications for meaning making online. SAGC offers different tools of communication like the audio, the chat and the whiteboard that include different semiotic modes that include visual, verbal and written modes as they can feature images too. The use of tools available in audio conferencing systems provides different semiotic modes with different affordances that are claimed to facilitate constructivist teaching and learning. Consequently, different researchers have concluded that the integration of these different tools in one medium has resulted in a modal complexity which has created new types of mediated multimodal interactions with specific characteristics hence affordances (Örnberg Berglund, 2009).

There is thus a need to define the concept of affordances which is a key concept to the present study.

2.6.3. Affordances of online multimodal interactions

Synchronous audio-graphic conferencing offers different tools of communication. The use of these tools offers a variety of affordances which may be positive (opportunities) or negative (constraints). Gibson (1966) defined affordances in the context of environments as 'what things furnish, for good or ill' (1966, p. 285). By affordances, he referred to all the distinctive features of the learning environment that facilitate or hinder understanding. This concept has been used in the field of online education research to refer to all the distinctive

features of online learning environments including the different mediational communication tools. Affordances offer advantages which influence the way we express and perceive communicative actions (Stickler and Hampel, 2010) as well as constraints to online discussions and the meaning construction process.

Earlier studies, that focused on asynchronous and synchronous chat-based systems that were less multimodal than new audio-graphic and video conferencing systems, have already pointed to the influence of the use of different tools of communication on interaction. Anderson (2003) pointed out that "As a result of this complexity, a number of online researchers and theorists have broken the concept of interaction down into component types based largely on the roles of human and inanimate actors involved" (2003, p. 131).

Ruberg, Moore and Taylor (1996) concluded that computer mediated communication offers an alternative pattern of interaction which differs from the face to face pattern. Besides the traditional types of interaction (students-teacher, student(s)-student(s) and students-content), Hillman, Willis, and Gunawardena (1994) identified learner-interface interaction which they defined as the process of manipulating tools to accomplish a task. They argued that "the interface was not neutral and would have effects on the way interaction with the other modes will occur". (1994, p.34). Moore and Kearsley (1996) emphasized the importance of learner-interface interaction and argued that the success of interaction with the interface is a pre-requisite for successful interaction. Hirrumi (2002) identified six types of online interactions and focused on the importance of learner-non-human interactions that are subdivided into further sub-types: learner-content, learner-environment and learner-interface.

In the context of multimodal technology (audio-graphic and video conferencing), Wang (2004b) claimed that notions of multimodality and affordances are more complex and more difficult to define. She stated that:

[P]robing the nature of interaction, one cannot help but notice its complexity and hence the problem of defining it. Such complexity lies not only in the inclusiveness and extensiveness of interaction, but also in its evolving content and roles in a time of technological innovation. In other words, the concept of interaction today appears much richer in content, scope, and depth than it did 20 years ago. (2004a, p. 91)

To describe the possible affordances of mediated conversations in the context of videoconferencing, Develotte, Kern, and Lamy (2011) adapted the following model (Figure 2.1) that was proposed by Lamy and Hampel (2007).

Cercle A : Le corps
(mimiques, gestes, etc.)

Manifestations corporelles non-pertinentes
pour la description de la conversation (ex:
physiologie ou étiologie du participant)

Interactions personne-machine non-
pertinentes pour la description des
conversations (ex: calculs
algorithmiques informatiques
déclenchés par l'humain mais
invisibles en tant que tels)

Conversations présentielles

Espace D

Cercle C : Environnement
matériel (et technologie)

Cercle B : Interactions
linguistiques

Règles conversationnelles

Aspects de l'environnement non-pertinents
pour la conversation (ex: non connus des
participants)

Affordances conversationnelles de
l'outil

Figure 2.1. The representation of mediation affordances of online conversations (proposed by Lamy and Hampel (2007), adapted by Develotte, Kern and Lamy (2011, p. 14)

The model suggests that conversation is mediated by body gestures, language and technology. The different overlapping circles represent interactive zones of mediations. The cross-section area D is the zone where all zones overlap, interact and mutually influence each other. This model suggests that the interaction and overlap between the different mediational tools of a learning environment generate different affordances, which I will define shortly. For instance, I may say that the interaction between zone A and zone B generates affordances that are different from the affordances generated when zone A interacts/overlaps with zone C. In this direction, Hutchby (2001) explained that new practices have emerged as a result of the interaction between the different communicative affordances of the artefacts and normative structures of discourse.

Thus, Develotte, Kern and Lamy (2011) defined affordances of the different types of mediational tools as a relation of reciprocity between participants and the environment. They further argued that this reciprocity is manifested as productive transformations, in the sense that users of conferencing platforms rethink the original functions of tools. For instance, the designed affordance of chat is to back-up online communication in case of technical problems. However, Lamy (2006) stated that the chat tool was alternatively used to fulfill socio-affective functions. This is well expressed by Hutchby who stated that:

> [W]hile designers may be said to have some control over the features they design into an artefact, and while they may have some idea about the range of uses to which the artefact should be put, they have little control over the artefact's communicative affordances- over the range of things it turns out to enable people to do. (2001, p. 123)

Norris (2004) introduced the notion of modal density to account for the ways in which different modes interrelated when we communicated. Participants in conversation are able to conclude levels of attention through modal density, she argued, and this can be achieved either through "modal complexity" which is defined as the emphasis on a combination of different modes or through "modal intensity" which is defined as the emphasis on one specific mode. In the same line of thought, Örnberg Berglund (2009) stated that "When using multimodal tools for online interaction, the way the different modes combine results in new types of constraints and affordances" (2009, p. 188).

Based on these claims, if I apply the views of Develotte et al. as regards affordances and Norris' views as regards modal density on the affordances provided by the different interactions between the mediational tools offered by audio-graphic conferencing tools (described in Chapter Three, section 3.2, Figure 3.1), I may have a Figure like the following:
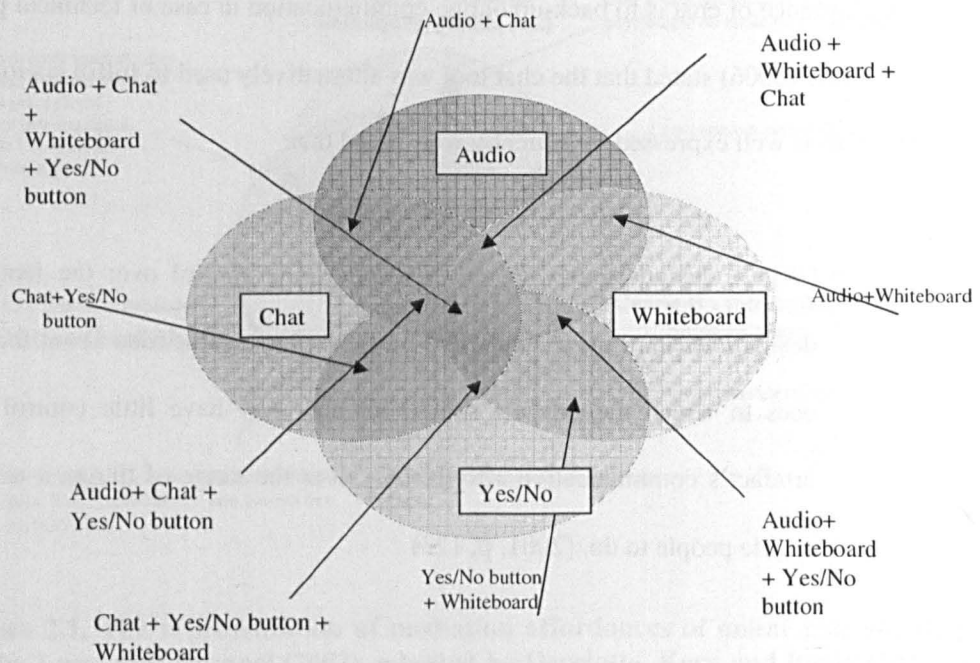
Figure 2.2. The representation of affordances of the interaction between mediational tools in audio-graphic conferencing systems.

The four zones represent the different tools of communication offered by SAGC tools. As was explained in the previous chapter, SAGC is an internet based application for tutorials combining shared graphics with real time, online, audio and chat discussions. In this study, the focus is on four tools only since our observations revealed that participants used these tools only. First, the audio tool is used. It allows a synchronous oral mode that includes simultaneous talking among multiple participants. With this feature, users simply click the Talk button to start a conversation. Elluminate sessions are set for one talker at a time. The moderator who is the tutor controls the use of the audio tool and can easily increase the number of simultaneous talkers from one up to six at any time during the session. Second, text-based communication is available in Elluminate using the chat tool. It serves to send a text message to everyone, to selected participants, or to a single participant in the session. It is not under the control of tutors and students are free to use it at any time during the tutorial. Third, Elluminate provides powerful and versatile whiteboard tools that allow all users to draw or write on the whiteboard. Multiple users can interact on the whiteboard simultaneously. Moreover, the whiteboard is object oriented; meaning that all objects place on the whiteboard can be edited. Tutors control access to the whiteboard in that students do not use it if they are not invited to by their tutors. Finally, the vote tool, known as the yes and no button, is used to show comprehension, agreements and disagreements.

Based on Norris' (2009) definition of modal density, Lamy and Hampel's (2007), and Develotte et al.'s (2011) views about the affordances generated through the use of the different elements of the learning environment, I assume that students' choice to use tools individually or in combination would result in different kinds of affordances depending on the combination

of tools used. The different overlapping zones identified on the Figure may be defined as different resulting types of mediational affordances.

Researchers concur that besides the affordances of each individual mediational tool, new dynamic and changing affordances result from the interaction between the affordances of participants' use of the different mediational tools. Given this view, Hutchby proposed the concept of interactional dynamics and explained that the affordances of use of technology reveal themselves in and through users' interactions with the artefact. This view suggests that the same tool might have different and multiple affordances depending on the way it is used by participants as well on the type of mediational tool with which it is simultaneously used. Lamy (2006) has argued that "The shaping that takes place through these mediational tools is iterative: the tools help create the learning, and in turn the learner shapes these tools, which further shape the learning and so on" (2006, pp. 385-386).

Thus, these claims are used to back up my assumptions that different affordances may be generated by the different multimodal choices of participants (the individual as well as the simultaneous use of the different tools of communication). At this point, I adopt Norris' (2009) views about modal density and Develotte et al.'s (2011) views about affordances, and assume that the interaction between the affordances of the different mediational tools of communication may result in the generation of other types of affordances that would influence the way students engage in constructive online discussions and hence the collaborative meaning construction process.

I assume that the modal density of online environments in terms of complexity and intensity offers different opportunities that facilitate the creation of new types of interaction which reflect the features of constructivist learning environments. I assume that the affordances of different communication tools influence the way learners collaborate to negotiate and co-construct meaning.

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2.6.4. Waves of research of multimodal online interactions

An examination of the current literature shows that online researchers have approached the analysis of multimodal online interactions differently. Kern, Ware and Warschauer (2004) identified two waves of research on online language learning which parallel technological and pedagogical changes. They note that the first wave "tended to focus on the most quantifiable and easily measured aspects of communication," while the second pushed for "greater attention to particular practices of use, described and evaluated in terms of their specific social contexts" (p. 243).

To examine the effects of online multimodal interactions on collaboration and knowledge construction processes, some researchers provided accounts of rates of interaction to argue for engagement in constructive discussions that facilitate meaning construction. Other researchers provided accounts of the quality of interactions by analyzing different aspects of the meaning construction processes. Furthermore, the majority of the studies focused on the analysis of the affordances of use of individual tools. Few studies focused on the analysis of the affordances generated through the interaction of the different multimodal tools (See section 2.7. and section 2.8).

The following section illustrates some of these studies and the way they approached the examination of the affordances of individual (modal intensity) and simultaneous (modal complexity) use of tools of communication.

2.7. Research perspectives on multimodal online interactions

Despite the fact that conferencing media offer different tools of communication, the majority of studies focused on the analysis of oral interactions using the audio tool. Many

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studies focused on the analysis of the affordances of use of the audio tool for the development of learning skills and neglected other tools. This bias towards the audio might be explained by the view that the audio is overwhelmingly used in multimodal audio-graphic and videoconferencing systems. The rates of use of other tools are insignificant compared to the rate of use of the audio tool (Mirza, 2010; Stickler and Hampel, 2010). Studies have shown that chat was used to replace the audio tool in case of technical problems. The whiteboard was used by the tutor to post pictures, activities and texts.

Some studies focused on the quantity of online interactions generated using each individual tool. Focus on the quantity of interactions stems from the belief that increased levels of mediational social interaction facilitate the creation of zones of proximal development where learners collaborate to co-construct knowledge. Thus, in terms of quantity, studies of audio-conferencing and video-conferencing (Hearnshaw, 2000) have shown that effective student-teacher interactions can and do take place. They also provide evidence of a change in the patterns of interaction as well as a substantial increase in the amount of participation. In their study, using quantitative accounts, Schallert et al. (2003) have demonstrated that interactive online courses democratized and equated participation. Hampel and Hauck (2004) have highlighted the importance of these tools as the ideal medium for collaborative learning through increased levels of social interaction both with tutors and with peers. Heins, Duensing, Stickler, and Batstone (2005) used quantitative analysis to study the direction of interactions to check if the use of online platforms promotes more learner-centered learning. The results of their research showed that tutors using audio-graphic conferencing systems (Lyceum) seemed to be more concerned than the face to face tutor to keep control of the tutorial, resulting in more tutor-led sessions. Anderson and Garrison (2003) noted that audio and video conferencing provided slightly less interaction between students and among teachers and students than face to face settings due to the inherent technological

distance between students and teachers imposed. In addition, student-content interactions were at medium levels.

In terms of quality, however, I did not have to delve deep into the literature to discover that very little attention is directed toward the study of the quality of interactions in audio-graphic conferencing and still less to the study of the socio-constructivist dimension.

Many studies have voiced the need for further research on the quality of interaction in audio-graphic conferencing (Shield et al., 2001; Hampel and Barber, 2003; Felix, 2003; Shield and Weininger, 2004; Hassan et al., 2005; Vetter and Chanier, 2006). Available literature revolves around certain aspects and issues related to online language learning such as: task design (Rosell-Aguilar, 2005), changes in tutor roles (Hampel, 2009; Guichon, 2012; Guichon and Hauck, 2011; Drissi, 2011), students' use of tools (Mirza and Lamy, 2010; Lamy and Flewitt, 2011; Örnberg Berglund, 2009), anxiety (De los Arcos, Coleman, and Hampel (2009), research on indicators of social-emotional presence (Satar, 2010). Some studies seek evidence of collaboration. Zahner, Fauverge, and Wong (2000) have provided evidence that audio-graphic conferencing is effective in supporting collaborative learning. Schwienhorst (2004) stressed that audio and video-conferencing environments allow students to interact and negotiate meaning as well as rehearsing the oral skills. Web-conferencing tools such as those that enable online presentations, video, screen-sharing, sharing of resources, polling, and chat can be used to enhance online engagement, and research has indicated that such increased levels of interaction in web-conferencing environments correlated with student satisfaction with online classes (Gurell, Kuo, and Walker, 2010).

However, the way the different tools are used by participants in case of modal density, and the affordances that might emerge out of this use has not received much attention from online researchers. Nevertheless, I could find some studies that attempted to examine the use of the different tools of communication offered by audio-graphic and videoconferencing.

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Some of the emerging papers that examined learning and teaching using web conferencing described general features and uses of web-conferencing software (Keir and Elizondo, 2010; Premchaiswadi and Tungkasthan, 2007; Regazzoni et al., 2007), some compared the features of different synchronous multimodal tools (Karabulut and Correia, 2008; Wang, 2009; Guichon, 2009).

However, current literature does not offer studies that study the affordances of use of different tools of communication in relation to enhancement of the meaning construction process. Moreover, current studies focus on the analysis of only some aspects of the process of meaning construction but do not study the process as a whole. All in all, different researchers have examined the affordances of multimodal interactions for different purposes. A brief description of some recent studies with their different perspectives better highlights the point.

2.8. The different perspectives of study of the affordances of the simultaneous use of tools of communication

Some studies focused on rates of use of the different tools as indicators of engagement in constructive discussions and learning, including Vetter and Chanier (2006); Okada et al. (2007); Hauck and Youngs (2008); Betbeder et al. (2008); and Örnberg Berglund (2009). They examined the frequency as well as the interactive and communicative purposes of use of each communication tool. However, they did not analyze the affordances of the simultaneous use of communication tools.

Vetter and Chanier's (2006) study focused on rates of use of tools offered by audio-graphic conferencing tools. The study was based on the analysis of multimodal interactions generated via Lyceum (audio-graphic conferencing tool). The researchers focused on the rates of use of each communication tool by participants as indicators of engagement in interactions

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and learning. They analyzed the purposes of use of each communication tool by individual participants. The results showed that multimodality in audio-graphical communication in fact led to more equal participation rates. The researchers stated that participants who contributed the most in audio, were less active using the chat tool and vice versa.

Okada et al. (2007) investigated the concept of knowledge mapping in relation to various data collected during meetings using the audio-graphic conferencing tool FlashMeeting. Using visualizations, they analyzed participation rates and tools and mode choices in different types of meetings. Based on the participation rates, they illustrated how participation patterns may alter depending on the purpose of the interaction.

Örnberg Berglund (2009) analyzed interaction in a multimodal desktop video conferencing environment, FlashMeeting, from an ecological perspective with two main foci: participation rates and conversational feedback strategies. The study was based on the analysis of interaction among students of English at a distance participating in discussions. Her study described the influence of tool and task design on student interaction in language learning at a distance. Her focus was on the analysis of the type of communication tool used to perform conversational feedback strategies. Particularly, her focus was on how the affordances of the tool influenced the strategies employed to create modal density. Quantitative data were used to investigate participation rates, with the aim of seeing whether multimodality in fact supports equalization; that is, whether the opportunity to choose a preferred mode of interaction ensures even participation rates. The qualitative analysis of conversational feedback strategies showed that whereas some multimodal strategies were employed, the students did not manage to fully act upon the communicative affordances of the tool, as the feedback ratio during and after the often long broadcasts was relatively low. These findings were related to task and tool design and the article discussed how design improvements in these areas might result in a more constructive language learning ecology. The results showed that neither the affordances of

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broadcasting nor those of multimodality automatically lead to more even participation in the verbal modes; instead these rates seem to depend on other factors such as, for example, language proficiency and previous experiences with online communication. The two modes (written and verbal) via the use of audio and text were predominantly employed by the same students throughout both sessions. Less talkative students could participate through the video tool by changing facial expressions. On the other hand, results showed that multimodality allowed for active participation on different levels. Different students used different communication tools to engage in participation.

Sauro (2009) analyzed multimodal interactions to identify the way students used multimodal tools (chat and the audio) to perform different interactional roles. The main purpose of this study was to explore how a pair of second language learners utilized the different tools of communication available to them during videoconferencing to negotiate interactional asymmetries that might have otherwise limited their opportunities to use the L2. She analyzed online interaction strategies of a pair of L2 learners using a videoconferencing tool that offers oral as well as writing tools of communication: Yahoo messenger. Results showed that learners used audio and chat tools, while the analysis of their interactional patterns illustrated how learners' strategic use of certain modes can influence the direction of the interaction and subsequent opportunities for L2 production and output. The analysis of the affordances of use of the audio and chat tools showed how the strategic appropriation of the different tools (change of modality of communication by making selective use of text chat or the audio) enabled students to negotiate interactional asymmetries and reposition their interactional roles. For instance, results showed that the change in modality allowed students to shift from a more receptive to a more productive position, subsequently increasing their opportunities to use the L2 and to contribute to the conversation. She suggested that the

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multimodality of the videoconferencing provided learners with tools and strategies that could help them garner increased opportunities for target language production.

In their study, Hauck and Youngs (2008) investigated the use of telecollaboration in online language teaching. They described the main features in terms of the design affordances of the multimodal online environments chosen for this telecollaborative exchange – a synchronous audio-graphic conferencing system (Lyceum) and an asynchronous blogging tool. They highlighted their respective affordances (focus on the analysis of each individual multimodal tool), that is, their specific potentials and limitations for representation, meaning making and communication in general and intercultural communication in particular. They focused on the exploration of how these affordances influence task design and execution as well as participant interaction during the project. The results showed that the different affordances of the different communication tools offered by the different CMC systems created distinct learning environments allowing for different levels of interaction. They further added that the extent to which telecollaborative partners could benefit from an exchange partly depends on their current level of multimodal communicative competence that was defined as "their ability to make efficient use of the modes for meaning making available to them online in order to engage in interculturally rich interaction" (2008, p. 123). Moreover, they suggested that tutors need to be trained in the design of tasks that make efficient use of multiple modalities so that there was a need for the learners to stretch, change, adapt and modify the means of representation, communication and interaction available to them.

In another study, Betbeder et al. (2008) analyzed the affordances of a synchronous audio-graphic conferencing tool (Lyceum) in an attempt to determine the different multimodal choices of participants. They focused on the rates of use of each tool of communication for the realization of their learning tasks. They studied the rate and quality of students' speech acts which occurred in the different modalities of the system to assess the level of interactivity in

this system. The results showed that students favoured some tools over other tools depending on their interactive and communicative purposes. Results showed some instances of multimodal complexity where participants tended to simultaneously use the different tools of communication depending on their understanding of the situation or the context of interaction.

Some studies did analyze the affordances of individual communication tools offered by multimodal conferencing system for tasks design purposes. However, they did not analyze the affordances of the combined use of communication tools.

Wang (2006) focused on the analysis of the design affordances of communication tools offered by videoconferencing. The aim was to determine the main affordances of the provision of synchronous oral and visual interactions that might promote the development of negotiation skills. She investigated the dynamics of meaning negotiation in task completion via videoconferencing. This study was based on the analysis of multimodal interactions of students learning Chinese online using NetMeeting (NetMeeting offers many pedagogically sound features such as an on-screen whiteboard, file transfer, document sharing, and self-image video). This study was based on empirical data from an evaluation of desktop videoconferencing-supported task completion. Occasions of focus on form that occurred in this learning environment were explored using the Varonis and Gass (1985) model for negotiation of meaning. She analyzed the rates of use of each communication tool to negotiate meaning and focus on form (the chat, audio, the whiteboard, File Transfer and Document Sharing). Initial findings indicated that videoconferencing-supported negotiation of meaning may facilitate second language acquisition at a distance and has its own distinct features. The videoconferencing used in this study allowed the participants to modify their interaction when there was a breakdown in task completion, thus facilitating L2 acquisition using the different tools of communication. The analysis also demonstrated that videoconferencing-supported negotiation of meaning has its own distinct features in comparison to face-to-face interaction.

Based on the same empirical data, Wang (2007) investigated the appropriateness of videoconferencing-supported-task design through the examination of the process of oral-visual interaction and participants' perceptions. She examined the affordances of multimodal tools offered by videoconferencing that might inform the design of tasks. On the basis of Chapelle's (2001) criteria for CALL task appropriateness, he analyzed the affordances of tools in terms of task aspects: practicality, language-learning potential, learner fit, authenticity, and positive impact. The aim was to identify which tool fit with the realization of different task aspects. Features of videoconferencing tools were analyzed in order to identify the appropriate tool for the task and to embed in task design the opportunities of employing its features for effective promotion of language acquisition. For example, she argued that tasks could be designed in such a way so that a whiteboard could be used to focus on form, the function of file transfer could be used to deliver prepared lecture notes as a way to save time.

Some other studies focused on the comparison between different affordances of different communication tools with the aim of identifying the most significant affordances of communication tools that might best promote students' engagement in collaborative learning.

Stickler and Hampel (2010) carried out a case study that aimed at identifying the affordances of the different tools offered by Moodle which included different tools of communication (FlashMeeting which is videoconferencing, wikis, blogs and forums). The aim was to identify the affordances that would fit individual students' preferred learning style. It focused on two learners who took part in an intensive online German course offered to intermediate level students in the Department of Languages of the Open University. One step of the analysis focused on the analysis of the affordances of the videoconferencing system FlashMeeting and the rates and purposes of use of each multimodal tool. The results showed that the affordances of the different tools offered opportunities for online language courses to

combine different approaches to learning and teaching (focus on communication or form or both). It also illustrated the link between students' choice of tools and their learning preferences (focus on form or communication; preference for written or spoken language).

Some other studies focused on the analysis of multimodal tools' affordances with the aim of identifying multimodal competencies online participants (tutors and learners) have to develop for effective use of audio and videoconferencing. Some researchers claim that a range of synchronous collaboration competencies are required for effective learning and teaching in web-conferencing environments. It was claimed that awareness of affordances is one thing, but knowing what to do with them is another challenge. Felix (2003) stated that: "We interpret best practice to mean using the most appropriate tools to their best potential to achieve sound pedagogical processes and outcomes" (2003, pp. 8-9). I will describe three different studies carried out by Bower (2011), Guichon (2009) and Develotte, Guichon and Vincent (2010).

Bower (2011) pointed out that using tools such as web-conferencing to facilitate learning and teaching was more complex than for asynchronous online learning. He further suggested that the multimodal affordances of web-conferencing systems provide the opportunity to apply more learner-centered learning and more active distance learning pedagogies but at the same time require an increased level of collaborative competency, in terms of being able to operate the technology (which tool to use and for what purpose) and being able to interact effectively. He claimed that "affordances of tools in combination require consideration" and he adds that: "decisions about how to use tools often need to be made in real time. Failure to understand one subtle feature of a tool or its use can have a crippling impact on the learning episode" (2011, p. 63). His study aimed at identifying the sort of synchronous collaboration competencies required in multimodal learning environments and elucidating their impacts on the learning and teaching process. Bower (2011) analyzed the use of the affordances of the use of different tools with the aim of exploring the different

multimodal choices of learners to classify them into competences. The results showed the existence of a range of different levels of synchronous collaboration competencies observed during this study:

> (1) Operational – the ability to operate the tools and functions of the collaborative technology (2) Interactional – the ability to effectively interact to perform a task or solve a problem using the technology (including the ability to apply interactional tactics to collaborate effectively) (3) Managerial – the ability to manage a group or class including providing support on how to use the technology and interact effectively (4) Design – the ability to select and organise tools in a way that optimises interaction and best supports activity management (including the ability to dynamically design the environment based on emerging collaborative and cognitive requirements). (2011, pp. 76-77)

The results showed that improvement in the teacher's synchronous collaboration competencies led to an increased capacity to spontaneously redesign the interface to meet arising cognitive and communicative needs of discussions.

Guichon (2010) analyzed the affordances of communication offered by Skype and Visu (videoconferencing tool for language teaching online) to identify their core functionalities that might assist teachers in their work. The aim was to design a desktop videoconferencing platform specifically dedicated to synchronous language teaching. He analyzed the activity of novice teachers confronted with the management of synchronous online teaching. Two teaching sessions were captured and analyzed with a special focus on the difficulties encountered by the participants in situation and the strategies they deployed.

Results showed that the management of tools almost simultaneously to carry various sub-tasks proved to be a great source of difficulty for teachers. Students and teachers need to have developed multimodal competencies for an effective use of the affordances of the different communication tools offered by videoconferencing. The analysis of the affordances of the conferencing tools resulted in the presentation of three functionalities designed to assist teachers to plan the online session: the session assistant that helped teachers to plan and organize in advance the online session; the zone of communication that helped to concentrate the content of the interaction so that "both participants focus their attention on this zone and have enhanced feeling of collaboration with their distant interlocutors" (p. 179), and the tracking zone that "allows interlocutors to keep track of time and estimate how much time is left for the interaction, thus providing a visual overview of the learning session with key elements such as changes of activity and pedagogical intervention of the teacher" (p. 179).

In another study, Develotte, Guichon and Vincent (2010) analyzed the affordances of video-conferencing tools to identify the main features of the system that would help in training tutors. The results showed that the main difficulty for tutors was that they have to manage these complex operations of production and interpretation in real time and in an environment that concentrates several communication tools into the limited space of a computer screen. Tutors developed semio-pedagogical skills that were specific both to the synchronous online pedagogical situation and to the affordances and limits of the tool they use by harnessing the affordances of the tool to enrich their pedagogical activity. They defined semio-pedagogical skills as "the capacity to mediate a pedagogical interaction by combining or dissociating modalities (written, oral, and/or video) that are adapted to objectives and to the cognitive requisites of the task" (2010, p. 296). The results showed that tutors need to develop these competencies by:

[C]oordinating their pedagogical action between the different means available to them (voice, facial expressions, gestures, images, text) and the different tools (webcam window, textual chat), and make appropriate and timely choices (associating or dissociating) between the different modalities according to objectives and learners' needs. (2010, p. 296)

The results showed how participants develop multimodal competencies drawing on the different affordances of multimodal tools offered by videoconferencing tools.

Finally I report a study conducted by my supervisor Lamy and myself (2010). The study investigated the affordances of multimodal tools offered by audio-graphic conferencing tools for the promotion of online meaning construction process. This study examined meaning construction as a comprehensible process (examining all its elements). However, it analyzed the affordances of the individual use of each communication tool.

Mirza and Lamy (2010) conducted a study where they compared the affordances of use of two different audio-graphic conferencing systems to understand the effects that the affordances of use of multimodal audio-graphic conferencing tools might have on the knowledge construction process. This study investigated multimodal interactions of two groups of adult students learning French online using two different audio-graphic conferencing tools (Lyceum and Elluminate). Both systems provided audio, chat as well as graphical facilities. This study brought together two lines of research: the first concerned participation rates of use of each multimodal tool; the second was to determine the communicative purposes (in terms of meaning construction features). The results of the study demonstrated that the affordances of the different communication tools provided by the different conferencing systems did promote collaborative meaning construction. This research raised our awareness of the fact that we were ignoring an important feature of mediation in

this context of multimodal web conferencing which was the affordances of use of tools in case of modal density (where focus is on an individual tool or a cluster of tools of communication). Thus, the results of this analysis motivated me to refine and widen the scope of my research to embrace the analysis of the affordances of the individual and simultaneous use of multimodal tools, not only the individual tools.

2.9. Critical view of the different studies

The studies described above agreed that new multimodal technologies create a new environment with different features for the exchange and construction of knowledge. It is also argued that the way learners make use of the affordances of these multimodal tools influences the shape of interaction in terms of quality and quantity. Furthermore, the above mentioned studies suggested that the affordances of the different communication modes and tools influence the way learners collaborate to negotiate meaning and co-construct knowledge. Researchers like Hauck and Stickler (2006), Hauck and Youngs (2008), Bower (2011) and Develotte, Guichon and Vincent (2010) claimed that the affordances of use of multimodal conferencing systems create new formats of learning where learners have to develop new learning competences (multimodal competence) besides the four learning competences (listening, speaking, writing and reading). It is defined as the ability to use the multimodal tools effectively for meaning making and collaborative learning.

However, the majority of the existing studies offered no insights into the nature of the affordances of the interaction between the different mediational tools offered by either the multimodal conferencing systems or the way in which they influence the meaning construction process. For instance, the aforementioned studies stated that multimodal online interactions promote collaboration but did not show how the generated affordances of the multimodal

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interactions foster collaborative construction of knowledge and the realization of socio-constructivist learning. As is shown earlier, current studies are generally based on quantitative ways of measuring interaction, such as: measures of turn taking, the number of contributions using each of the available communication tools, the educational purposes behinds the use of each tool (Stickler and Hampel, 2010; Mirza and Lamy, 2010). Students' rates of participation and interaction have been for years the most cited data on the educational benefits of computer conferencing (e.g., Harasim, 1990; Hiltz, 1990; Pena-Shaff and Nicholls, 2004). To put it differently, it is claimed that the higher the level of turn-taking, or the greater number of times students use the different tools, the greater the level of interaction occurring. However, I concluded that these quantitative indicators addressed neither the processes nor the quality of learning taking place.

This indicates that the claim that audio-graphic conferencing promotes socio-constructivist principles of learning is based on the premise that high levels of participation are equated to collaboration, and collaboration to engagement in zones of proximal development and hence in meaning construction processes. However, interaction is not collaboration and quantity alone does not account for the quality of interactions nor engagement in the meaning construction process. Interaction should not be equated with collaboration, and collaboration should not be equated with the meaning construction process. Mason (1992), for instance, explicitly warned about the danger of confusing the quantity of student activity for student learning, or mistaking group interaction for group participation. I assume that the mere generation of more opportunities to interact may not necessarily lead to educationally productive and constructive collaboration and quality learning (Palloff and Pratt, 2003). Mediated interactions and collaboration are key elements in the meaning construction process but do not comprise the process itself.

On the other hand, Walther (1996) suggested that the advantages and constraints of online communication change over time and that studies cannot therefore provide only a limited understanding of these affordances if they do not consider longer-term impact (Walther, 1996). In addition, when interacting with others, specific protocols for how to deal with the communicative affordances of the environment develop, and by analyzing interactional patterns, these conventions could be detected (cf. Hutchby, 2001)

The present literature has not provided accounts of the possible affordances generated by the interaction between the different tools. I could find studies that focused on the affordances of the mediation of each overall learning environment but not the particular affordances of the single as well as the simultaneous use of communication tools by students. I assume that the mediational multimodal choices of students create different types of affordances that might have impacts on the quantity and the quality of interaction that might have different implications for the collaborative meaning construction process.

Within a socio-constructivist perspective on language learning, the concept of mediation is inherently fundamental to the analysis of the collaborative meaning construction process. The interaction between the different tools shaped by the different multimodal choices of students is a very important aspect of the affordances of mediation in the context of multimodal online discussions. I assume that we can understand the opportunities that students have to collaborate to construct meaning when engaged in multimodal discussion only if we examine the mediational affordances of use of the different mediational tools when used individually or simultaneously for the collaborative meaning construction. In this direction, Hauck and Youngs (2008) stated that:

[N]ew media offer us the possibility of drawing on a number of different modes in the making of texts such as writing, speaking and the visual and, at first

sight, it seems that the resources at learners' and tutors' disposal online replicate those available in more traditional face-to-face classrooms settings.

(2008, p.92)

They have insisted that in the case of web conferencing, we should not lose sight of the fact that communication is mediated by computers and thus "The modes and affordances that the computer offers have to be factored in and the issue how meaning is made in new multimodal environments such as, for example, audio-graphic conferencing and blogs needs to be addressed" (p. 92).

To sum up, the few attempts made to study the combined use of the mediational tools focus on two different aspects: either on the rate of use of the different tools or focus on the examination of single aspects of the meaning construction process. The available studies do not examine meaning construction as a comprehensible process; rather they focus on individual aspects of this process like the quality of multimodal online interactions and extent of collaboration. However, since I assume the meaning construction process to be a comprehensible process, I need to examine the way all its elements take place, relate to each other and the way they are mediated by the different affordances of use of the available mediational communication tools. To put it differently, to examine this process, I need to examine the types of mediational interactions and the possible opportunities they offer for the process of collaborative meaning construction.

In spite of the repeated claims that the affordances of multimodal online interactions generated by the use of different communication tools support socio-constructivist learning (knowledge construction), there is little evidence from the research literature to prove the actual achievement of these aims. There is a need to broaden the scope of research on online interaction to encompass the examination of the quality of online interaction from the socio-

constructivist point of view with due focus on the affordances generated from the single and simultaneous use of the different multimodal tools offered by SAGC.

In my view, it is the establishment of this sort of relationship between the affordances of multimodal online interactions and their impact on the meaning construction process that would allow for a better understanding of the teaching/learning phenomena in SAGC environments.

In line with these assumptions, Hauck and Hampel (2006) suggested that it might be useful to consider the process of making meaning using the tools and media available in audio-conferencing environments. Hauck (2007), Hopkins el al., (2008), and Wang (2004a) have urged the widening of the scope of research in the field of SAGC to focus on the processes of making meaning in such environments.

The ways students use the available mediational and multimodal tools determine the way meaning is communicated and collaboratively constructed. In a language learning context via audio-graphic conferencing, the individual and simultaneous use of the available tools of communication can lead to the creation of new types of online multimodal interactions that offer different affordances for meaning construction. I assume that one way of analyzing the impact of online interactions on the meaning making process is by focusing on the affordances of use of the different tools and the options these affordances might offer, that is, the options provided by the environment to students, particularly those that are acted upon by students.

Finally, I join the call for the investigation of the meaning construction process in the context of SAGC and add to it another dimension. The aim of this research is to investigate multimodal online interactions to understand how the affordances of the individual and combined use of online multimodal tools mediate learning as students engage in collaborative meaning construction.

2.10. Research questions

In the light of this background, I raise questions about the extent to which the socio-constructivist aims of promoting social interactions for the realization of the collaborative construction of knowledge are achieved in SAGC:

- What are the patterns of online multimodal interactions?

- What is the effect of the affordances of the individual and the simultaneous use of communication tools on patterns of online multimodal exchanges?

- Do multimodal online synchronous interactions in audio-graphic conferencing support meaning construction process and if so to what extent?

- How do students and tutors perceive their experiences of online multimodal interactions in audio-graphic conferencing in terms of participation opportunities and adequacy of learning support?

2.11. Conclusion

So far, this section has explained the key concepts that underpin the present study. The examination of the current literature, in terms of the examination of the affordances of use of multimodal online conferencing tools and their possible impacts on the meaning construction process, helped in shedding light on the gaps in understanding that need to be addressed. This study is an attempt to fill this gap by investigating multimodal online interactions to

understand how the affordances of the individual and the simultaneous use of online multimodal tools mediate learning as students engaged in collaborative meaning construction.

The following chapter explains the methodological framework of the current study.

Chapter Three

Methodology

3.1. Introduction

The previous chapter demonstrated that online learning mediated by different tools of communication is fundamentally social in nature and positioned the present study within a socio-constructivist perspective. This chapter explains how the socio-constructivist principles of learning were used to analyze the way online students use the different tools of communication to engage in multimodal interactions for collaborative meaning construction.

The first section describes the context of data collection and the features of the conferencing system under study. The second section explains the procedure towards the development of a socio-constructivist methodological framework for the description, transcription and analysis of multimodal online interactions. The focus is on the development of models of transcription and analysis that take into account: the nature of multimodal data, the affordances of use of tools, and the possible effects of these affordances on students' engagement in the collaborative meaning construction process from a socio-constructivist point of view. The second also explains the procedures involved in the design, conduct, and analysis of tutors' interviews and students' questionnaires. The last section describes how I obtained the ethical approval to collect data.

3.2. Context and procedures of data collection

To describe and analyze online interactions, observation of how students engaged in interactive participation was needed, so it was by observation and video-recordings that data was collected. Video-recording allows repeated viewing and transcription of interactions, essential for proper analysis. However, by video-recording I mean the screen capture of everything that happens on the platform. Students' names are visible, but students' faces and gestures cannot be seen (see Figure 3.1). In addition, as outlined by the fourth research question (Chapter One, section 1.3); this research seeks to capture students' and tutors' perceptions about their online experiences. Hence, the primary data comprises video-recordings of online tutorials and secondary data comprises questionnaires submitted to students and interviews conducted with tutors. In the present section (3.2), I describe the procedures of collection of data from the online tutorials. In section (3.5), I describe in detail the procedures of data collection using questionnaires and interviews.

I was fortunate to be able to conduct my research within the UK Open University (OU). My research project investigates the interaction patterns and the collaborative meaning construction process of two groups of UK OU students who used the synchronous audio-graphic conferencing environment Elluminate to learn French. The OU offers different language courses. However, I opted for French courses as I am fluent in French.

For matters of generalisability, I observed three groups of OU students who were taught by three different tutors. I wanted to have a representative number of students taught by different tutors to have a better picture of online learning experiences in different online learning situations. The groups were observed during a whole semester. A high proficiency group (L310 which corresponds to level C1 of the Council of Europe Common European Framework of Reference for Languages) and two upper intermediate proficiency groups (L211

students seeking to attain Level B2 of the Council of Europe <u>Common European Framework of Reference for Languages</u>) were observed and the online tutorials were video-recorded. I opted for different levels as, based on my previous research (Mirza, 2010) and on the present literature review, students' proficiency levels have an impact of their multimodal choices.

I recorded more than six sessions with each group. Each recording was of approximately one hour and a half. The 18 sessions were fully written up, transcribed and coded. Recordings were conducted with the aid of Elluminate for sound recording and screen recording.

However, because of two issues, data from the high proficiency group was not used in this research. First, the high proficiency group predominantly used the audio tool and avoided using the other tools as they seemed confident using the oral mode of communication. As the purpose of this study was to examine the quality of multimodal interactions and their impact on meaning construction opportunities, I decided to concentrate on lower proficiency groups. My observations showed that less linguistically proficient students showed a tendency to use the written mode using the writing tools to avoid using the oral mode. Hence, the underlying assumption which governed my choice was that richer opportunities for interaction and use of the different tools of communication were more likely to be observed at level two (upper intermediate level) more than in more linguistically proficient groups. Second, the questionnaires were not sent at the right time to this group. As is explained in the Ethics section of the present chapter (section 3.6), tutors were invited to send information on my behalf to their students as I could not get in touch with them directly. Despite my multiple requests, the high proficiency group's tutor did not send the questionnaires to his students at the right time. It was only at the end of the course that the tutor responded and sent the questionnaire to his students. The questionnaire contained a number of questions which appealed to participants' micro-memories of the tutorials, but students could not be expected to remember details that far back or might have accumulated new Elluminate related memories as some of them had already gone

on other online courses. Besides, I received no responses from this group. These concerns were discussed with my supervisors and as an alternative it was suggested to use the data from the video-recordings of the two intermediate proficiency groups only. Nevertheless, it was suggested to use the data obtained from the high proficiency group to test my transcription and coding scheme and to check the reliability of my proposed model of analysis. Hence, data from the high proficiency group was used to test the reliability of my coding schemes.

Participants were thus adult OU upper intermediate proficiency students learning French online. The course L211 was designed to enable students to achieve a level of language proficiency equivalent to level B2 of the Council of Europe Common European Framework of Reference for Languages (Garrido and Beaven, 2002).

Students are adults with different profiles, goals and backgrounds as explained by Coleman and Furnborough (2010):

> [The] profile of OU students, especially on popular beginners courses, is typically much wider than in conventional, full-time, face-to-face universities: they range from those who have no experience at all of higher education to highly qualified students who have successfully studied with the OU or in conventional higher education over many years. (2010, p. 16)

As online tutorials are not compulsory, only sixteen students attended the tutorials on a regular basis. For reasons of objectivity, I decided to analyze the contributions of these sixteen students and excluded the contributions of the other students.

The course drew on socio-constructivist principles of learning where the focus is on the development of collaborative as well as autonomous learning. The course offered face-to-face and online tutorials. The online tutorials were not compulsory, which is a feature of all OU

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tutorials, designed to support adult students' need for maximum flexibility in their mode of study. They served to enhance students' listening and speaking skills. The course focused on the development of the four skills, but also addressed other skills concerned with comprehension, analysis and manipulation of different material – for example, summarizing, expressing opinion on written passages, style and register, appreciation and accuracy. The course was lively and varied, with a wide range of mixed-media material (audio-visual and web based materials) that had been selected in order to build up students' confidence in the different language skills. The materials were interactive and encouraged students' participation and active interactions. The course was structured around themes, each covering a different aspect of life in French-speaking countries. Students were provided with print-based materials as well as practising listening and speaking with an interactive DVD-ROM which features video footage and audio interviews. Online tutorials offered tasks developed by the academic course team at the OU. The tasks were based on key socio-constructivist principles of interaction, collaboration and student-centered learning. Tasks such as role plays and discussions required collaborative interaction. The activities covered all the language skills with due focus on the listening and speaking skills. As a result of this emphasis on the importance of collaboration and discussion, all the recorded tasks were discussions and debates.

The synchronous audio-graphic conferencing environment Elluminate was used to deliver online tutorials. It is an internet based application for tutorials combining shared graphics with real time, online, audio discussions (Hauck, 2010). The following screen shot shows the different tools Elluminate offers:
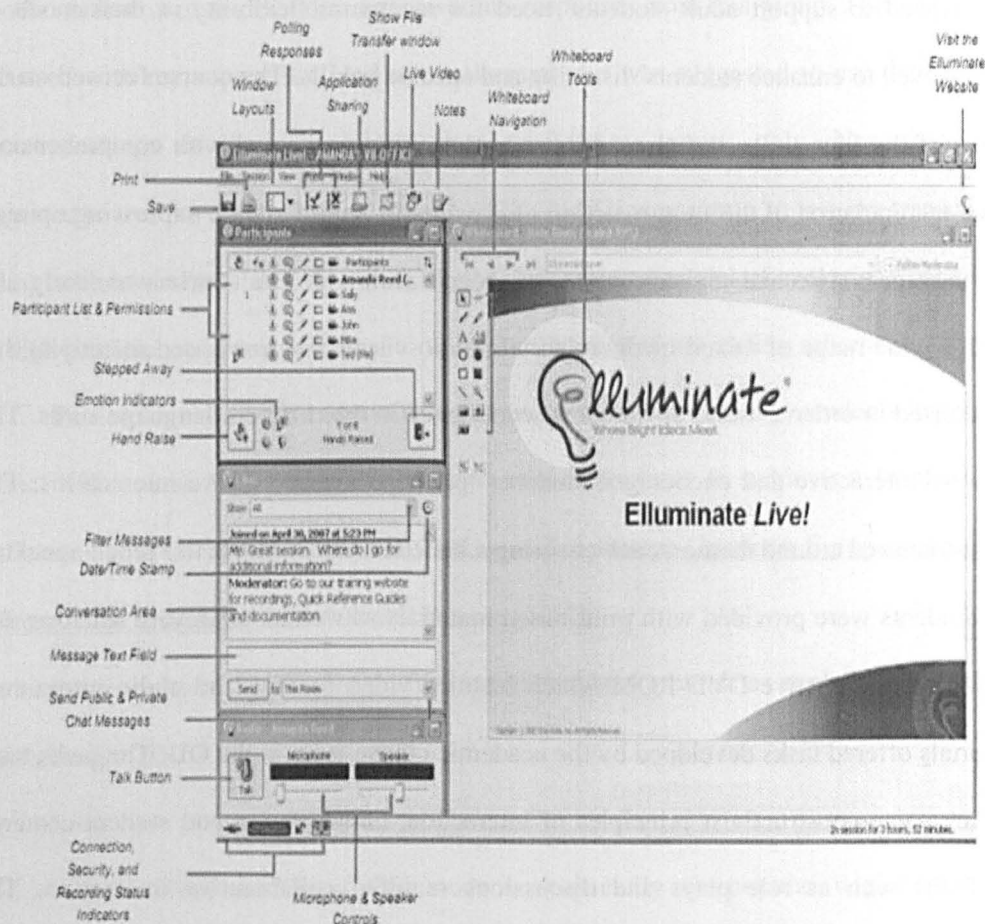
Figure 3.1. Screenshot of the audio-graphic conferencing environment Elluminate Live (Retrieved from the OU training web site)

The screen shot shows that Elluminate offers different tools of communication that enable users to provide instruction in an interactive, real time setting. Its features allow educators to duplicate many elements of face-to face interaction in an online environment. Crofton, Pugh and Evans (2001) described Elluminate features as follows:

• Real time, online instruction using an interactive whiteboard and/or through sharing applications, such as Word and Excel documents, over regular internet connections,

• Multimedia delivery of content, transfer of all types of files, including audio, video, and PowerPoint, audio interactions, including simultaneous talking among multiple participants,

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- Breakout rooms for participants to work in small groups

- The ability to record sessions which can be achieved and viewed later, communication among participants via text-messaging among others.

- Individual and joint production and manipulation of text and images

- Uploading and downloading (from the WWW) of images and texts

- Saving of images and text created by learners

- Real-time dialogue supported by paralinguistic features such as intonation, pitch, volume and /or pace, a raised hand and an away icon as well as a voting button and a gather button

- Simultaneity of audio and text (shared documents and/or chat)

Elluminate is typically based on multi-way live audio transmissions allowing up to six participants to engage in simultaneous talk using the audio tool. It offers a text chat which is similar to instant messaging systems. The text chat provides space for additional synchronous textual input, again both bi- and multidirectional similar to instant messaging systems. It offers a shared display of visual information in the form of a virtual whiteboard, which allows participants to annotate slides or produce simple drawings collaboratively in real time. It offers presence indicators, visual cues like the use of emoticons and instant feedback or voting functions to elicit quick responses and to monitor and coordinate participant involvement. Moreover, tutors have numerous options to 'coordinate' their groups by instantly creating breakout rooms for smaller groups of participants. Its features therefore lend themselves to online language tutorials which require high levels of student-student and tutor-student spoken and/or written interactions.

As explained in the previous chapter, I hypothesize that meaning made via a combination of tools does not equal meaning expressed through the use of each tool.

Information conveyed through different tools can carry complementary, contradictory or similar meanings. In order to fully understand the meaning making potentials of the tools and modes available in these environments, Kress et al. (2001) have explained that each mode provides different communicative potentials. This view implied the need to take the affordances of use of the different tools offered by Elluminate into account. In this research, my focus is only on the tools that were used by participants. The tools that were used most frequently by the current research participants were: the audio, chat, whiteboard and the yes-no vote tools and the breakout rooms. However, the analysis of students' online interactions when sent to breakout rooms was problematic. Elluminate does not record whatever room the observer is in. Elluminate can only record in the main room but not in the breakout rooms. Hence if the researcher was recording breakout rooms, the only way of obtaining a recording for breakout room 2 would have been to ask one of the participants to record it on his/her computer, an approach which raised ethical issues and was therefore not adopted. Additionally, a limited experiment using external cameras to record a small number of breakout rooms showed only that, in pairs or small groups and in the absence of their tutor, students used only the audio tool. Hence, I decided to not include them in the analysis.

As was pointed out by Lamy (2012), there is inconsistency in multimodal research regarding the definitions and use of terms such as mode, modality, tools, channels, media, and code. In this research, to avoid any form of confusion, I have adopted Lamy's (2012) definitions. The semiotic systems in her data were written and spoken language, while the modalities were audio, text-chat, shared document and voting system. Modality is then "The relationship between modes and the culturally intelligible object that they underpin" (Lamy, 2012, p. 111). On the other hand, different material tools or medium can be used to perform the same mode or modality. Medium is defined by Kress and Jewitt (2003) as the material resource that is used for the production of semiotic products. Hence, by mode I refer to the forms of

human language which are the written, the oral and the visual modes. By tools of communication I refer to the material resources students used to convey information and contribute to online discussions. In this research the audio, the chat, the whiteboard and the voting (Yes/No) tools are referred to as tools of communication.

3.3. Methods of representation and analysis of data

The primary data is the tutorials from each group. In addition, students completed surveys and interviews at the end of the course (February to December 2010).

3.3.1. The analysis of online tutorials (video-recordings)

As explained in the preceding chapter, this study aims at checking whether audio-graphic conferencing systems may increase learners' opportunities to collaboratively construct meaning during online discussions. The focus is on the impact on this process of the mediational choices which the participants make. More specifically, the aim is to determine how meaning construction occurred in the conditions of "modal density" (Norris: 2004) where a mix of different modes and tools of communication is being simultaneously used. Hauck (2010) explained that:

> [M]ultimodal online applications such as Skype (with webcam and text chat facilities), audio blogs, and audio conferencing applications with shared graphic interfaces and webcam facilities such as Elluminate and Flashmeeting, bring together a variety of semiotic modes including spoken and written language as

well as visual resources such as images and icons and/or gestures in an orchestration of meaning. (2010, p. 225)

This is to say that recent technologies like synchronous audio-graphic conferencing offer different tools of communication that mediate the meaning construction process. Socio-constructivist researchers insist that all human exchanges are mediated (Vygotsky, 1978; Leontiev, 1981; Wertsch, 1991) and that social activities cannot be analyzed separately from the artefacts that mediate them (Lantolf, 2000). Thus, we cannot analyze online multimodal conversation separately from their mediational tools. This inter-linkage was well described by Lamy and Flewitt (2011) who argued that:

[A]s a technology mediated social event, the multimodal conversation here engages us with issues of mediation and socialization. As an instructed task, it invites scrutiny of learning processes and outcomes with a view to identifying successful dynamics for online learning dialogues. As a video-recorded event, it presents us with issues of data representation. (2011, p. 71)

In their attempt to describe online conversations, Lamy and Flewitt raised the same question: "What does the literature tell us about our particular object of study and how do insights from multimodality and research on computer-mediated conversations help us to structure the way we approach the description and the analysis?" (2011, p. 71). Different researchers have made the same claim about the lack of research on the presentation and analysis of multimodal data (Mirza and Lamy, 2010; Develotte et al., 2011; Hauck et al., 2010; Satar, 2010).

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Therefore, in the first place, this chapter focuses on the challenges of describing how the participants used different tools of communication offered by synchronous audio-graphic systems to discuss and collaboratively construct meaning online. The chapter explains the way I intend to find answers to the different research questions raised in the previous chapter. In particular, I explain my procedures for the description and analysis of the different data of this research. My analysis goes through three steps, namely, a) transcription and coding of the data, b) quantification of patterns of multimodal interactions and multimodal 'exchanges, and c) analysis of their effects on the meaning construction process.

The research seeks to answer different research questions. Each of the following two main sections (section 3.3.2 and 3.4) focuses on particular research questions and suggests models of presentation, transcription and finally analysis of multimodal data generated in SAGC. The suggested models permit the identification, analysis and classification of the patterns of interaction that occurred and the way the various tools of communication were used to interact and collaboratively construct meaning. In so doing, this study undertakes a finely grained analysis of the structure of interaction in order to track its nature.

3.3.2. Description and analysis of patterns of online multimodal interactions

This section seeks to provide answers to the first research question:

- What are the patterns of online multimodal interactions?

To answer this question, I needed models for the representation and transcription of multimodal online data. To do so, units of analysis need to be first identified and then models of representation and transcription were explored.

3.3.2.1. Units of analysis

The identification and particularly the conceptualization of the boundaries of my units of analysis was a big issue in this study. One of the most important ideas in any research study is the unit of analysis which is defined as the major entity which represents the target data and which will be subjected to statistical and qualitative analysis (Muukkanen, Lakkala and Hakkarainen: 2001). The unit of analysis determines how the data is to be broken down into manageable items for subsequent coding and categories of analysis. The choice of units of analysis affects the accuracy of the coding and the extent to which the data reflects the true content of the original conversation or discourse. Hence, the recognition and accommodation of units of analyses in educational research require deep reflection. Muukkanen et al. (2001) and Veldhuis-Diermanse (2002) have warned that analyses based on different units or units that are not explicitly identified could lead to very different and misleading interpretations. To come to grips with units of analysis and related issues, it is worth avoiding the risks of collecting and analyzing data in ways that conceal more than they reveal, as described by Cronbach (1976).

Henri (1992) suggested that ideas in online discussions were the result of a collaborative endeavour. The production of constructive discussions (which were defined as instances of collaboration where students used different mediational tools to create ZPD for the exchanges and negotiation of information that led to the construction of meaning) implies that collaborative learning takes place which is related to the concept of knowledge-building discourse (Scardamalia and Bereiter, 1994). In this regard, Fischer et al. (2002) pointed out that the social modes of co-construction describe to what extent learners refer to contributions of their learning partners, and this is found to be related to knowledge acquisition. In this same realm of thought, Mercer (2004) asserted that two important aspects should be taken into account if we want to explain how talk is used to create knowledge, understanding, and

meaning, namely context and continuity. Here, the context includes whatever was present in the environments that mediate communication. By continuity, he meant the fluidity of change and a dynamic interactive flow of discussion. Mercer observed "[a]s learning is a process that happens over time, and learning is mediated through dialogue, we need to study dialogue over time to understand how learning happens and why certain learning outcomes result" (2008, p. 5). Therefore, it is important to consider each communication exchange both independently and as part of a continuous train of a dynamic interactive flow of communication. It is worth investigating the way students interacted, the types of their contributions or communication exchanges, and the way these build up into an ongoing meaning construction process reflecting on their mediational choices. The meaning construction process as reflected in oral as well as written exchanges shows the way they are related to each other. I assume that the analysis of exchanges and their interdependence helps to determine the way meaning construction mediated by the different tools of communication offered by synchronous audio-graphic conferencing takes place.

As a result, I decided to explore the quantity and the quality of all communication exchanges whether spoken or written. In this regard, I decided to segment the data into turns and exchanges to examine the interrelationship between the different turns and how they build up into exchanges and constructive discussions as long as online discussion develops. I decided to examine the impact of multimodal choices participants make during the process of communication on the continuity aspect (interdependence among communication turns) of the different communication exchanges.

Since this study examined synchronous computer mediated discourse that displayed the spontaneity of speech and structural forms of written text, I decided to analyze patterns of turns and exchanges in online interactions. There is a consensus among educational researchers on the definition of pedagogical exchange that is conceptualized as a hierarchical organization of turns

and moves (Sinclair and Coulthard, 1975; Roulet, 1999; Orechioni, 2000; Sotillo, 2000; Fischer, 2003; Orechioni, 2005). An exchange consists of at least an initiating and a responding turn, performed by a minimum of two participants. A turn consists of at least one move that indicates its pragmatic function. Thus, pedagogical exchanges are distinctive for their three-part structure of I-R-F: an initiation (I) by the teacher, followed by a response (R) from students, followed by feedback (F) to students' responses from the teacher that closes the exchange. I, R, and F are defined as the different interactive roles participants might adopt while interacting.

The analysis hence seeks to determine how the turns were realized, the way they built up into exchanges that, in turn, built up into constructive discussions. My focus is particularly on how the technology mediated this process of collaborative meaning construction. As a consequence, the research is designed to analyze the turns and exchanges in online communication in an effort to capture the patterns of online interactions, the intensity of multimodality and its possible effects on the meaning construction process. The analysis of the quality and quantity of turns and exchanges is believed to determine the interactive and communicative functions of online multimodal interactions and hence their patterns. I decided therefore to split up the data into turns and exchanges and analyze the structure of online turns and exchanges in terms of the interactive function of each turn using the I-R-F system introduced by discourse analysis researchers. To realize this purpose, I opted for discourse analysis which is assumed to allow the interpretation of language use and participants' interactive roles while using the different meaning-making available to them. Discourse analysis is distinctive from other models (conversation analysis for instance) for its focus on processes of communication (Van Dijk, 1997). It holds that language is a dynamic means of expressing intended meanings in interaction (Wetherell et al. 2001). "It involves not just the study of the textual data, but is balanced by a consideration of the general principles of interpretation by which people normally make sense of what they hear and read" (Brown and Yule, 1983, p. 27).

The aim of discourse analysis is to understand interactive behaviour through the meaning making strategies reflected in speech acts.

However, discourse analysis was elaborated to deal with discursive texts, but conversational texts (such as transcripts from tutorials) are a special case. Hence, I borrowed from conversation analysis the concept of turn.

However, there were difficulties in defining the unit of analysis of this research: the turn. In traditional analysis of data coming from traditional face to face discussions, the turn refers to the use of speech. This same definition of turn in the context of online discussions could not be used as the unit of analysis since participants had different tools of communication other than the audio/speech. In this case of synchronous learning, there was a modal density (Norris: 2004) to be taken into account. Liddicoat (2011) pointed out that online "conversation does not begin when participants are able to communicate orally via computer, but rather the interaction is a hybrid, mixed mode interaction in which the oral and written components are both equally relevant" (p. 365). Additionally, Lamy and Flewitt (2011) contended that discussion was sometimes restricted to audio, sometimes accompanied by typed texts and/or visual/graphical exchanges, which made it problematic to precisely determine the boundaries of online turns. Online students communicate to construct meaning using the different communication tools available for them. This implies that the use of the different communication tools entails a communicative purpose or function. Furthermore, as explained earlier in this chapter, the meaning construction process is held to be reflected in oral, written and visual and graphical exchanges. A turn hence refers to the use of any of the communication tools available for participation. Writing in the chat box is considered a turn, an oral contribution is considered a turn, a visual or a graphical contribution is considered a turn as well.

However, the problem was not resolved. The simultaneous use of different tools of communication by the same speaker is another issue. A speech turn starts when a speaker starts

communicating and ends when that same speaker finishes, which is not always the case in

online multimodal discussions. I propose the following extract (3.1) as an example.

It should be noted that the onset time of the use of the different tools of communication

is provided in hours, minutes and seconds. Audio, chat, whiteboard and YN turns are numbered

in separate series. Additionally, I adopted a pragmatic approach, with no indication of pauses or

intonation in the transcription of spoken turns. The chat is reproduced verbatim, with no attempt

to correct or standardize.

Extract 3.1

Chat Time	Audio Time	Audio (A)	Chat (C)
	1.9.40	29. St4. la laïcité est la séparation de l'église de l'état	
1.9.56	1.9.55	30. T2. Oui très bonne définition effectivement avec ce premier point la séparation de l'église et de l'état séparation que l'on a en France depuis le début du 20ème siècle depuis nos lois de 1902 1904 1905 mais c'est un principe très français parce que nous ne l'avons pas en Angleterre et plus tard ce soir nous parlerons de ça la laïcité donc c'est l'un des principes fondamentaux de la France cette décision selon laquelle on respecte les croyances personnelles de chacun mais ces croyances religieuses n'ont pas de place dans le domaine de l'état dans le domaine public qu'on fait référence ici aux collèges lycée et écoles publics le mot clé ici c'est public	3. T2. un état dans lequel le pouvoir politique et administratif est exercé pour les autorités laïques sans la participation des autorités religieuses

In this case of multimodal density, the tutor used the audio tool to evaluate the

contribution of student St4 and to explain the new concept that she introduced earlier.

Simultaneously, she used the chat tool to explain this new concept. In this case, the tutor's

contributions in audio and chat could not be considered as two different turns since the same

tutor was using the chat tool to summarize her oral explanations while she was still talking.

There was a continuous flow of communication which made this turn 'oral-graphic-written' at

the same time (Bouchard, 2007). Since the aim of learning in this particular environment was

communication, we needed hence to redefine the concept of turn and particularly its boundaries

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to cope with the nature of online communication. Given that turns were communicative and multimodal at the same time, the use of "multimodal communication turn" as a unit of analysis of this research was proposed. This was the use of one or more than one communication tool to convey a communicative message by the same speaker. It started when the speaker started communicating using any communication tool, and finished when the same speaker ended his/her communication flow using any communication tool. Multimodal communication turn then referred to the use of one or different tools of communication "simultaneously or consecutively by the same participant to convey one and the same communicative goal/message.

Having identified the multimodal communication turn as a unit of analysis, it was still however difficult to apply the three-exchange structure (IRF) described above to online multimodal data because online multimodal discussions did not progress in a linear way. Online discussions are not strictly structured in the way which has been described by traditional discourse analysis researchers (Sinclair and Coulthard, 1975). Rather, there was a multimodal hybrid interaction where different speakers communicated simultaneously using different communication tools to perform different interactive and communicative roles. For instance, one student might be acting as a respondent contributing a new idea. Another student might simultaneously be trying to reinitiate and revive an already closed discussion in a preceding exchange using another communication tool.

To describe the interactive functions of the different turns performed by participants in this particular research, two new interactive functions were defined.

- **Initiation continuity (IC):** when a participant reinitiates an already closed exchange while a new exchange has already started. In other words, there is a continuity of a previous exchange

that has already been closed. Participants reinitiate the same discussion though the tutor has already provided feedback and closed the exchange.

- **Response continuity (RC):** when a participant (a student or the tutor) builds on others' contributions within the same exchange (follow up on previous turns), or when his/her response is associated with a preceding response. This is to say that there is continuity in the flow of communication where participants engage in successive responses to the same initiation building on the same idea by adding their own ideas and opinions.

This is illustrated by the following example (Extract 3.2).

Extract 3.2

C Time	A Time	Audio (A)	Chat (C)
	1.9.55	(115) St1. Moi tout ce qui touche à l'écologie ça m'intéresse beaucoup euh surtout sur l'économie de l'énergie et surtout dans les euh la recherche sur les les les nouvelles comment dirais-je les les énergies nouvelles qu'on peut maintenant adapter à nos besoins comme les eaux et les capteurs solaires et les utiliser l'eau comme l'hydraulique ou enfin et puis bon aussi n'oublions pas le nucléaire R	
	1.10.41	(116) St3. Si d'ailleurs si je suis d'accord utilisons nous utilisons les la géothermie les énergies hydrauliques les pistes éoliennes et tout ça je trouve qu'on peut faire ça on peut viser à un avenir plus positif RC	
1.10.36	1.11.08	(117) St4. En France ils utilisant utilisaient l'hydro-électrique pour les usines et les maisons RC	(47) T1 : tout le monde est d'accord avec le nucléaire IC
1.11.45 1.11.50	1.11.34	(118) T1. J'ai posé une question dans la messagerie sur le nucléaire vous pouvez répondre tout le monde est d'accord avec l'emploi de l'énergie nucléaire qu'est ce que vous en pensez IC	(48) St4 : non RC

Multimodal turns were related and built on each other. This linkage was very important and needs to be presented. In this regard, Hepburn and Potter (2004) explained "We may refer to the concept of prospective or continuous classification where "each utterance is oriented to what comes before, and sets up an environment for what comes next". (p. 190). The tutor built on St3's response and initiated another exchange inviting students to give their opinions about the use of nuclear power as a source of energy. She invited student St1 to respond, which St1 did (A 115). Successively, other students started to build on St1's contributions adding their personal opinions and experiences before the evaluation of the teacher. Their contributions were qualified as "response continuity" rather than "response" where students built on St1's response rather than suggesting different ideas. While student St4 (A 117) was responding to a new initiation, the tutor went back to previously discussed ideas to reinitiate a new discussion over these same ideas using the chat tool (C 47) and another student responded (C 48) to this new re-initiation. The tutor's contribution is coded as "initiation continuity" rather than initiation. This example showed that participants could simultaneously use different tools to realize different interactional functions; some initiated a new exchange while others were still responding to the current non-closed exchange, others trying to reinitiate a previous already closed discussion while some others tried to respond to previous replies building on each other's ideas.

It was assumed that the analysis of the new interactive roles would allow us to know if the communicative exchanges were thematically related and interdependent. Analysis of interactive categories as frequencies of initiation (I), initiation continuity (IC), response (R), and response continuity (RC) turns could reveal depth of information exchange and extent of collaboration during online interaction. The high percentages of (I) coupled with high percentages of (R) might imply a tendency to focus on own contribution rather than building on previous contributions. The high percentages of (I) coupled with high percentages of (RC) might imply a tendency to follow up on previous turns. The high percentages of (IC) coupled

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with high percentages of (R/RC) might imply a tendency to follow up on previous exchanges which might suggest greater collaborative efforts to actively attend to the meaning and implications of others' contributions and further develop the topic of discussion through reinitiating turns, as opposed to only focusing on own contributions. In this regard, the study of the structure of multimodal interactions in terms of (I), (IR), (R), (RC) serves to depict the path of information dissemination and progression of constructive discussion.

To sum up, given the focus of the first research question on the analysis of patterns of multimodal interactions, I opted for the I-R-F system proposed by discourse analysis to study the patterns and structure of online multimodal interactions. There was a need to modify the three-structure I-R-F exchange and turn it into a five-structure exchange I-IC-R-RC-F. This adapted structure would reveal the extent of participation in terms of the frequency and range of multimodal turns and exchanges showing the mediational choices adopted by participants.

3.3.2.2. Transcription and description of the data

As was stated earlier, one of the premises in Vygotsky's (1978) theoretical framework was that mental processes could only be understood when there was understanding of the tools and signs that mediated them. As such, there was a need for a methodology to transcribe and analyze synchronous multimodal interactions to show the way the different affordances of use of the different tools of communication complement and/or overlap in order to influence learners' opportunities to interact and collaborate constructively.

The description and representation of multimodal data continue to intrigue researchers (Develotte et al., 2010; Mirza and Lamy, 2010). Lamy and Flewitt (2011) concluded that there was a lack of research that showed "how the different channels and modalities work together as well as the mechanics that underlie such co-operation" (p. 52). There was also a need for

models to show how the different tools of communication worked together and influenced the way students engaged in interaction to construct meaning together. Thibault (2000) has explained that the way we choose to represent multimodal data might influence the way we interpret them. To meet this challenge, Hauck et al., (2010) suggested to follow the approach proposed by Lamy and Hampel (2007, p. 47), i.e. "to start by identifying the modes involved in making up a multimodal environment", and "then to consider the possibilities that they afford the learner, both as single and as combined modes".

In this regard, this research followed the same approach; to identify the individual as well as the simultaneous use of tools of communication and then to figure out possible interrelationships. The following example (Extract 3.3) illustrates this point:

Extract 3.3

C Time	A Time	A	C
	1.9.55	(115) St1. Moi tout ce qui touche à l'écologie ça m'intéresse beaucoup surtout sur l'économie de l'énergie et surtout dans les la recherche sur les les les nouvelles comment dirai-je les les énergies nouvelles qu'on peut maintenant euh adapter à nos besoins comme euh les eaux et les capteurs solaires et les utiliser l'eau comme l'hydraulique ou enfin euh et puis bon aussi n'oublions pas le nucléaire R	
	1.10.41	(116) St3. Si d'ailleurs si je suis d'accord utilisons nous utilisons les la géothermie les énergies hydrauliques les pistes éoliennes et tout ça je trouve qu'on peut faire ça on peut viser à un avenir plus positif RC	.
1.10.36	1.11.08	(117) St4. En France ils utilisant utilisaient *l'hydro-électrique* pour les usines et les maisons RC	(47) T1. *tout le monde est d'accord avec le nucléaire* IC
1.11.45 *1.11.50*	1.11.34	(118) T1. J'ai posé une question *dans la messagerie* sur le nucléaire vous pouvez répondre tout le monde est d'accord avec l'emploi de l'énergie nucléaire qu'est ce que vous en pensez IC	(48) St4. *non* RC

As was explained above, this study focused on the use of the audio, the chat, the whiteboard and the YN tools. In order to represent the multimodality of the interactions, tables with different columns were used, with each column for a modality (tool) as well as columns for the timing for the use of each tool. The aspects of communication occurring simultaneously were highlighted using bold and italics formats and this overlap was indicated in the time column as well.

The description of the simultaneous use of different tools of communication and their possible interdependence was one of the most difficult issues in this research. It was exactly this interdependence that determined the way meaning construction took place. Fischer et al. (2002) suggested that the social modes of co-construction indicate the extent to which learners refer to the contributions of their learning partners, and they claimed that this is to be related to knowledge acquisition. I first used arrows to indicate the interdependence between the different tools.

For instance, from the above table, the arrow that went from the multimodal communication turn (C 47) to multimodal communication turn (A 115) indicated that the audio contribution was interactively and thematically related to the chat contribution. However, it was too confusing working with arrows. They worked perfectly with a small set of data but not with a larger set. Furthermore, it was difficult to figure out the direction as well as to map out the interdependence between tools of communication. Hence, an alternative method of identification had to be sought. At some point, the same work was being done twice: the description of the interactive functions of turns and the description of the tools being used to perform these same functions. However, I realized that the description of the interactive functions should not be separated from the description of the interdependence between tools of communication simply because they were very interrelated. I thought of providing a full

description of the interactive and the communicative function of each turn, the tool used to realize it, and the turn to which it is interactively and thematically related.

As was explained above, the turn (C 47) is interactively and thematically related to the contribution (A 115). This written contribution is a follow up to the oral contribution. The contribution realized using the chat mode is initiation continuity (IC) triggered by the contribution (A 115) realized using the audio tool. Hence, to show this thematic link, the transcription code would be chat IC (A 115).

Extract 3.4

Chat Time	Audio Time	Audio	Chat
	1.9.55	(115) St1. Moi tout ce qui touche à l'écologie ça m'intéresse beaucoup euh surtout sur l'économie de l'énergie et surtout dans les la recherche sur les les les nouvelles comment dirai-je les les énergies nouvelles qu'on peut maintenant euh adapter a nos besoins comme euh les eaux et les capteurs solaires et les utiliser l'eau comme l'hydraulique ou enfin euh et puis bon aussi n'oublions pas le nucléaire **R A 114**	
	1.10.41	(116) St3. Si d'ailleurs si je suis d'accord utilisons-nous utilisons les la géothermie les énergies hydrauliques les pistes éoliennes et tous ça je trouve qu'on peut faire ça on peut viser à un avenir plus positif **R A 114**	
1.15.36	1.11.08	(117) St4. En France ils utilisant utilisaient *l'hydro-électrique* pour les usines et les maisons **RC A 116**	*(47) T1. tout le monde est d'accord avec le nucléaire* *IC A 115*
1.11.45 *1.11.50*	1.11.34	(118) T1. J'ai posé une question *dans la messagerie* sur le nucléaire vous pouvez répondre tout le monde est d'accord avec l'emploi de l'énergie nucléaire qu'est ce que vous en pensez **IC A 115**	*(48) St4. non* **RC C 47**

In sum, I ended up by defining two new interactive roles which were (IC) and (RC), the adoption of turns and exchanges as unit of analysis, and the conception of a new method for the representation and transcription of online multimodal data.

So far, I have explained the way multimodal transcription was carried out. In addition, I have explained the use of concepts borrowed from discourse analysis to describe the interactive patterns of online interactions.

Hence, to address any progression or evolution of patterns of online discussions within the groups, I used the I-IC-R-RC-F exchange system borrowed and modified from discourse analysis. Discourse analysis regarded discourse as the main actor in the construction of realities, but socio-constructivist researchers believed in the joint social construction of realities through the negotiation of collective and individual understandings. Discourse analysis focused on interpreting individual contributions and did not allow deeper enquiry into the social process of meaning construction. It provided a pedagogical interpretation of the participants' individual interactive actions which was only a first step to understand their socio-constructivist functions. As such, there was need for a model to dive deep into participants' online multimodal discussions to comprehensively depict what was actually taking place from the socio-constructivist point of view.

To find the appropriate model for the analysis of the collaborative meaning construction process was not easy either because of the lack of models of analysis. As was explained earlier, research on synchronous interactions in supporting knowledge construction processes is scarce and the analytical models for examining online interactions are mainly designed for asynchronous discussions. I could not find appropriate analytical methods for examining synchronous oral interactions from the socio-constructivist perspective. In this line, Anderson, Archer, and Garrison (2000) have raised the following question: "the question that remains is how this task of improving our understanding of such online interactions can be framed" (p. 124).

Hence, there is still much research that remains to be done in order to understand online interactions. The following section explains the challenges I was confronted with in my search for a model of analysis as well as the solutions that I could propose.

3.4. Analysis of the collaborative meaning construction process

This section explains how this research sought to answer the following two research questions:

- What is the effect of the affordances of the individual and the simultaneous use of communication tools on patterns of online multimodal exchanges?

- Do multimodal online synchronous interactions in audio-graphic conferencing support meaning construction process and if so to what extent?

The purpose of this study was to characterize students' discussions with respect to the relations between multimodality and the collaborative meaning construction process. Thus, it was necessary to consider the contribution of this interdependence to students' participation in the meaning construction process. Hence, the third step was the examination of the effects of the modal density of online discussions (multimodal online interactions) on the collaborative process of meaning construction.

Fahy (2001) and Gunawardena (1997) have argued that research has failed to design and conceptualize techniques and theories for the guidance of online data analysis research. In the same line of thought, other researchers, for instance Henri (1992), Kanuka and Anderson (1998), Rourke, Anderson, Garrison and Archer (1999), Fahy, Crawford, Ally, Cookson, Keller and Prosser (2000), have highlighted the partial success of the attempts to analyze the quality of online multimodal interactions generated in computer conferencing. It seemed to me that current

studies were generally based on quantitative ways of measuring participation (for instance measures of turn taking, the length of a thread in a discussion, the length of sentences to examine the quality of online interactions (Sing and Khine, 2006). However, these quantitative indicators did not address either the processes or the quality of learning taking place (Mason, 1992; Pena-Shaff et al., 2001; Romiszowsky, 1996). Students' rates of participation and interaction were the most cited data on the educational benefits of computer conferencing (Harasim, 1990; Hiltz, 1990; Pena-Shaff et al., 2001). This implied that the claim that audio-graphic conferencing promotes socio-constructivist principles of learning was based on the premise that high levels of participation were equated to collaboration and learning. However, participation is not collaboration and quantity alone does not account for the quality of interactions nor their socio-constructivist dimension. Researchers have since tried to focus more on the quality rather than the quantity to assess learning processes in online environments. (Butler, 1992; Gunawardena, 1997; Newman et al., 1996; Newman et al., 1995; Pena-Shaff et al., 2001; and Zhu et al., 1996).

Nevertheless, only a few important models of analysis that used the principles of constructivism as a framework to describe online discussions could be identified. The models stated below were designed to analyze the quality of online interaction. The models were based on the premises that higher forms of learning are socially mediated and co-constructed in collaborative interaction and mutual sharing of information. The following table (Table 3.1) and paragraphs detail the contributions and deficiencies of the most important content analysis methods in online conferencing research.

Henri (1992)	Newman (1995)	Zhu et al. (1996)	Pena-Shaff & Nicholls (2004)	Salomon (2000)	Gunawardena et al. (1997)
Participative dimension	Problem identification Elementary clarification a triggering event arouses observing or studying an interest in a problem, identifying its elements, observing their linkages	Participation categories	Questioning Reply (sharing information	Access and Motivation	Exchange of ideas and opinions
Interactive dimension	Problem definition In-depth clarification Define problem boundaries, analysing a problem to ends and means understand its underlying values, beliefs and assumptions	Participants' roles	Interpretations Clarifications	Online socialization	Dissonance and Inconsistencies
Social dimension	Problem exploration inference admitting or proposing an idea, based on links to admittedly true propositions	Meaning categories: question, answer, reflection, comments, discussion, information sharing, scaffolding	Conflict, assertions, Consensus building	Information exchange	Negotiation/ co-construction
Cognitive dimension elementary clarification, in-depth clarification, inference, judgment, the development of strategies	Problem applicability Judgement evaluation of alternative making decisions, evaluations solutions and new ideas and criticisms		Judgement (justifying the relevance of new knowledge	Knowledge construction where discussions and collaboration take place	Testing tentative constructions
Meta-cognitive dimension	Problem integration Strategies acting upon understanding to for application of solution validate knowledge following on choice or decision		Reflective (self appraisal and acknowledging learning	Development of practice and reflective communities	Statement and application of newly constructed knowledge

Table 3.1. CMC content models of knowledge construction analysis

- Henri (1992) developed a theoretical framework for the analysis of the learning processes involved in computer conferencing. The framework addressed the participative, interactive, social, cognitive and meta-cognitive processes that might occur in computer conferencing environments. The cognitive dimension was defined in terms of different elements such as

understanding, reasoning, critical thinking, problem resolution and depth of processing. Henri proposed different categories to analyse the elements of each dimension. For instance, she defined the following categories to analyze the cognitive dimension: elementary clarification, in-depth clarification, inference, judgment, and the development of strategies (See table 1).

- **Newman et al. (1995)** compared the quality and types of learning taking place in computer-supported seminars as opposed to face-to-face seminars. To do so, they developed a set of indicators based on Henri's indicators (See table 3.1). They included relevance and importance of contributions, novelty of information, ideas and solutions, bringing in outside experience or knowledge to address the problem, linking ideas and interpreting information, justification of statements and solutions, and critical assessment of own or others' contributions.

- **Zhu et al. (1996)** aimed to evaluate meaning negotiation and knowledge construction during electronic conferencing in a graduate level distance-learning course within a constructivist framework. They coded the messages into participation categories, participant's role, and meaning categories. Meaning categories (question, answer, reflection, comments, discussion, information sharing, and scaffolding) were defined a priori. However, this model suffered from the same problems as the preceding ones. Although some of the categories provided good descriptors, others (e.g., comment, discussion, and information sharing) were very broadly defined. In addition, Zhu did not code raw data. Messages were only coded after they had been summarized and synthesized.

- **Pena-Shaff & Nicholls (2004)** analyzed students' interaction and meaning construction in a college-level course using an asynchronous computer bulletin board system. The researchers analyzed and coded the messages according to whether they were interactive ("interactive") or not interactive ("monologue") messages, as well as on the type of learning process taking place.

- **Salomon (2000)** used constructivist principles of teaching to explain and assess the progressive development of the online learning community. The model suggested that a social community included five stages: (1) access and motivation, (2) online socialization (3) information exchange (4) knowledge construction where discussions and collaboration take place, (5) development of practice and reflective communities.

- **Gunawardena et al. (1997)** developed an "interaction analysis model" to describe hierarchical phases in the co-construction of knowledge based on a constructivist perspective. The model elucidated how participants in a constructivist-learning environment arrived at a higher level of critical thinking through five hierarchical phases of interaction (debate) with peers in the co-construction of knowledge. These stages were: sharing/comparing of information, discovery of dissonance and inconsistency, negotiation of meaning/co-construction of knowledge, testing and modification of proposed synthesis, agreement/application of newly constructed meaning.

While these studies did examine the processes of critical thinking and knowledge construction, many were in the end limited to producing just quantitative analyses. The categories and the coding schemes of the four first models were criticized. It was pointed out that they were very broadly and vaguely defined making it difficult to sort messages into the categories proposed (de Wever et al., 2006). For instance, Henri's model was not empirically tested. As Henri herself pointed out, her framework was simply an attempt to provide an initial model for analyzing the content of online discussions. Henri et al., Newman et al., Pena-Shaff, and Zhu's indicators were suggestive for identifying cognitive processes found in online messages. However, the category descriptors for the classification of interactions were not provided, which made it difficult for me to sort student messages into their category system.

Despite the fact that Salomon's model drew on constructivist principles of learning, it focused on the measurement of the outcomes that resulted from the online learning process and

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the development of a learning community rather than the process of social construction of knowledge itself.

It was difficult to implement these models in the analysis of the present research data. The frameworks of the discussed models addressed the participative, interactive, social, cognitive and meta-cognitive processes that might occur in online conferencing. However, Henri et al. (1992), Newman et al. (1995), Pena-Shaff (2004), Zhu (1996), and Salomon (2000) did not provide category descriptors to aid in classification. On the other hand, the coding gave no impression of the levels or progression of the process though it was argued that meaning construction evolves through series of phases.

Gunawardena et al's. (1997) model thoroughly explained the different stages of the social knowledge construction. It allowed the description of cognitive presence which was defined as "the extent to which participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication" (Garrison et al., 2000. p: 4). Garrison and Andersen (2003) defined it as "the intellectual environment that supports sustained critical discourse and higher-order knowledge acquisition and application" (p: 55). The model also allowed a description of the development of the ZPD, scaffolding presence or assisted performance as well as the direction of cognitive and social processes of meaning construction. The presence and interactions between these elements in Gunawardena's model were considered crucial prerequisites for a successful learning experience. The cognitive presence reflected the "intellectual climate" (Garrison, 2000, p: 2) of the learning environment. The existence of assisted performance indicated the existence of a social climate that "facilitates the knowledge sharing process necessary to sustain cognitive presence and mediate all these components" (Anderson et al., 2001, p.5).

However, this model was questionable in its context because the data for it came from a highly structured, formal preconference debate among professionals that took place in a conference debate. In this regard, Pena-Schaff & Nicholls argued:

> [It]'s not clear how well their findings would apply to discussions undertaken by students, who are themselves not yet proficient in the arts of persuasion and argument, and whom we as educators are trying to assist in developing the kinds of cognitive structures that the participants in the pre-conference debate already possessed. (2004, p. 65)

I tried to apply this model in my previous research because the classification of phases of knowledge construction was important. However, the coding categories did not allow the treatment of my data which was drawn from a teaching-learning context. I was obliged to refine it by adding and deleting some codes to accommodate the data left untreated. In an effort to solve this problem there was a need to design another model which was an adapted version of Gunawardena's classification. The categories of Gunawardena's classification of phases of meaning construction were modified to fit with the nature of my data from an online learning context. Hence, a category system based on previous research was initially applied to the data and then modified to provide more detailed categories and indicators.

A scan of the different models (table 3.1) showed that researchers agreed on certain categories to be directly related to the process of knowledge construction. Fischer (2006) viewed students' discussions as collective information networks in which content changed and evolved dynamically by adding information, explaining, evaluating, summarizing, or transforming it. Of the categories identified in Table 3.1, statements of clarification, interpretation, conflict, assertion, judgment and reflection appeared to be most directly related to

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the process of knowledge construction. Adding information means that a new input was linked to the discussion. Explaining information meant that earlier stated information was made clear, specified, categorized, or illustrated. Evaluating meant that learners stated the strength or relevance of added and/or explained information. In transforming knowledge, learners evaluated and integrated the added and/or explained information into the collective knowledge base. Summarizing means that learners had already internalized the new information and were finally able to reorganize, restate, or use it.

In my previous research (Mirza, 2010), I had to add the category 'requests' to all the sub-phases proposed by Gunawardena et al., as the inquiry process "makes covert abstract processes visible, public and manipulable and serves as a necessary catalyst for reflective meta-cognitive activity" (Puntambekar et al., 1997). Requests indicated that students attempt to make sense of and understand the topics discussed. It was argued that by posing questions, elaborating on the ideas presented, debating and interpreting their own statements and those of others, students explore the discussed content, reach their own interpretations about the ideas being discussed: only then can they internalize the newly discussed and constructed information.

Furthermore, it is argued that meaning construction is reached through negotiation and debate. According to Fischer et al. (2002) and Weinberger and Fischer (2006), the social modes of meaning co-construction describe the extent to which learners refer to the contributions of their learning partners as well as negotiate and debate the exchanged information. They argued that this has been found to be related to knowledge acquisition. Based on this argument, my indicators that were defined as negotiation functions focused on debate and negotiation-related interactive categories. For instance, my proposed negotiation function categories included questions, reply, support, acceptances, explanation, consensus building, clarification/elaboration, evaluations, conclusions and checks, challenges, arguments, and counter-arguments. Thus, the proposed negotiation categories (shown in Table 3.2 below)

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focused on how the students share and construct meaning interactively through articulating thoughts to the group, questioning group members, accepting contributions of group members, applying others' perspectives, or disagreeing with them by arguing or counter-arguing.

Moreover, it was argued that when we describe higher forms of thinking, only then can we assess the individual socio-constructivist dimension of learning (Hopkins et al. 2008).The negotiation function categories reflect the forms of thinking which participants use when engaged in online interactions. Hence, the proposed negotiation categories offer a description of the socio-cultural constructivist learning process in the sense that they allow the description of forms of thinking, addressing both social and individual dimensions of learning.

Phases	Interactive codes	Comments
Phase 1: sharing and comparing information (low level negotiation functions)	Information request	Ask for information, exchange of ideas, experience or an opinion
	Information provision	Provide information, experience, ideas, opinions, ...
	Acceptance	Accept, a statement of agreement from one or more other participants
	Corroboration	Add or give similar examples, experiences, opinions...
	Comprehension check	To check understanding
Phase 2 (Moderate negotiation skills)	Explanation request	To ask to specify something, give more details, precisions..
	Explanation	Make clear, specify ...
	Disagreement	Identifying and stating areas of disagreement
	Rapid agreement	No other proposition and acceptance of the same idea, proposition and apply others' perspectives. Restating the participant's position, and possibly advancing arguments or considerations in its support
Phase 3 (Elaborate negotiation functions)	Exploratory request	Pointing at a problem, misunderstanding or disagreement. Recognition of some confusion/curiosity or perplexity as a result of a problem/issue arising out of an experience: posing a problem and enticing others to take a step deeper into it.
	Clarification/exploratory	Give more information, arguing own statements and establishing comparisons.
	Rejection	Express disagreement and refusal of the ideas, opinions, explanations, interpretations...
	Argument	Expressing reasoning, use of examples, analogies to defend ones ideas

Phases	Interactive codes	Comments
	Assertion	Maintaining and defending ideas questioned by other participants by providing explanations and arguments that defend original statements. (Restatements of assumptions and ideas, defending own arguments by further elaboration on the previous ideas.
	Critical challenge/counter argument	Propose/suggest another direction for discussion or thought, and to assert the need for another direction for discussion or thought.
	Conflict	Debating other participants' points of view, showing disagreements, presenting alternative or opposite positions
	Justification (reasoning)	Include constructed rather than retrieved beliefs and are used to present: goals, problems and solutions. It presents support or contraindication for alternative hypothesis. It is used to respond to a stated position/point of view with supporting or contrary evidence/information. It is used to defend a stated position or challenge/dispute a stated position with information/evidence
	Concession	Recognize the validity of an alternative viewpoint expressed in a previous turn.
	Consensus building	Co-construction build on each other's ideas trying to attain a common understanding of the issues in debate
Phase 4 (Highly elaborate negotiation functions)	Reflective requests	To invite learners to reflect, test and evaluate the newly Constructed meaning
	Testing	Evaluate and test new constructed meaning against previous knowledge or personal opinion
Phase 5 (Highly elaborate negotiation functions)	Summary and conclusions	To be able to restate and recognize the different points discussed
	Meta-cognitive requests	To invite learners to make statements illustrating their understanding and awareness of the newly constructed meanings
	Meta-cognitive statements	statements by the participants illustrating their understanding that their knowledge or ways of thinking (cognitive schema) have changed as a result of the conference interaction
	Application requests	Invitations to apply newly constructed knowledge
	Application	To be able to use spontaneously and authentically the newly constructed meanings

Table 3.2. The modified version of Gunawardena et al.'s model of analysis

- **Phase (1) sharing and comparing information** is compared to cumulative talk

(Mercer, 2000) where learners build positively but uncritically on what the others say through

performing the following low negotiation functions: suggestions (information provision), additions (corroborations), acceptance, and agreements (acknowledgement). At this point, there is no continuity in the discussion and the construction of meaning. Articulating thoughts or putting forward statements in favour of a specific proposition are at a lower level.

- **Phase (2) Dissonance and inconsistency/Quick Consensus Building** is compared to disputational talk (Mercer 2000) where consensus is quickly reached. Clark and Brennan (1991) argued that when negotiating and co-constructing meaning, learners needed to build a minimum consensus or common ground regarding the learning task. There are different styles of reaching consensus: quick consensus building and deep consensus building. During this phase, students perform moderate negotiation functions: disagreement, explanation requests and rapid agreement (non-negotiated agreement). Students build on each other's contributions and build consensus very quickly. In this case, students accept the contributions of their learning partners not because they are convinced, but in order to move up the discussion and be able to continue discourse (Clark and Brennan, 1991). Fischer et al. (2001) and Weinberger and Fischer (2003) argued that quick consensus building indicated a lack of change of perspective and understanding; it was rather a coordinating discourse move. However, quick consensus building is important in the management of interaction. Keefer et al. (2000) and Leitao (2000) have argued that to favour quick consensus is detrimental to individual knowledge acquisition, when learners disregarded other forms of consensus building in its favour.

Hence, there is no continuity of meaning construction at this moderate second level of the discussion. During phase (1) and phase (2), the discussion is at a low level of meaning construction where students simply exchange ideas.

- **Phase (3) Negotiation and co-construction of meaning (Deep conflict and consensus building)** is compared to exploratory talk where students engage critically but constructively with each other's ideas trying to solve conflicts at the aim of building consensus.

In language learning, the purpose of conflict solving and consensus-building tasks is to trigger negotiation and construction of meaning. The negotiation functions of this phase are qualified as elaborate negotiation categories. The majority of the interactive categories of this phase embody elements of argument, for instance concession, reason, justify, challenges, arguments, counter-arguments. Statements and suggestions are offered for joint consideration. These may be challenged, argued and counter-argued. Challenges are justified and alternative hypotheses are offered. Following argument construction, learning partners construct counter-arguments in order to challenge the initial positions. Construction of counter-arguments facilitates meta-cognitive activities and engages learners in rethinking their primary positions. Then, learners justify, reason, concede to refine their initial positions. Constructing arguments to justify their assertions facilitates domain knowledge of the content of discussion while constructing counter-arguments to challenge the assertion of other learning partners triggers students to think further or rethink their initial argument. Finally, they try to elaborate a new agreed-upon meaning to solve the conflict and build consensus.

Compared with the other two previous types, there is continuity in the construction of meaning. Meaning is made more publicly accountable and reasoning is more visible in talk. Learners try to build a deep consensus. According to Galloti (1989) and Shaw (1996), there are close connections between the concept of argumentation and the concepts of high forms of thinking. Learners have to consider each other's assertions and evidences for those assertions during the argumentation and consensus building process, and in this way they engage in high forms of thinking. Consequently, this third phase seeks to uncover the level of students' deep consensus building move. During this phase the discussion moves up to high levels; putting forward statements that aim to balance and to advance a preceding argument and counter-argument is at a higher level of meaning construction.

    - Phase (4) Testing tentative constructions (judgment of the relevance of the newly

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constructed knowledge) is a high level of meaning construction. In this phase, students use highly elaborate negotiation functions to predominantly reflect on their newly constructed meaning by testing it against their previous knowledge, their existing cognitive schema, and their personal experience and interpretations.

- **Phase (5) Agreement statement/applications of newly constructed meaning** is the highest level of meaning construction. This final phase is devoted to meta-cognitive statements where learners restate all the points discussed, make conclusions and illustrate their understanding that their knowledge or ways of thinking have changed as a result of online discussions. They end up using the agreed new meanings. The negotiation functions that constitute this phase are described as highly elaborate.

In sum, the model of analysis applied to code and analyze the data classifies negotiation functions of online interactions into four levels that correspond to five phases of meaning construction. The first level was qualified as low level interactions where discussion was at a basic level of simple exchange of information and opinions. This level corresponds to Ph1 of meaning construction. The second level was qualified as moderate interactions where there was a disagreement but no attempts to follow up. Discussion did not move up to high levels of debate. This level corresponds to Ph2 of meaning construction. The third type was elaborate or high level interactions where discussion moved up to high levels of debate and negotiation before participants could reach agreement and build consensus. This third level corresponds to Ph3 of meaning construction. The fourth level corresponds to Ph4 and Ph5 of meaning construction where participants test the new knowledge, internalize it and finally apply it. This fourth level then is subdivided into two phases of meaning construction; Ph4 for reflecting on the learning process and Ph5 for the application and internalization of new understandings and meanings.

Hence, as illustrated in table 3.2, the meaning construction process is made up of five phases of meaning construction. These categories range from externalization of thoughts (focus on meaning of concepts) at a superficial level to a higher level of social interaction in terms of conflict-oriented consensus building, testing and finally internalization (application of concepts). Building on this critical review, I propose this hybrid model of analysis that draws on socio-constructionist interaction and content analysis models for the examination of the way students co-construct meaning mediated by different tools of communication in the context of online language learning.

Based on the socio-constructivist methodological framework explained above, the analysis of the online tutorials goes through different steps and implements different instruments as shown in Table 3.3.

Instruments	Codes
Instrument one: the analysis of the interactive roles of participants contributions	**I:** initiation, **IC:** initiation continuity, **R:** response, **RC:** response continuity, **F:** feedback
Instrument two: the analysis of the negotiation functions of the interactive roles of participants' contributions	**Level one:** Low level negotiation functions (Information request, Information provision, Acceptance, Corroboration, Comprehension check) **Level Two:** Moderate negotiation functions (Explanation request, Explanation, Disagreement, Rapid agreement) **Level Three:** Elaborate negotiation functions (Exploratory request, Clarification, Arguments, Rejection, Assertion, Challenge (counter-argument), Justification, Concession, (negotiated agreement), Consensus building) **Level Four:** Highly elaborate negotiation functions (Summary, Reflective requests, Testing, Meta-cognitive requests, Meta-cognitive statements, Application requests, Application).
Instrument three: the classification of participants' contributions in terms of phases of meaning construction	**Ph1** (Sharing and comparing information), **Ph2** (Dissonance and inconsistencies/Quick consensus building), **Ph3** (Negotiation and co-construction of meaning/Deep conflict and consensus building) **Ph4** (Testing tentative constructions and judgment of the relevance of the newly constructed knowledge), **Ph5** (Agreement statement and application of newly constructed meaning),
Instrument four: the analysis of types of online exchanges (in terms of structure and modal density) using the five part exchange: I-IC-R-RC-F	**I-R-F:** I-R-F (Audio-only), I-R-F (A+YN), I-R-F (A+C), I-R-F (A+WB), **I-R-RC-F:** (I-R-RC-F (Audio-only), I-R-RC-F (A+YN), I-R-RC-F (A+C), I-R-RC-F (A+WB), I-R-RC-F (A+C+WB+YN), **IC-R-F:** (IC-R-F (A-only), IC-R-F (A+YN), IC-R-F (A+C), IC-R-F (A+WB), IC-R-F (A+C+YN+WB)) **IC-R-RC-F:** (IC-R-RC-F (A-only), IC-R-RC-F (A+YN), IC-R-RC-F (A+C), IC-R-RC-F (A+WB), IC-R-RC-F (A+YN+C+WB)).

Table 3.3. The four analysis instruments used to analyse the data

The focus is on the effects of the affordances of use of the different tools of communication on the collaborative process of meaning construction:

• Multimodal transcription of the data using the methods of multimodal transcription and presentation explained above.

• The analysis of the patterns of online interactions. To do so, I use discourse analysis where I apply the five-point I-IC-R-RC-F system to describe and analyze the multimodal interactive roles of the different participants. Turns are coded in terms of the five identified interactive categories (I, IC, R, RC, and F) defined as interactive roles. I hypothesize that the organization of online interactions reflected in the interactive roles adopted by the different participants affects learners' degree of involvement in terms of quality and quantity as well as it determines the interactive and participative roles of the teacher and learners. It should be noted that discourse analysis is used only for the description of the structure and patterns of online interactions.

• The coding of interactive categories into sub-categories based on the communicative functions of turns. The communicative functions of turns are reflected by the negotiation functions performed by participants.

• Quantification of the different interactive and negotiation categories according to the tools used by participants.

• The classification of turns into phases of meaning construction according to their negotiation categories and tools being used.

• The classification of exchanges into phases of meaning construction according to the extent of collaboration reflected by the extent of interdependence between tools and the type of interactive and negotiation functions conveyed.

I propose the following extract (Extract 3.5) as an illustration:

Extract 3.5

C T	A T	Audio	Chat
	12.10	(31) T3. Ostensible oui trop visible donc une petite croix religieuse discrète il n'y a pas de problème mais une kippa juive sur la tête d'un petit garçon non c'est trop visible un voile musulman sur la tête d'une petite fille dans une école publique non c'est trop visible et ça on l'accepte pas alors nous avions bien sûr notre principe de laïcité dans les écoles publiques mais en début des années 2000 on s'est dit il faut maintenant avoir par écrit une loi qui nous dit clairement que manifester ostensiblement son apparence religieuse dans les écoles publiques n'est pas acceptable en France je vous invite à travailler tous ensemble à débattre ce concept de laïcité I	
15.07	14.30	(32) St17. Oui mes convictions à moi ne sont pas très religieuses je serais le parfait laïc en plus dans les écoles je pense que c'est tout-à-fait normal de ne pas avoir de différence entre les élèves que les écoles soient neutres mais aussi si on compare en Grande Bretagne ils font les études religieuses non pas du tout pour apprendre qui fait quoi dans la bible ou dans le coran mais c'est pour apprendre aux jeunes ce que c'est *le christianisme* l'islam l'indouisme et tout ça donc tout ça c'est très bien mais bon le reste l'interdiction des ports des signes religieux et séparation de la religion de l'état moi je suis avec la laïcité **R A 31**	(6) St18. *Oui je voulais juste ajouter que c'est l'idée d'afficher ses croyances religieuses je pense qui n'est pas acceptable et non pas les religions et les croyances personnelles* RC A 39 + A 32
	15.48	(33) St19. En prenant en compte ce que vous avez dit St18 et St19 nous ici en Grande Bretagne nous avons une conception différente de ça nous ne faisons pas de différence entre foi religieuse et liberté individuelle pour moi il n'y a pas de problème à avoir liberté et foi religieuse je pense que c'est une ségrégation ou plutôt une forme de répression des droits de l'homme on doit respecter nos appartenances religieuses et culturelles **RC A 41 + A 40 + C 6**	
17.38	17.22	(34) St20. Je suis d'accord avec St19 l'école anglaise accepte la religion comme J nous l'a dit avec les cours d'instruction religieuse qui n'ont pas de place dans l'école française publique moi je trouve que c'est dommage parce que je pense que ces cours sont importants pour apprendre à se connaître il ne faut pas nier le faite qu'on est *différent et* ce n'est pas en niant les différences qu'on va se connaître et apprendre à vivre ensemble **RC A 33 + A 32**	(7) St17. *Ce n'est pas une forme de répression mais c'est seulement que l'école française et l'état français se veulent citoyens et laïcs* RC A 33
19.16	18.45	(35) St17. Non je ne partage pas votre opinion le principe est que l'espace public d'une école française est un espace qui est républicain qui à nouveau fait référence à nos principes liberté égalité fraternité donc dans une école primaire si tout les garçons doivent être libres et égaux être égaux ça veut dire il ne doit pas y avoir une différence visible on ne veut pas avoir dix garçons identiques et *puis notre petit garçon* à côté qui montre visiblement qu'il est d'une religion particulière en France	(8) St18. *Je ne suis pas du tout d'accord, être égaux et libres en mettant des contraintes sur la liberté de la personne, elle est ou la liberté ici ?* RC A 35

		ce n'est pas acceptable parce que c'est un signe de communautarisme et de refus d'intégration alors que le principe républicain insiste sur la nécessite de l'intégration dans la vie française RC A 34 + C 7	
20.56	20.11	(36) St18. Je ne suis pas du tout d'accord en Angleterre et dans beaucoup de pays comme les Etats Unis on célèbre les différences ce n'est pas la différence qui fait peur mais c'est le fait de ne pas comprendre l'autre si on l'empêche de montrer ses différences je pense que les différences culturelles et *religieuses apportent* beaucoup de richesse à notre société je ne vois pas du tout pourquoi les rejeter RC A 35 + C8	(9) St19. *Je suis tout à fait d'accord avec toi je ne comprends pas à quoi sa gênerait d'avoir des signes religieux pourquoi ça gênerait d'avoir une femme voilée au travail il est ou le problème* RC A 35 + A 36+ C8
	21.12	(37) St17. La laïcité en France vise à combattre le communautarisme traduit par les signes religieux à l'école ou sur les lieux du travail RC A 36 + C 9	*•*
	21.38	(38) St20. Moi aussi je trouve que c'est une atteinte à la liberté personnelle ici on est libre d'afficher nos croyances religieuses tant qu'on ne fait pas de mal aux autres et on respecte la liberté et les croyances des autres pour moi ça n'a rien avoir avec le communautarisme mais c'est juste accepter l'autre RC A 36 + C 9 + A 38	
22.35 **22.40**	22.00	(39) St19. Ce que je ne comprends pas on dit que cette loi vise à atteindre la justice sociale donc pour vous on atteint la justice sociale on rejetant les différences comment expliquez vous cette controverse en plus il n'y a pas de mal à célébrer le *multiculturalisme* comme on fait ici au UK RC A 37 + A 38 + C 9	(10) St17. *Non ce n'est pas une controverse* RC A 39 (11) St18. *Moi je suis d'accord* RC A 39
	22.46	(40) St18. Moi je pense qu'on fait tout un bruit pour une situation qu'on pourrait régler facilement par exemple, je ne vois pas d'inconvénients d'avoir des piscines pour les musulmans et les juifs religieux l'état n'a pas à se mêler des religions sauf si elles touchent à l'ordre public à mon avis RC A 39	
24.18	23.35	(41) St17. Ben non en France avoir des piscines comme ça c'est une forme de ségrégation et d'exclusion sociale et le principe fondamental de notre république est l'inclusion sociale c'est justement célébrer les différences mais sans pour autant exclure l'identité française nous avons maintenant et ce qui est troublant des 2eme, 3eme, voire 4eme générations ne sont toujours pas intégrées je peux dire en deux mots que la laïcité telle que définie en France est le respect de l'autre quand cet autre vous accepte sur son sol actuellement notre république confrontée au communautarisme une intégration en panne donc voilà il fallait passer cette loi pour ne pas trahir les principes de notre république pour s'intégrer en France l'idée ce n'est pas le rejet des cultures ou les religions des autres *mais on doit se couler* dans le moule républicain qui est le même pour tous alors qu'en Grande Bretagne et même aux Etats-Unis le mode d'intégration qu'ils ont valorise les différences les met en avant on dit dans votre monde anglo-saxon c'est bien d'avoir ces différences cela rend notre société multiculturelle et bien plus riche alors qu'on France on va se dire non pour être français pour devenir un membre de cette même république il faut accepter les principes fondamentaux de cette république alors nous on accepte un certain moule je pense qu'il faut défendre l'identité française sur le territoire français on veut protéger l'identité de la France républicaine, nos grands parents se sont battus pour ces	(12) St18. *C'est l'une des controverses autour de cette loi les gens accusent l'état de ségrégation et racisme mais moi je pense que les intentions sont loin de la c'est vrai que je ne suis pas d'accord avec cette loi mais je pense que le but comme je viens de le comprendre la France veut que les français soient égaux et qu'ils ne soient pas traités différemment* RC A 54

		principes républicains **RC A 39 + A 40**	
	26.37	(42) St19. C'est vrai je suis comme St18 je ne comprenais pas cette loi comme ça je pense que je comprends mieux ce concept maintenant vous cherchez aussi le multiculturalisme mais une totale intégration des différentes religions et cultures enfin c'est un argument mais je ne suis pas convaincue que ce soit une bonne chose **RC A 41 + A 40 + C 12**	

In this example, students discuss an important concept that triggered intensive negotiations and debates. I first applied the I-IC-R-RC-F system on this long exchange to code the different interactive functions implemented by the participants. As is shown, the tutor's contribution (A 31) was described as an initiation (I) as the tutor started a new topic. Then, the tutor's F and IC interactive categories were further sub-divided in terms of its communication functions into two negotiation functions: clarification and exploratory request. The tutor clarified the meaning of the concept then invited students to debate this same concept. His contribution was then described as I (clarification + exploratory requests). Concerning students, as the exchange showed, some students supported while others contested the concept, which trigged an intensive debate. Hence, their contributions were all described as RC interactions as they were engaged in the process of negotiation and argumentation, clarifying, rejecting, challenging and asserting each other's ideas. Then, their RC interactive categories were sub-coded in terms of their negotiation functions. For instance, contribution A 36 is an RC (rejection) as student St18 rejected student St17's ideas and justifying her rejections, the contribution A 41 was coded as an RC (challenge and counter-argument) and St17 rejected other students' ideas and tried to defend his own idea, and the contribution C 12 was coded as having two negotiation functions, RC (concession + consensus building), as the student stated that he finally understood St17's ideas, he stopped challenging and accepted student St17's clarifications and assertions.

Hence, in terms of the level of meaning construction, the extract showed that all of the participants used elaborate negotiation functions which indicated that their contributions reached Phase 3 (Ph3) of meaning construction. In addition, the extract showed that the contributions made in the different modalities were interrelated as students were referring to each other's contributions and building on each other's ideas. As such, the exchange was described as a multimodal IC-R-RC-F as different tools were used. The exchange or the discussion reached Ph3 of meaning construction as participants were collaboratively working, their multimodal contributions were related, and they used elaborate negotiation functions building consensus et the end of the discussion.

Finally, characteristics such as objectivity and reliability are important criteria for any research (Rourke, et al., 2003, p148). To avoid shortcomings, the coding scheme was tested, developed and refined over a three-month period and intra-coder reliability was assessed by my coding the data three times to check any discrepancies.

Moreover, in order to take account of the possible threats to validity and to add methodological rigour, I submitted data to double coding. Prepared data from the online tutorials were analyzed according to the coding scheme by two other colleagues. The three coders were required to code the conference data twice and alone. First, my colleagues and I twice coded turns into interactive categories. At the end of each coding, we subsequently compared codes and resolved discrepancies. Then, the interactive categories were further sub-coded into negotiation categories. Again, each coder worked alone and did the coding twice. We went through exactly the same steps, by which we had to compare codes and resolve discrepancies after each round. For the second round, there was strong agreement between my colleagues and myself and the intra-coder reliability was high. Cohen's Kappa is at .86 for the coding categories.

The analysis of online tutorials provided detailed evidence of the ways in which participants used the different tools of communication to participate in the collaborative meaning construction process. However, it provided only limited evidence of the reasons for and the thinking behind participants' actions. Tutorials were therefore supplemented by a series of questionnaires and interviews intended to reveal unexpressed aspects of participants' interactions and multimodal choices to provide different perspectives on that interaction, and thus to enrich understanding of the effects of different factors on learning (Zhu, 2006).

Hence, this research makes use of qualitative analysis of questionnaires and interviews to illuminate the qualitative analysis of online tutorial data.

3.5. Interviews and questionnaires

To answer the fourth research question, questionnaires were administered to students and interviews were conducted with tutors.

- How do students and tutors perceive their experiences of online multimodal interactions in SAGC in terms of participation opportunities and adequacy of learning support?

The second main source of data was the tutors' interviews and students' questionnaires to examine participants' views and accounts of their overall online experiences, collaboration and interaction opportunities as well as the availability of the different tools of communication. Questionnaires and interviews proved to be beneficial in generating information on participants' perceptions and eliciting participants' reflective perspectives on their learning experiences. An interview "attempts to understand the world from the subjects' point of view, to unfold the meaning of people's experiences" (Kvale, 1996, p. 1). In addition, a form of triangulation was

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needed to enhance the validity of the study. The different evidence from questionnaires and interviews served to partially substantiate, or negate the results of the analysis of online tutorials. Interviews and questionnaires were also intended to add credibility to the research by including learners' accounts of their online activity as well as the researcher's interpretation of that activity. Interviews and questionnaires were therefore carried out to extend and inform interpretation of the online tutorial data.

Prior to a systematic analysis of online tutorial data, the application of the coding scheme allowed me to make sense of the data and have a general idea of the outstanding features of each case. I designed the questionnaire questions and items and organized the interview questions around these themes and features identified from the analysis of online tutorials. The recurrent themes that emerged from the analysis of the tutorials were: the importance of collaboration, participation opportunities, the importance of use of the different tools of communication, the type of tasks, and tutors' scaffolding. Based on these themes I designed the questionnaire and interview items.

3.5.1. Interviews

The two tutors were interviewed. I opted for semi-structured interviews that allow "individuals to expand on their responses to questions" (Jones, 1991, p. 203). They provide interviewers with flexibility to probe in-depth, providing richer data (Nunan, 1992). As advocated by Nunan (1992), the interviews were determined by topics and issues rather than a list of questions. The interviews were semi-structured with some initial questions as the starting point opening up into more flexible exchanges. These questions, and the use of the method in this study, were trialed on two students with experience of online group learning. Their responses were considered as pilot data, and were not incorporated within the main study.

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Interviews were conducted over Elluminate and lasted between 60 and 90 minutes each. Elluminate interviewing was selected rather than face-to-face interviewing because the tutors were distributed within the UK, so meetings would have been difficult to arrange, time consuming and expensive. The method allows both interviewer and respondent to select suitable interview times, and provides time to consider questions and responses.

The interviews were conducted right after the end of the semester. It should be noted that participants' comments reflected their accumulated perceptions on the overall experience with the potential influence of time on their memories and perceptions via retrospection.

Prior to the interview, I sent the consent form to tutors and a letter that explained the flexible structure of the interview and guaranteed anonymity and confidentiality. When interviewing tutors, I encouraged them to talk about their experience in as many directions as they wished. I finished the interview by asking them if there was anything they wished to add (Dörnyei, 2007).

The conversations were recorded and then transcribed in full. Thematic qualitative analysis was used for the analysis of interviews. Thematic analysis goes beyond simply counting phrases or words in a text and moves on to identifying implicit and explicit ideas within the data. It emphasizes pinpointing, examining, and recording themes within data (Guess, Macqueen, & Namey, 2012). The identified themes are very important to the analysis of the questionnaires and the interviews. Hence, thematic analysis helps in the analysis of the identified themes that are as categories for the analysis of tutors' and students' responses. They were analyzed according to two main meaningful dimensions. First, the answers were grouped according to central ideas and themes identified. Second, similarities and differences in tutors' answers were identified.

3.5.2. Questionnaires

The questionnaires are meant to provide an examination of students' perceptions of their online learning experience, with particular focus on their general views on the affordances of use of tools of communication and collaboration opportunities. Although it was impossible to probe and clarify, questionnaires were an efficient means of collecting data in terms of time, efforts and financial resources (Dörnyei, 2003).

The questionnaires were distributed to the students who belonged to the two observed groups (L211) only. The questionnaire was not distributed to other French L211 students as this research seeks to understand the observed students' perceptions of their online experience to understand the reasons behind their multimodal choices. Sixteen questionnaires were sent to the students that attended the online tutorials on a regular basis. I obtained 100% response rate.

Because of ethical considerations, I was not provided with students' email addresses. Tutors passed on any information or request on my behalf to their students. Consent forms were sent to tutors who transmitted them to their students. During the online tutorials, I explained the questionnaire items to students and anonymity and confidentiality were guaranteed. All students consented to participate in the survey. Upon reception of their signed consent form, I sent the questionnaire to tutors who emailed it to their students. The questionnaires were completed with a 100% response rate.

The questionnaire items focused on the experience of working together online and the use of the different tools of communication, in order to investigate the understanding of students of the different affordances of use of tools. Questionnaires involved "a series of questions or statements" to which students replied by either selecting from given options or by providing written accounts (Brown, 2001, p. 6). The questionnaire included Likert-type questions, as well as several open-ended questions relating to students' feelings about interaction and collaboration opportunities and their multimodal choices. The survey answers were compiled

and in the case of the Likert-type responses, tallied by percentages, and the answers to the open ended questions were categorized by themes.

As explained above, online tutorials allowed the analysis of the social dimension of learning. The socio-constructivist perspective that informed the design of this study suggests that learning is both social and individual. This implied the need to examine both dimensions for a better understanding of the collaborative meaning construction process. Hence, I quantified the contributions of each individual student in terms of interactive roles, negotiation functions and use of tools to perform these functions. I included this quantitative data in the thematic analysis of the students' responses to the questionnaires to check the individual dimension of learning endorsed by students' reflections.

3.6. Ethics

Ethical decisions in this study were governed by the instructional guidelines set by the BERA guide (Revised Ethical Guidelines for Educational Research, 2004) and the ethical principles for research involving human participants that determined that a human research ethics permit and informed consent from participants were required for this study. Consequently, permission was sought from the OU Student Research Project Panel (SRPP) and the Human Participants and Materials Ethics Committee (HPMEC).

An information sheet and a consent form were sent to participants in which I explained what participation would involve (see Appendix 1 and Appendix 2). Three tutors volunteered. The tutors who agreed to be observed asked for the permission of their students who explicitly gave their consent. Participants were informed that the data was protected under the Open University's implementation of Data Protection Act (1998) regulations and would be destroyed

in case of withdrawal. The consent form included details on the aims of the project, what participation involved, and what would happen in case of withdrawal.

As anonymity, confidentiality and privacy in online environments are concerns in online contexts (Joinson, 2003), participants were given assurances regarding these matters. All research data was, and is, stored securely on a password-protected computer. To provide privacy and confidentiality in publication, I have anonymized the names of the participants throughout the thesis. Informed consent was obtained from the OU in March 2010 before the commencement of the main study. I acknowledge that informed consent might present methodological risks of influencing participants' behaviours and consequently the quantity and quality of interaction.

My findings have applicability to distance-teaching of languages in general, and possibly immediate applicability to distance teaching of languages at the OU. The aim is then to extend knowledge and understanding in the area of SAGC systems to ameliorate the design and the implementation of such internet applications. The present research has many methodological and pedagogical benefits that are highlighted in Chapter Six, Section 6.7, Section 6.8 and Section 6.9.

3.7. Conclusion

In sum, the modified five-structure I-IC-R-RC-F was used to describe the interactive functions of turns as well as the patterns of multimodal communication turns and exchanges. This description allowed me to capture the dynamics underlying the interplay or interdependence between the different tools that students used to perform their communicative and interactive functions. Such an analysis would indicate the impact of mediational choices of

the participants on the progressions of discussion, which revealed depth of information exchange and extent of collaboration during online interaction.

Describing and quantifying turns was important in this research. However, quantitative data alone offered no insight into the quality of interaction. To examine the quality of interaction, we needed a model that analyzed the features of the teaching and learning from a socio-constructivist dimension. However, previous research on synchronous interactions in supporting knowledge construction processes was sparse and the analytical models for examining online interactions were mainly designed for asynchronous discussions. I could not find appropriate analytical methods for examining synchronous oral interactions from the socio-constructivist perspective. In this respect, Anderson, Archer, and Garrison (2000) argued that "the question that remains is how this task of improving our understanding of such online interactions can be framed" (p. 124). It was pointed out that much research and development remains to be done in order to understand online interactions. Hence, I had to adapt or modify Gunawardena et al.'s model and propose a new coding to analyze my data. By proposing such a coding, I assumed that learning is a social active process, in which individuals create meaning by sharing ideas/opinions/concepts, negotiating by analyzing/discussing/evaluating the shared knowledge, and experiencing new situations and applying newly constructed meaning.

It should be noted that I did not carry out any statistical analysis of the quantitative data because I did not aim to generalize in statistical terms. I compared data within and across groups via tables and graphs. To answer the fourth research question, questionnaires were administered to students and interviews conducted with tutors. I used quantitative and qualitative data to thematically analyze the questionnaires and the interviews.

The following chapter illustrates how the proposed methodological framework was implemented to analyze the different data of this research.

Chapter Four

Analysis of the Online Tutorials

4.1. Introduction

The preceding chapter set the methodological framework that was implemented in this study. The aim of this chapter is to analyze the data to increase understanding of the affordances of use of tools of communication and types of multimodal interactions that can support shared construction of meaning in synchronous audio-graphic conferencing environments. It should be noted that Chapter Four aggregates behaviors and treats students as coherent groups (G1 and G2).

The present Chapter Four comprises five main sections (section 4.2, section 4.3, section 4.4., section 4.5, and section 4.6). The different sections aim to provide answers to the following research questions:

- What are the patterns of online multimodal interactions?

- What is the effect of the affordances of the individual and the simultaneous use of communication tools on patterns of online multimodal exchanges?

- Do multimodal online synchronous interactions in audio-graphic conferencing support meaning construction process and if so to what extent?

To answer these research questions, I examined the extent to which the different tools of communication were used as well as the patterns of multimodal interactions and exchanges.

Reflecting on this study's conceptualization of the hierarchical structure of educational online exchanges, turn types in exchanges were first coded according to five interactive roles which drive exchanges: Initiate (I), Initiation continuity (IC), Response (R), Response continuity (RC) and Feedback (F). The coded turns were further classified according to their communicative functions which are reflected in the negotiation functions of their associated moves. Hence, interactive roles were then sub-divided into turn types defined as negotiation functions For instance a turn could be coded as an IC interactive role. The IC turn could then be coded as having the negotiation function to check, clarify, extend, or challenge.

This analysis of patterns of multimodal interactions revealed the structural organization of the pedagogical online exchanges as well as the communicative functions underlying the turns constituting the exchange. It should be noted that, in this study, coding of interactive and communicative functions of turns was largely guided by interpretations of their relevance in terms of discussion context and content rather than consideration of the correctness or accuracy of language. Thus, the macro analysis of turn types revealed the interactive roles of participants. The micro analysis of turn types revealed the communicative functions of participants' interactions.

A preliminary examination of interaction showed the existence of two kinds of exchanges: (1) exchanges which were exclusively teacher-student. They concerned the progression of the lesson depending on the teacher's intent (informing, directing, eliciting or checking) and, (2) exchanges which were exclusively student-student. They concerned small group work when students were sent into separate breakout rooms.

However, the analysis showed that when sent into breakout-rooms students used the audio tool only. As the aim of this study is the examination of learners' multimodal choices

and the affordances offered by the use of the different tools when used individually or in combination, student-student interactions were not analyzed.

4.2. The analysis of interactive functions of participants' interactions

4.2.1. The use of tools of communication by tutors

Both tutors showed very similar patterns of choice as regards which communication tool to use (see Table 4.1). There are four single tools that were used by tutors. In addition, two types of multimodal turns were identified. The first type was the audio + whiteboard (A+WB) multimodal turn where the tutors simultaneously used the audio and the whiteboard tools. The second type was the audio + chat (A+C) multimodal turn where the tutors simultaneously used the audio and the chat tools.

It should be noted that we are interested in the types of multimodal choices of participants and their impacts on the meaning construction process. Focus is more on the quality of multimodal online interactions with relation to the affordances of the different tools of communication. Hence, focus is on the frequency of use of each tool of communication and the quality of the multimodal contributions rather than the length of actual employment of the tool.

In table 4.1, results are shown in terms in numbers of contributions and percentages.

	A (Audio)	C (Chat)	WB (Whiteboard)	YN (Yes and No tool)	A+WB (Audio + Whiteboard)	A+C (Audio + Chat)
Tutor 1 (T1)	237 (68.10%)	29 (8.33%)	24 (6.89%)	22 (6.32%)	24 (6.89%)	12 (3.44%)
Tutor 2 (T2)	137 (64.59%)	15 (7.17%)	12 (6.74%)	15 (7.17%)	10 (4.78%)	19 (9.54%)

Table 4.1. Proportion of use of tools of communication by tutors

The results show slight differences between the multimodal choices of tutors. The table displays higher usage of the different tools by T1 than T2. However, in both cases, the audio tool was predominantly used and accounts for more than 60% of tutors' total contributions. The second most frequently used tool was the chat tool for T1 but the A+C cluster for T2. In third place came the whiteboard and A+WB for T1 and the chat and the YN tools for T2. In fourth place came the YN tool for T1 and the whiteboard tool for T2. In fifth place came the A+C for T1 and the A+WB for T2.

The multimodal choices of each tutor were as follows in decreasing order of use (see Figure 4.1):
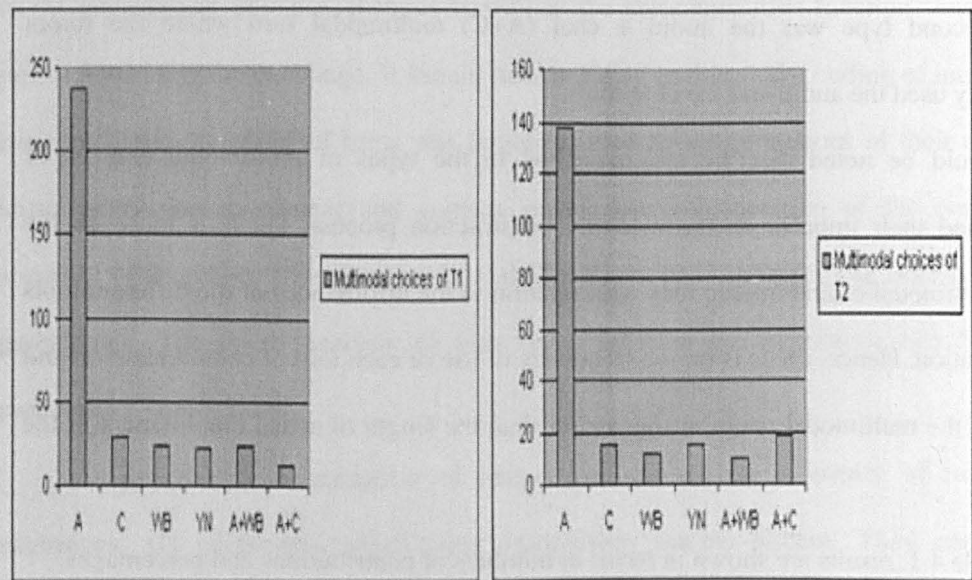
4.1. Tutors' multimodal choices

The results showed the same preferences by both tutors towards the use of the audio, the chat, the whiteboard and the YN tools. However, tutors did not use multimodal turns in the same ways. T1 used A+WB more than T2, for whom A+WB comes last in order of preference

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for communication tools. T2 on the other hand showed a preference for A+C, which came second after the audio tool, yet this multimodal cluster came last for T1. These differences are discussed in the coming sections of the analysis to see the impact of tutors' multimodal choices in discussions.

4.2.2. The use of tools of communication by students

Contrary to their tutors, students used each of the four tools singly and did not use the tool clusters as tutors did (see Table 4.2).

	A	C	WB	YN	A+WB	A+C
Group 1 (G1)	195 (73.30%)	24 (9.02%)	15 (5.63%)	32 (12.03%)	0 (0 %)	0 (0 %)
Group 2 (G2)	234 (78.78)	12 (4.04%)	21 (7.07 %)	30 (10.10 %)	0 (0 %)	0 (0 %)

Table 4.2. Proportion of use of tools of communication by students

The results showed that both groups of learners predominantly used the audio tool, which was expected, as previous research showed that OU language students met online to practise their oral French (Mirza, 2010). In second place, both groups used the YN tool. Again, this is not surprising as they were often asked to do so by tutors to show their agreement and disagreement as well as to check comprehension. However, they showed different tendencies towards the use of the chat and the whiteboard tools. Group 1 Students (henceforth G1) used the chat tool more than the whiteboard while Group 2 students (henceforth G2) used the whiteboard tool more than the chat tool.

A cross-group comparison of the contributions of both tutors and both student groups showed that tutors and students shared more or less the same preferences towards the use of

the different tools of communication (there were similar patterns between the contributions of the tutors and students). However, unlike their tutors, students used no multimodal turns.

I now look at what interactive purposes participants use the different tools for, and the impact that the choice of any particular tool or a cluster of tools might have on patterns of interactions and engagement in discussions.

4.2.3. Interactive roles of participants

The analysis of the interactive dimension of turns revealed the interactive roles adopted by the different participants. In addition, the analysis of the communicative dimension of turns revealed the negotiation function of participants' interactions. The interactive functions of participants' turns displayed sub functions that revealed their communicative functions.

This section presents the results of the analysis of interactive roles of participants defined as the turn types they adopted. The first focus of this analysis is to find patterns of participants' engagement with each other's contributions and interaction through the application of the coding scheme explained in the methodology chapter (Chapter Three). The analysis of the patterns of online interactions and exchanges permits the description of the interactive roles of participants which is a preliminary step towards the identification of the communicative functions described as the negotiation functions of participants' online interactions.

I expected to see more student-student exchanges since Elluminate sessions were pedagogically designed to be learner-centred. However, as explained in the methodology chapter (Chapter Three), a preliminary analysis of the Elluminate sessions revealed predominantly teacher-centred interactions as all exchanges were initiated by tutors. Hence, to

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describe the interactive roles of participants' discourse, the I-R-F exchange pattern was chosen. Nonetheless, when I tried to implement the I-R-F model, some of the patterns found did not fit into the I-R-F exchange pattern. Hence, two new interactive roles were created, which were IC and RC. The concept of turn types was operationalized as the following categories: I, IC, R, RC, and F. The five interaction categories reflected the structural organisation of online turns and subsequently online exchanges.

- An initiate turn (I) anticipated a subsequent turn by another participant which led to the start of a new exchange

- An initiation continuity turn (IC) was an attempt to extend discussion by reinitiating previous discussions before moving on to discuss others' ideas. Participants tended to reinitiate the preceding discussion inviting other participants to contribute to the same discussion before moving on to another discussion.

- A response (R) replied to a previous initiating turn

- A Response continuity turn (RC) where participants replied and built on a previous response, conveying attempts towards collaborative discussion and negotiation. Different participants responded to the same initiating turn building on each other's contributions before finishing the discussion.

- Feedback (F) was generally provided by tutors by accepting, correcting or commenting on students' replies. This signaled the end of the exchange.

A frequency analysis of these turn types was carried out to reveal the interactive roles of tutors first and then students.

4.2.3.1. Tutors' interactive roles in online exchanges

Results show that the five types were produced by both groups (Table 4.3), but in varying proportions of each tutor's total number of turns.

	I	IC	R	RC	F
T1	67 (19.54%)	93 (26.72%)	15 (4.31%)	28 (8.04%)	143 (41.37%)
T2	78 (37.32%)	27 (12.91%)	15 (7.17%)	14 (6.69%)	74 (35.88%)

Table 4.3. Frequency of Tutors' interactive roles

T1 engaged in IC more than in I interactions whereas T2 engaged in I more than in IC interactions. This showed that T1 tended to reinitiate previous topics more than tutor 2. This may be because T1 had more participants than T2 and she had to invite each individual participant to respond by reinitiating the same topic.

A relatively large proportion of tutors' discourse was also dedicated to providing feedback. The prevalence of I, IC and F was expected given the tutors' role as facilitators who were responsible for directing and stimulating discussions and were expected to offer the social support and evaluation that constitute social and teaching presences in online environments. However, the marked difference in percentages of R by T1 and T2 suggested that G2 students asked more questions than G1 students. Both tutors engaged in RC interactions building on students' ideas with more or less the same rates. The results suggested that both tutors engaged in collaborative construction with their students contributing substantial information to discussions.

An analysis of the tools being used to engage in the different types of interactions was carried out. Results provided an idea about the quantity of participants' contributions in relation to which tools of communication they chose to use.

The analysis is multidimensional. In the following tables, the figures refer to the frequencies of the interactive roles performed using each different tool. Tables 4.4. and 4.5

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show the proportions representing the primary interactive role of turns (in terms of frequencies of interactive contributions) in relation to tutors' tool choice using each individual tool. For instance, the first figure shows that 77.61% of initiations where performed using the audio tool.

Results showed some similarities as well as differences between the rates of interactive roles performed by both tutors.

T1	A	C	WB	YN	A+C	A+WB
I	77.61	0	7.46	0	0	14.92
IC	82.79	6.45	0	0	0	10.75
R	46.66	40	0	0	13.33	0
RC	42.85	25	14.28	7.14	17.85	0
F	62.23	6.99	10.48	13.98	3.49	2.79

Table 4.4. Interactive roles of turns with relation to the multimodal choices of T1

T2	A	C	WB	YN	A+C	A+WB
I	83.33	0	0	0	7.69	8.97
IC	66.66	3.70	0	0	18.51	11.11
R	40	40	0	0	20	0
RC	14.28	28.57	21.42	45.71	0	0
F	62.16	5.40	12.16	13.51	6.75	0

Table 4.5. Interactive roles of turns with relation to the multimodal choices of T2

In the following tables (Table 4.6 and Table 4.7), the figures show the frequencies of use of each tool of communication dedicated to perform the different interactive roles. Tables then show the primary role of each individual tool to realize a particular interactive role. For instance, the first figure shows that 21.94% of the audio contributions were dedicated to initiate new exchanges.

T1	I	IC	R	RC	F
A	21.94	32.48	2.95	5.06	37.55
C	0	20.68	20.68	24.13	34.48
WB	20.83	0	0	16.66	62.5
YN	0	0	0	9.09	90.90
A+C	0	0	16.66	41.66	41.66
A+WB	41.66	41.66	0	0	16.66

Table 4.6. The primary interactive roles of the different tools of communication (T1)

T2	I	IC	R	RC	F
A	47.44	13.13	4.38	1.45	33.57
C	0	6.66	40	26.66	26.66
WB	0	0	0	35	75
YN	0	0	0	33.33	66.66
A+C	31.57	26.31	15.78	0	26.31
A+WB	70	30	0	0	0

Table 4.7. The primary interactive roles of the different tools of communication (T2)

4.2.3.1.1. Initiation

I start by stating the main differences in terms of multimodal choices of both tutors. Contrary to T2, T1 did not use the A+C cluster to launch new discussions. T2 did not use the whiteboard whilst T1 dedicated 20.83% of her whiteboard contributions to initiate new exchanges. However, neither tutor used the chat or the YN tools.

In terms of similarities, for initiations, both tutors mainly relied on the audio tool. Besides the use of the audio tool, results show that high frequencies of T1's WB (20.83%) and A+WB (41.66%) contributions were dedicated to engage in relatively low proportions of initiations (I-WB: 7.46%, I-A+WB: 14.92%).

Results indicate that WB tool, A+WB and A+C clusters were mainly used to start new discussions. Tutors introduced new topics orally, and at the same time summarized key points using the written mode relying on the chat and/or the whiteboard tools.

4.2.3.1.2. Initiation continuity

As explained in the methodology chapter, this interactive role reflects attempts towards extended exchanges in the sense of more attempts towards discussion and negotiation that may reach upper levels of meaning construction. The results reveal differences and some similarities in terms of tutors' multimodal tendencies. Table 4.6 and Table 4.7 show that neither tutors used the WB and the YN tools. Contrary to T1 who did not use the A+C cluster, a high proportion of T2's A+C contributions was dedicated to reinitiate previous topics. For high proportions of re-initiations, both tutors mainly relied on the audio tool. Table 4.4 and Table 4.5 show that low proportions of re-initiations were performed using the A+WB cluster by T1 and A+C and A+WC clusters by T2. Finally, table 4.4 and Table 4.5 show that both tutors used the chat tool to engage in low proportions of IC (T1: 6.45%, T2: 3.70%).

The results indicate then that multimodal clusters were more frequently used to initiate and reinitiate discussions. This indicates the importance tutors attributed to the simultaneous use of the oral and written modes to launch new discussions.

4.2.3.1.3. Response

Both tutors made the same multimodal choices when responding to their students' requests. Table 4.6 and Table 4.7 show that high proportions of tutors' responses were performed using the following tools in decreasing order: audio tool, the A+C cluster, and finally the chat tool. This indicated the importance of the simultaneous use of the chat and the audio tools when responding to students' requests. The use of A+C cluster indicated that tutors supported their oral responses using the written mode.

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4.2.3.1.4. Response continuity

Tutors made different multimodal choices to build on students' contributions but with significantly different preferences and frequencies of use. Table 4.4 and Table 4.5 show that the highest proportions of RC interactions were performed using the audio tool by T1 (42.85%) but the YN tool by T2 (45.71%). Secondly, a high proportion of T1's WB contributions (16.66%) and chat contributions (24%) were dedicated to building on students' ideas. T2 used the YN tool to support her students' ideas. Thirdly, more than 40% of T1's A+C contributions and a high proportion of T2's WB contributions (35%) was devoted to building on students' ideas. Contrary to T2, T1 used only low proportions of YN tool (9.09%) to this end. Surprisingly, T2 infrequently used the audio tool to this end (5.06%).

4.2.3.1.5. Feedback

Tutors made the same multimodal choices to evaluate students' contributions except for the use of the A+WB cluster by T1. Table 4.6 and Table 4.7 show that both tutors mostly relied on the audio tool then the YN tool to simply show agreement or disagreement with students' responses. Secondly, T2 used more than 80% of her WB contributions and T1 used more than 48.27% of her chat contributions to write comments on students' responses. Thirdly, more than 30% of T1's WB contributions, high proportions of T2's A+C contributions (26.31%) and chat contributions (26.66%) were used to provide feedback. Finally, T1 dedicated 41.66% of her A+C contributions to perform a very low rate of F interactions (6.75%).

4.2.3.1.6. Summary

To sum up, it is clear that different multimodal choices were made by tutors to perform their different interactive roles. As far as I, IC and F interactions are concerned, the audio was markedly favoured over the rest of the tools. This is not to undermine the importance of the remaining tools where the highest proportions of A+WB, A+C and WB were dedicated to engaging in I and IC interactions. In addition, the highest proportions of YN, chat and WB contributions were used to provide feedback. The results showed the important role WB played in launching and re-launching discussions. By posting pictures and summarizing the main points to be discussed on the whiteboard, tutors tended to focus their students' discussions.

A close examination of tutors' behaviours showed that the use of chat, WB, A+WB, A+C and YN outweighed the use of the audio tool when engaging in R and RC interactions. The total frequencies of R and RC interactions accounted for more than 60% of the use of the chat, WB, A+WB, A+C and YN, against 30% of R and RC contributions using the audio tool. Tutors then used the writing tools more than the audio tool to respond to and build on students' ideas. Tutors tended to withdraw from discussion to give students more opportunities to engage in collaborative discussions, while at the same providing them with guidance using the written mode. The examination of the negotiation functions used by tutors (section 4.3.1 below) would confirm or reject this conclusion.

The main conclusion is then the predominance of writing tools over audio tools to engage in R, RC and F contributions.

4.2.3.2. Students' interactive roles in online exchanges

I analyzed students' contributions to check the primary roles of their interactions and the tools they used to perform the different roles. Results showed some similarities as well as differences between the numbers of interactive roles performed by both groups of students. Tables 4.8 and 4.9 show the proportions representing the primary interactive role of turns (in terms of frequencies of interactive contributions) in relation to students' tool choice using each individual tool.

G1	A	C	WB	YN
I	100	0	0	0
IC	100	0	0	0
R	76.92	2.30	5.38	15.38
RC	68.70	16.03	6.10	9.16

Table 4.8. Interactive roles of turns with relation to the multimodal choices by G1

G2	A	C	WB	YN
I				
IC				
R	81.70	2.43	4.90	10.97
RC	75.18	6.01	9.77	9.02

Table 4.9. Interactive roles of turns with relation to the multimodal choices by G2

Tables 4.10 and 4.11 show the primary role of each individual tool to realize a particular interactive role. Analysis of each follows the Figures.

G1	I	IC	R	RC
A	1.02	1.53	51.28	46.15
C			12.5	87.5
WB			46.66	53.33
YN			62.5	37.5

Table 4.10. The primary interactive roles of the different tools of communication (G1)

G2	I	IC	R	RC
A	0	0	57.26	42.73
C			33.33	66.66
WB			38.09	61.90
YN			60	40

Table 4.11. The primary interactive roles of the different tools of communication (G2)

4.2.3.2.1. Initiation, Initiation continuity and Feedback

Table 4.8 and table 4.9 show that G2 students did not make any attempts to initiate or re-initiate discussions. However, G1 made a very few attempts to initiate and reinitiate discussions using the audio tool only. In addition, students did not make any attempts to provide feedback. This indicated that online interactions were managed, structured and controlled by tutors. However, R and RC were the most important roles performed by students with slightly different frequencies.

4.2.3.2.2. Response

Both groups used the four tools of communication to respond to their tutors, making the same multimodal choices to a certain extent. First, high proportions of R interactions (G1:76.92%, G2: 81.70%) were performed using high proportions of audio contributions (G1: 51.28%, G2: 57.26%), which was expected. Secondly, Table 4.10 and Table 4.11 show that both groups used more than 60% of their YN contributions and more than 30% of their WB contributions to respond. Finally, both groups used the chat tool. However, G1 used a low proportion (12.6%) compared to G2 who used more than 30% of their chat contributions to respond.

4.2.3.2.3. Response continuity

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Students used the different tools of communication but showed the same preference towards the use of the audio tool. Hence, the highest frequencies of RC interactions (G1: 68.70%, G2:75.18%) were performed using high proportions of audio contributions (G1: 46.15%, G2: 42.73%). In addition, the highest proportions of chat (G1: 87.5%, G2: 66.66%) and WB (G1: 53.33%, G2: 61.60%) contributions were used to build on each other's ideas (G1: 6.10%, G2: 6.77%). This indicated that students used the writing tools to build on each other's ideas more than simply contribute their individual ideas when responding to their tutors. Finally, high proportions of YN (G1: 37.5%, G2; 40%) contributions were dedicated to engaging in a small rate of RC interactions (G1: 9.16%, G2: 9.02). This indicated students' attempts towards negotiation and debate rather than simply showing quick agreement or disagreement.

4.2.3.2.4. Summary

Overall, the extent of engagement with each other's contributions was revealed by the extent of IC and RC interactions present in online discussion. Comparative group analysis showed active engagement in the collaborative process of meaning construction by both groups in terms of contributions of turns and overall tendencies to build on each other's contributions. Students used the audio tool. However, they showed more tendencies to use the writing tools to build on each other's ideas more than when responding to their tutors. The YN tool was mostly used when engaged in R interactions rather than RC interactions, which indicated more efforts towards negotiation and debate than simply expressing agreement or disagreement.

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A consideration of the relationship between the communicative and interactive aspects of turns in relation to the tools being used is needed for a better understanding of the possible impacts of participants' multimodal choices on their engagement in collaborative meaning construction. The next section (4.3.) therefore examines the negotiation functions performed by the different participants, so that we can assess the communicative aspect of online interactions.

4.3. Analysis of the negotiation functions of participants' turns

While the preceding analysis revealed interactional purposes of turns contributed based on five interactive categories, results of the analysis of negotiation functions underlying the turns are presented below. In the following analysis, turns previously coded as I, IC, R, RC, and F are further categorised according to the interpretation of their communicative functions. Analysis of turns as frequencies of communication functions adopted reveals the underlying negotiation functions and strategies of participants, which form the basis for a close examination of the meaning construction development phases during the collaborative group learning process. Negotiation functions reflect the rhetorical tactics used by participants to achieve certain communicative purposes.

Hence, this section presents the analysis of meaning construction phases at the finer level of communication functions of interactions for a more informative interpretation of the observed engagement patterns.

4.3.1. Negotiation function of tutors' turns

The following table shows the frequencies of use of the different negotiation functions by both tutors.

	Negotiation functions	T1	T2
Level 1 (Ph1)	Information request (IFR)	6.09	12.01
	Inform (IF)	23.41	28.36
	Acceptance (AC)	8.67	12.98
	Corroboration (CO)	0	0
	Comprehension check (CC)	2.31	3.36
Level Two (Ph2)	Explanation request (EXR)	2.31	0
	Explanation (Ex)	7.80	9.61
	Disagreement (DS)	1.73	2.40
	Rapid Agreement (RA)	0	0
Level 3 Ph3	Exploratory requests (EXPR)	17.91	12.98
	Clarification (CL)	14.73	8.65
	Arguments (AG)	3.46	1.44
	Rejection (RJ)	0.28	0
	Assertion (AS)	5.20	1.92
	Challenge/counter-argumentation (CH)	0.57	4.80
	Justification (JU)	0	0.48
	Concession (CS)	1.44	0
	Consensus (CSS)	0.57	0
Level 4 (Ph4+Ph5)	Reflective requests (RFR)	0.28	0
	Testing (TS)	0	0
	Summary (SM)	0	0
	Meta-cognitive requests (MCSR)	0	0
	Meta-cognitive statements (MCS)	0	0
	Application requests (APR)	3.75	2.40
	Application (AP)	0	0

4.12. Negotiation functions by T1 and T2

The table shows that both tutors performed the different negotiation functions with different frequencies. Results show some differences and similarities. First, concerning the first level, results show slight differences between tutors. The highest frequency of performance goes to the low negotiation function inform which is expected as tutors were supposed to provide students with new information. T2 performed more information requests than T1 which implies that she spent more time inviting students to exchange information and

share opinions than T1. Neither tutor corroborated their students' responses which may imply that they tended to engage them in more elaborate negotiation functions than simple corroborations. In addition, both tutors performed low frequencies of comprehension checks. Again, this may imply that tutors were more concerned with engaging students in more constructive discussions than simply checking comprehension.

Second, concerning the second level, tutors performed high rates of explanations which is expected as this is one of the most important roles of tutors which is providing and explaining new information and issues. However, tutors performed low rates of the different negotiation functions which may imply that tutors did not tend to point at issues and dissonances rather engaging students in constructive discussion for the critical examination of their ideas and understandings.

As far as the third level is concerned, results show that both tutors performed the different elaborate negotiation functions. The frequency of exploratory requests is very high which indicates tutors' efforts towards engaging students in the process of negotiation for the critical discussion of their ideas. Results show that T1 was more engaged in clarifying, asserting, and providing arguments to defend his ideas and reject critically his students' ideas. However, T2 was more implicated in challenging his students. In addition, T1 was even more implicated in the process of negotiation and argumentation where she could help her students reach concessions and construct consensus.

Finally, concerning the fourth level of meaning construction, only T1 invited her students to reflect on their learning process. This indicates again that T1 was more implicated in the negotiation and argumentation process than T2. Results show that both tutors invited their students to apply new knowledge. However, neither tutor performed meta-cognitive requests. In addition, results show that tutors did not perform important highly elaborate

negotiation functions like summary, meta-cognitive statements, and application. This indicates that these elaborate negotiation functions were more to be performed by students than tutors.

Hence, in the following sections, each level of negotiation functions is analyzed. This analysis is also multidimensional. The different tables from Table 4.13 to Table 4.18 show the proportions of the different negotiation functions performed, with their associated interactive roles adopted by tutors, together with their multimodal choices. This analysis helps towards understanding the affordances of use of the different tools in enhancing or hindering online communication.

For matters of convenience and for better representation of the different results of the analysis of the interactive and negotiation functions of tutors with relation to their multimodal choices, negotiation functions that were not performed by tutors were not displayed in the following tables. In addition, tables display the tools used to perform the different interactive and negotiation functions. This is to say that tools that were not used to perform a particular interactive and negotiation function are not displayed. For instance, Table 4.13 shows that T1 used the W+B and the audio tool to invite students to provide information. Table 4.13 did not display the other tools for this negotiation function because T1 did not use them to perform this negotiation function.

4.3.1.1. Low level negotiation functions

Tables 4.13 and 4.14 show the frequencies of negotiation functions in interactive roles in relation to tutors' tool choice using each individual tool.

T1	I (67)		IC (93)			R (15)		RC (28)	F (143)			
	A+WB	A	A+WB	A	C	A	C	YN	A	C	WB	YN
IFR		47.61		42.85		9.52						
If	6.17	18.51	6.17	12.34	2.46	2.46	2.46		49.38			
AC								6.66		3.33	23.33	66.66
CO												
CC		50		50								

Table 4.13. Low negotiation functions by T1

T2	I (78)			IC (27)			R (15)	RC (14)		F (74)		
	A+WB	A+C	A	A+WB	A+C	A	A	A	YN	A+C	A	YN
IFR			80			20						
IF	8.47	3.38	16.94	1.69	5.08	11.86	3.38	0		8.47	37.28	
AC								7.40	18.51		3.70	3.70
CO												
CC			100									

Table 4.14. Low negotiation functions by T2

Tables 4.15 and 4.16 show the frequencies of each interactive role in each of the performed low level negotiation functions in relation to tutors' tool choice.

T1	IFR	IF			AC			CC
	A	A+WB	A	C	C	WB	YN	A
I	14.92	7.46	22.38					5.97
IC	9.67	5.37	10.75	2.15				4.30
R	13.33		13.33	6.66				
RC							7.14	
F			27.97		0.69	4.89	13.98	

Table 4.15. Interactive roles of turns with relation to the negotiation functions and multimodal choices by T1

T2	IFR	IF			AC		CC
	A	A+WB	A+C	A	A	YN	A
I	25.64	6.41	2.56	12.82			8.97
IC	18.51	3.70	11.11	25.92			
R				13.33			
RC					14.28	35.71	
F			6.75	29.72	13.51	13.51	

Table 4.16. Interactive roles of turns with relation to the negotiation functions and multimodal choices by T2

Tables 4.17 and 4.18 show the frequencies of use of each communication tool in the proportions of low level negotiation functions in relation to tutors' different interactive roles.

T1	IFR			IF				AC		CC	
	I	IC	R	I	IC	R	F	RC	F	I	IC
A	4.2	3.79	0.84	6.32	4.21	0.84	1.68			1.68	1.68
C					6.89	3.44			3.44		
WB									29.1		
YN								9.09	90.9		
A+WB											
A+C											

Table 4.17. Primary low negotiation functions of the different tools by T1

T2	IFR		IF				AC		CC
	I	IC	I	IC	R	F	RC	F	I
A	14.49	3.62	0.72	5.07	1.44	15.94	1.44	7.24	5.07
C									
WB									
YN							33.33	66.66	
A+WB			50	10					
A+C			10.52	15.78		26.31			

Table 4.18. Primary low negotiation functions of the different tools by T2

4.3.1.1.1. Information request

The frequency of performance of this negotiation function was low (See Table 4.12). Table 4.13 and Table 4.14 show that the highest proportions of T1 information requests were performed when initiating (47.61%) and reinitiating (42.85%) using the audio tool. A small proportion of information requests performed by T1 (9.52%) was produced when responding to students' requests using the audio tool too.

Table 4.12 shows that T2 performed a higher proportion of information requests than T1. The highest proportion of information requests was performed when initiating using the audio tool (80%). A low proportion of information requests was performed when reinitiating using the audio tool too (20%).

Hence, both tutors used the audio tool to perform this low negotiation function. Results revealed that T2 spent more time requesting information than T1. The low proportions of tutors' contributions are quite surprising since tutors were expected to invite students to provide information and share their opinions. Furthermore, they produced a low proportion of this negotiation function when reinitiating, which indicated that tutors spent more time inviting students to negotiate and debate each other's ideas than simply inviting them to share information. The analysis of exchanges would show whether this kind of re-initiation had a positive or a negative impact on the progression of discussions.

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4.3.1.1.2. Information provision

Table 4.12 show that both tutors provided high proportions of information when providing feedback and commenting their students' contributions. T1 used the audio tools and T2 used the audio tools and a high proportion of A+C contributions.

Secondly, T1 provided information while initiating using mainly the audio tool and the whiteboard tool. T2 provided less information while initiating than T1, making different multimodal choices. Table 4.18 shows that T2 used the audio tool, more than 50% of A+WB contributions as well as a low proportion of A+C contributions (10.52%).

Table 4.15 and Table 4.16 show that T2 reinitiated to provide information more than T1 making different modal choices. T1 used mainly the A+B cluster, the chat tool and finally the audio tool. T2 used the audio tools but only low proportions of A+C (15.78%) and A+WB clusters (10%).

Finally, T1 provided a low proportion of information while responding to students using the audio and the chat tools.

Results showed that tutors provided low proportions of information switching between the written and the oral modes of communication when. They used the chat and the WB tools simultaneously with the audio tool to draw and focus their students' attention on target information.

4.3.1.1.3. Acceptance

Table 4.13 and Table 4.14 show that tutors produced low proportions of this low negotiation function when providing feedback on students' contributions. Both tutors relied mainly on the YN tool. Results showed that the YN tool is mainly used to accept students'

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answers. Besides the use of the audio tool, T1 used the WB and the chat tools. Contrary to T1, T2 used the audio tool.

Finally, T1 accepted students' responses when engaged in RC interactions using a low proportion of YN contributions.

In general, this low negotiation skill served to provide quick feedback using the YN tool in the first place for both tutors. The use of the YN tool was predictable since tutors did not have to comment on all their students' answers. T1 did not use the oral mode, switching to the written mode, which is quite surprising.

4.3.1.1.4. Corroboration

Neither tutor performed this low level negotiation skill.

4.3.1.1.5. Comprehension check

Table 4.12 shows that both tutors produced low proportions of this low negotiation skill. Both tutors used the audio tool while initiating and building on students' answers, which was expected. Tutors did not need to use the written modes to check their students' understanding.

4.3.1.2. Moderate negotiation functions

Table 4.19 and Table 4.20 show the proportions of moderate negotiation functions (in percentages) in interactive roles in relation to tutors' tool choice using each individual tool.

T1	I	IC	R	RC	F
	A	A			A
EXR	25	75			
EX	7.40	11.11			81.48
DS					100
RA					

Table 4.19. Moderate negotiation functions by T1

T2	I		IC		R	RC	F
	A+C	A	A+WB	A+C	A		A
EXR							
EX	10	15	10	10	5		50
DS							100
RA							

Table 4.20. Moderate negotiation functions by T2

Table 4.21 and Table 4.22 show the proportions (in percentages) of each interactive role in each of the performed moderate negotiation functions in relation to tutors' tool choice.

T1	EXR	EX	DS	RA
	A	A	A	A
I 67	2.98	2.98		
IC 93	6.45	3.22		
R 15				
RC 28				
F 143		15.38	4.19	

Table 4.21. Interactive roles of turns with relation to moderate negotiation functions and multimodal choices by T1

T2	EXR	EX			DS	RA
		A+WB	A+C	A	A	
I			2.56	3.84		
IC		7.40	7.40			
R				6.66		
RC						
F				13.51	3.51	

Table 4.22. Interactive roles of turns with relation to moderate negotiation functions and multimodal choices by T2

Table 4.23 and Table 4.24 show the frequencies of use of each communication tool to perform the different moderate negotiation functions and in relation to tutors' different interactive roles.

T1	EXR	EX	DS	RA		
	I	IC	I	IC	F	F
A	0.84	2.53	0.84	1.26	9.28	2.53
C						
WB						
YN						
A+WB						
A+C						

Table 4.23. Primary moderate negotiation functions of the different tools by T1

T2	EXR	EX				DS	RA
		I	IC	R	F	F	
A		2.17		0.72	7.24	3.62	
C							
WB							
YN							
A+WB			20				
A+C		10.52	10.52				

Table 4.24. Primary moderate negotiation functions of the different tools by T2

4.3.1.2.1. Explanation request

Table 4.12 show that the frequencies of performance of this moderate negotiation function were low for both tutors. To invite students to explain their views, both tutors used the audio tool when initiating. T1 invited students to explain their views when engaged in I more than when engaged in IC interactions. The low frequencies of explanation requests showed that tutors avoided pointing at dissonances. They avoided inviting students to express their disagreement, suggest alternative ideas or new directions for discussion right at the beginning of new discussions. This indicated that tutors were not willing to disrupt the progression of discussions right from the beginning.

4.3.1.2.2. Explanation

Table 4.12 shows that both tutors performed low frequencies of this moderate negotiation function. Tutors provided the highest proportion of explanations when providing feedback (T1: 81.48%, T2: 50%). Both tutors relied on the audio tool. In addition, T1 explained issues when initiating and reinitiating discussions using the audio tool. T2 initiated to explain issues using the audio tool. She re-initiated using some of her A+WB (20%) and A+C contributions (10.52%).

T1 did not use the writing mode, contrary to T2 who switched between the written and the oral modes of communication to explain issues.

4.3.1.2.3. Disagreement

Both tutors produced low proportions of disagreements while evaluating students' answers (T1: 4.19%, T2: 3.51), using the audio tool only. Results then show that both tutors avoided disagreeing with their students.

4.3.1.2.4. Rapid agreement

Tutors did not engage in rapid agreements with students which suggested their attempts to involve students in the process of negotiation and argumentation.

4.3.1.3. Elaborate negotiation functions

The results of the different Tables (see Table 4.25 to Table 4.30 substantiated earlier findings that T1 was more involved in her group's discussions, compared to T2, by reinitiating and inviting students to build on each other's ideas by contributing elaborate negotiation functions.

Tables 4.25 to 4.26 show the proportions of negotiation functions in interactive roles in relation to tutors' tool choice using each individual tool. Tables 4.27 and 4.28 show the proportions of each interactive role in each of the performed elaborate negotiation functions in relation to tutors' tool choice. Tables 4.29 and 4.30 show the proportions of use of each communication tool to perform elaborate negotiation functions in relation to tutors' different interactive roles.

	A+WB	A	A+WB	A	C	A+C	A	C	A+C	A	C	WB	A+WB	A+C	A	C	WB
EPR	3.22	16.12	4.83	62.90							1.61						
CL	3.92		1.96		7.84		3.92	3.92		3.92	3.92		7.84	7.84	41.1		13.7
AG	8.33		8.33			8.33	8.33			25				16.6		25	
RJ										100							
AS								16.6	22.22		22.2	22.2				16.6	
CH										100							
JS																	
CS										40						60	
CSS										50							50

Table 4.25. Elaborate negotiation functions by T1

T2	I (78)			IC (27)		R (15)			RC			F	
	A+WB	A+C	A	A	C	A+C	A	C	A	C	WB	C	WB
EPR			74.07	18.51	3.70			33.33					
CL	11.11	11.11		5.55		16.66	5.55	22.22	0	0	5.55	22.22	
AG								33.33		66.66			
RJ													
AS							50				50		
CH										10			90
JS										100			
CS													
CSS													

Table 4.26. Elaborate negotiation functions by T2

T1	CL					AG				RJ	ASS			CH	CS		CSS	
	A+WB	A+C	A	C	WB	A+WB	A+C	A	C	A	A+C	C	WB	A	A	C	A	WB
I	2.98					1.49												
IC	1.07			4.3		1.07												
R			13.3	13.33			6.66	6.66				20						
RC			7.14	7.14				10.71		3.57	14.28	14.28	14.28	7.14	7.14		3.57	
F	2.79	2.79	14.7		4.89		1.39		2.09			2.09				2.09		0.69

Table 4.27. Interactive roles of turns with relation to elaborate negotiation functions and multimodal choices by T1

T2	CL					AG	ASS		CH		JU	CS	CSS
	A+WB	A+C	A	C	WB	C	A	WB	C	WB	C		
I	2.56	2.56											
IC			3.70										
R		20	6.66	26.66		6.66	13.33						
RC					7.14	14.28		14.28	7.14		7.14		
F				5.40						12.16			

Table 4.28. Interactive roles of turns with relation to elaborate negotiation functions and multimodal choices by T2

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T1	EPXR		CL					AG					RJ	ASS			CH	CS		CSS	
	I	IC	I	IC	R	RC	F	I	IC	R	RC	F	RC	R	RC	F	RC	RC	F	RC	F
A	7.59	16.45			0.84	0.84	8.86		0.42	1.26			0.42				0.84	0.84		0.42	
C				13.79	6.89	6.89						10.34		10.34	13.79	10.34			10.34		
WB							29.16								16.66						4.16
YN							18.18														
A+WB	8.33	12.5	8.33	4.16			16.66	4.16	4.16												
A+C								8.33				16.66			33.33						

Table 4.29. Primary elaborate negotiation functions of the different tools by T1

T2	EPR			CL					AG		ASS		CH		JU
	I	IC	R	I	IC	R	RC	F	R	RC	R	RC	RC	F	RC
A	14.49	3.62			0.72	0.72					1.44				
C		6.66				26.66		26.66	6.66	13.33			6.66		6.66
WB							8.33					16.66		75	
YN															
A+WB				20											
A+C				10.52		15.78									

Table 4.30. Primary elaborate negotiation functions of the different tools by T2

4.3.1.3.1. Exploratory request

This is one of the most important negotiation functions tutors performed. Exploratory requests interpret tutors' attempts to involve students in the process of meaning construction by clarifying, arguing, defending and challenging each other's ideas.

Results show that T1 produced far more exploratory requests than T2, which indicated that T1 made more attempts than T2 to engage students in the collaborative process of meaning construction. Furthermore, tutors made different multimodal choices.

Both tutors made exploratory requests when initiating and reinitiating previous topics. However, T1 more frequently made exploratory requests when reinitiating than when initiating. She relied mainly on the audio tool, and used more than 20% of her A+WB contributions to invite students to negotiate and debate ideas. She wrote questions on the whiteboard at the same time as explaining them using the audio tool.

Contrary to T1, Table 4.26 shows that T2 invited students to negotiate and debate ideas when initiating more than when reinitiating. Table 4.30 shows that T2 relied mostly on the audio tool and dedicated a low proportion of her chat contributions (6.66%) to making exploratory requests.

Tutors re-initiated previous discussions, invited students to respond to exploratory questions, asking them to clarify, argue and challenge each other's ideas to reach a consensus at the end of the discussion. This reveals tutors' attempts to engage students in constructive discussion. In addition, the high frequency of T1's exploratory requests and low frequency of her information requests indicated that T1 reinitiated previous discussions as an attempt to involve students in the process of negotiation and debate more than simple exchange of views. Furthermore, both tutors used mainly the oral mode but they also used the written mode using the WB and the chat tools. Results indicated then that the written mode was used to support

the oral mode when performing elaborate negotiation functions. Tutors used the written mode

to draw their students' attention and make them focus on the questions while explaining them

using the oral mode. I conclude that the whiteboard and the chat tools were used to support

students' memory and perception, hence they served as a cognitive support.

4.3.1.3.2. Clarification

This was one of the most important negotiation functions. It reflected tutors' attempts

to move online discussions up to high phases of meaning construction. Table 4.25 and Table

4.26 show that both tutors clarified issues when initiating and reinitiating discussions,

responding to their students, and evaluating their students' responses.

T2 produced far more clarifications than T1. First, the highest proportions of T1's

clarifications were performed when evaluating students' contributions using the audio tool

(41.10%), the WB tools (13.7%), the A+WB (7.84%) and the A+C (7.84%) clusters. However,

Table 4.26 shows that T2 clarified more when responding and building on students'

contributions. She used more than 18% of her A+C contributions and more than 20% of her

chat contributions as well as a low rate of her audio contributions (5.55%) to respond to her

students' requests. In addition, to engage in RC interactions, she used a low proportion of

audio contributions. Interestingly, Table 4.30 shows that T2 used 26.66% of her chat

contributions to perform more than 28% of clarifications (See Table 4.28).

Secondly, Table 4.29 shows that T1 used a low proportion of her chat contributions

when responding (6.89%) and a low proportion of her audio (0.84%) and chat contributions

when engaged in RC interactions (6.89%) clarifying the points raised during discussions.

Table 4.27 and Table 4.28 show that T2 produced more clarifications when engaged in R and

RC interactions than T1. However, Table 4.26 show that the second highest proportion of T2's

clarifications was performed when initiating and reinitiating. She used high proportions of her A+WB (11.11%) and A+C (11.11%) contributions to clarify right at the beginning when initiating discussions. She used a low proportion of the audio contributions (0.72%) to perform a low proportion of clarifications (5.55%) that account for a low proportion of IC interactions too (3.70%).

Finally, T1 infrequently used clarifications to launch and relaunch discussions. She used a low proportion of her A+WB (8.33%) when initiating and a low proportion of her chat (13.97%) and A+WB (4.16%) contributions when re-initiating. The low frequencies of clarifications associated to low frequencies of I (2.89%) and IC (5.37%) interactions were expected since discussions were not supposed to reach such an advanced level of construction right from the beginning (See Table 4.25 and Table 4.27).

Finally, T2 used a high proportion of her chat contributions (26.66%) to clarify her students' contributions while evaluating them. Both tutors used the writing tools to spell out their students' contributions while evaluating them by clarifying them.

Clarification is a very important communicative function which showed that tutors were engaged in extended and constructive discussions with students. The multimodal choices made by tutors are interesting. Tutors used the written mode using the chat and the WB tools to support their oral clarifications. Tutors seemed to be aware of the pedagogical importance of this negotiation function and the affordances offered by the use of the writing tools along with the audio tool. They used the writing tools to extend discussions by clarifying issues and misunderstandings, providing students with written clarifications to illustrate, support and guide their discussions. Hence, the same conclusion was reached that the written mode was used as a support mode when participants used elaborate negotiation functions.

4.3.1.3.3. Argument

Tutors were involved in the process of negotiation with students arguing and defending their ideas and views. This indicates that tutors were actively engaged in the process of negotiation, building on their students' contributions.

Tutors made different multimodal choices. The highest proportions of T1's arguments (41.6%) were performed when evaluating students' contributions, using more 10.34% of her chat contributions and a low proportion of her audio contributions (1.68%). T2 did provide arguments while evaluating her students' answers. Table 4.12 shows that both tutors produced high rates of arguments when responding (T1: 13.32%, T2: 6.66%) and even higher proportions when building on students' answers (T1: 10.71%, T2: 14.28). T1 used low proportions of her audio contributions (0.42%) and 8.83% of her A+C contributions when responding (See Table 4.29). T2 responded providing arguments using a low proportion of her chat contributions (6.66%) when responding and a higher proportion (13.33%) when engaged in RC interactions to clarify students' contributions.

In sum, the highest proportions of tutors' arguments were produced when engaged in RC interactions building on students' contributions. Both tutors switched to the written mode using the WB and chat tools to withdraw from oral participation to give students the opportunity to interact with each other by building on each other's ideas. The use of the written mode instead of oral mode was explained as an attempt to motivate, direct and scaffold students' discussions. We reached the same conclusion that the written mode comes to support and assert what was being shared, explained, clarified, argued and counter-argued orally. This indicated that there was a strong interplay between the oral and the written modes of communication.

4.3.1.3.4. Rejection

The frequency of performance of this negotiation function by T1 was low (See Table 4.12). T2 did not perform this elaborate negotiation function. T1 used the audio tool to reject her students' ideas and justify her rejections. However, the low proportions of T1's rejections accounted for low proportions of RC interactions (3.57%).

4.3.1.3.5. Assertion

Assertion was one of the most important communicative roles performed by the tutors. When asserting their ideas, they defended their ideas when rejected by students and vice versa. The high proportions of assertions associated with R (T1:16.60%, T2: 50%) and RC (T1: 66.66%, T2: 50%) interactive roles showed that tutors were actively involved in the process of negotiation with their students using the different tools (See Table 4.12). Besides, T1 asserted her contributions when providing feedback too using the chat tool. The highest proportion of T1's assertions was performed when building on their students' ideas using high proportions of her chat (13.79%) and A+WB (33.33%) contributions. T2 used 16.66% of her WB contributions to assert her contributions when engaged in RC interactions.

Results refute the conclusion reached in section 4.3.1.3.3 where both tutors switched to using the written mode (using chat and WB tools) when engaged in the process of negotiation building on their students' ideas. It was expected for tutors to use the whiteboard to assert their views and ideas as attempts to guide, support and scaffold students' discussions.

4.3.1.3.6. Challenge

Both tutors were engaged in the process of argumentation challenging and counter-arguing their students' ideas. This indicated that tutors actively engaged in constructive

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discussions building on their students' contributions. More than 10% of T1's RC interactions were meant to challenge students' ideas using the audio tool. The high frequency proportion of this elaborate negotiation function indicated that T1's RC interactions were dedicated to engage in the argumentation process. On the other hand, T2 made different multimodal choices using a low proportion of her chat contributions to build on students' contributions. In addition, she used more than 80% of her WB contributions to perform 90% of challenges when evaluating students' contributions. The use of the WB tool to challenge students' ideas while evaluating their contributions was quite surprising. The analysis of extracts would highlight this point.

4.3.1.3.7. Justification

T1 did not perform this elaborate negotiation function. However, T2 performed a low proportion of justifications that account for a low proportion of RC (7.14%) interactions using a low proportion of chat contributions (6.66%). Results refute the same conclusion reached in section 4.3.1.3.5 and section 4.3.1.3.3 where focus is on the importance of using writing tools to engage in RC interactions. In addition, the low frequency of justifications indicates that tutors preferred to avoid imposing their views by avoiding justifications.

4.3.1.3.8. Concession (negotiated agreement)

T2 did not perform this elaborate negotiation function. However, T1 was more engaged in the process of negotiation and argumentation with her students. First, T1 conceded and accepted students' challenges using the chat tool (10.34%) when evaluating her students' contributions (2.09%). Secondly, she used a low proportion of audio contributions (0.48%) to

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perform a high proportion of this negotiation function (40%) when engaged in less than 7% of her RC interactions. Results then showed that the highest proportion were performed using the written mode which confirms earlier results about the cognitive support which the use of the writing tools offers.

4.3.1.3.9. Consensus building

Unlike T2, T1 did perform this elaborate negotiation function. She was more involved than T2 in constructive discussions, which was illustrated by the high proportions of re-initiations and RC interactions. T1 supported her students' discussions and helped them reach a negotiated agreement and consensus. She used a low proportion of her audio contributions (0.42%) to perform this elaborate negotiation function when building on her students' contributions (3.57%). In addition, 50% of this negotiation function were performed using the WB tool (4.16%) to evaluate the students' contributions (0.69%). Thus, T1 used the written mode using the WB tool to debate ideas and write up the consensus they reached to scaffold students' efforts to create a new agreed upon meaning. Writing the agreed upon negotiated meaning helps to focus students' attention and perception, hence providing them with a cognitive support.

4.3.1.4. Highly elaborate negotiation functions

Figures from Tables 4.31 to Tables 4.36 show the proportions of the highly elaborate negotiation functions (in numbers) in interactive roles in relation to tutors' tool choice using each individual tool.

T1	I 68		IC 93		R	RC	F
	A	WB	A	C	A+C		
RFR					100		
APR	15.38	38.46	46.15				

Table 4.31. Highly elaborate negotiation functions by T1

T2	I	IC	R	RC	F
	A				
RFR					
APR	5				

Table 4.32. Highly elaborate negotiation functions by T2

Tables 4.31 and 4.32 show the proportions of each interactive role in each of the performed highly elaborate negotiation functions in relation to tutors' tool choice.

T1	RFR	APR		
	A+C	A	C	WB
I		2.98		7.46
IC		6.45		
R	6.66			
RC				
F				

Table 4.33. Interactive roles of turns with relation to highly elaborate negotiation functions and multimodal choices by T1

T2	RFR	APR
		A
I		6.41
IC		
R		
RC		
F		

Table 4.34. Interactive roles of turns with relation to highly elaborate negotiation functions and multimodal choices by T2

Tables 4.33 and 4.34 show the proportions of use of each communication tool in the proportions of the highly elaborate negotiation functions in relation to tutors' different interactive roles.

T1	RFR	APR	
	R	I	IC
A		0.84	2.53
C			
WB		20.83	
YN			
A+WB			
A+C	8.33		

Table 4.35. Primary highly elaborate negotiation functions of the different tools by T1

T2	RFR	APR
		I
A		3.62
C		
WB		
YN		
A+WB		
A+C		

Table 4.36. Primary highly elaborate negotiation functions of the different tools by T2

4.3.1.4.1. Reflective requests

T1 was more involved than T2, who did not invite her students to reflect on their online contributions and engagement in the collaborative meaning contribution. The frequency of reflective requests is very low though. When engaged in R interactions (6.66%), T1 used 8.33% of her A+C contributions to reflect on their newly constructed knowledge or learning experience in general. T1 used the written and oral modes to perform this elaborate negotiation function which confirms the importance of the simultaneous use of the written and

the oral modes to support students' discussions and provide them with the cognitive support they need to collaboratively construct new understandings and meaning.

4.3.1.4.2. Application requests

Both tutors invited their students to apply newly constructed knowledge. This is a highly elaborate negotiation function. Both tutors performed high proportions of application requests when initiating and reinitiating discussions. One of the most important reasons for launching IC interactions was to invite students to apply new knowledge.

Table 4.12 show that T1 produced more application requests than T2. The highest proportions of T1's application requests (46.15 %) account for a low proportion of IC interactions (6.45%) using a low proportion of her audio contributions (2.53%). On the other hand, T1 initiated inviting her students to apply new knowledge using a high proportion of her WB contributions (20.83%) and a low proportion of her audio contributions (0.84%). She used the audio tool to perform more than 24% of this negotiation function when reinitiating. T2 used the audio tool (3.62%) to invite students to apply new meanings (5%) when initiating new discussions (6.41%).

4.3.1.5. Summary

Generally speaking, results showed that tutors performed the different interactive roles using the different negotiation functions making different multimodal choices.

To perform low negotiation skills, both tutors used the audio tool particularly when engaging in I and F interactions. However, they mainly used the audio along with writing tools (the chat and the WB tools) to perform elaborate negotiation functions particularly when

engaged in IC and RC interactions. Results showed that high proportions of elaborate negotiation functions were performed when reinitiating and when engaged in RC interactions building on students' contributions switching between the oral and the written modes of communication. Moreover, writing tools were more used than the audio tool when performing elaborate negotiation functions: reinitiating previous topics and building on students' contributions. Finally, tutors provided feedback and engaged in R interactions making different multimodal choices depending on the associated negotiation functions. For simple acceptance of students' contributions, they used the YN tool. To provide more comments explaining, clarifying, arguing or even challenging their contributions, tutors used the A+C and the A+WB clusters or writing tools switching between the oral and the written modes of communication.

The main conclusion was thus that tutors assign different interactive and communicative functions to the different tools of communication. The simultaneous use of the audio and the writing tools offered a cognitive support to sustain students' constructive discussions. The yes and no tool and the audio tool, when used individually, served to engage in initiations, responses or F interactions to perform low or moderate negotiation functions.

This was better exemplified by the analysis of patterns of online multimodal exchanges and the analysis of some extracts.

4.3.2. Negotiation functions of students' turns

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	Negotiation functions	G1	G2
Level 1 (Ph1)	Information request (IFR)	1.87	
	Inform (IF)	7.89	20.20
	Acceptance (AC)	2.40	10.43
	Corroboration (CO)	1.20	5.05
	Comprehension check (CC)	0.60	0.67
Level Two (Ph2)	Explanation request (EXR)	1.80	0
	Explanation (Ex)	5.42	2.69
	Disagreement (DS)	12.04	3.03
	Rapid Agreement (RA)	0	0.67
Level 3 Ph3	Exploratory requests (EXPR)	3.61	1.68
	Clarification (CL)	8.43	7.40
	Arguments (AG)	34.33	23.23
	Rejection (RJ)	6.62	3.03
	Assertion (AS)	14.45	6.06
	Challenge/counter-argumentation (CII)	6.02	3.03
	Justification (JU)	2.40	2.35
	Concession (CS)	3.61	1.68
	Consensus (CSS)	3.01	1.68
Level 4 (Ph4+Ph5)	Reflective requests (RFR)	0	0
	Testing (TS)	0	0
	Summary (SM)	3.01	0
	Meta-cognitive requests (MCSR)	0	0
	Meta-cognitive statements (MCS)	2.40	0
	Application requests (APR)	0	0
	Application (AP)	15.66	7.07

Table 4.37. Negotiation Functions by G1 and G2

The results are very interesting. Both groups performed the different negotiation functions with different frequencies. First, concerning the first level of meaning construction, result show that G2 performed more low negotiation functions than G1. This indicates that G2 students spent more time exchanging and corroborating each others' ideas and views than G1. Second, concerning the second level of construction, G1 students engaged more than G2 students in pointing at issues and expressing their disagreements. However, G2 students reached rapid agreement while G1 students did not. This indicates that G1 students raised issues and expressed their disagreements aiming at critical negotiation and discussion rather than reaching rapid and shallow agreement. Third, concerning the third level of negotiation

functions, both groups performed the different elaborate negotiation functions with different frequencies; which implies that both groups engaged actively in the process of negotiation and argumentation. Results show that both groups clarified, asserted, justified and provided arguments to defend their ideas and views. In addition, both groups engaged in the argumentation process by rejecting and challenging each others views. Furthermore, both groups could reach concession and construct consensus. However, G1's students performed more elaborate negotiation functions than G2's students, which indicate that G1's students were more actively engaged in the collaborative process of meaning construction. Finally, the results of the analysis of the fourth level of negotiation functions confirms that G1 students are more involved in the process of meaning construction than G2 students.

Only G1's students could make reflective statements to reflect on their learning and thinking process. In addition, G1's students applied new knowledge more than G2's students.

Now, I proceed to the analysis of each level of negotiation functions with relation to the multimodal choices made by students.

The analysis of students' contributions is also multidimensional. The different Tables (Table 4.38 to Table 4.43) show the proportions of the different negotiation functions performed, with their associated interactive roles adopted by tutors, together with their multimodal choices.

4.3.2.1. Low level negotiation functions

Table 4.38 and Table 4.39 show the proportions of low level negotiation functions in interactive roles in relation to students' tool choice using each individual tool.

G1	I	IC	R				RC			
	A	A	A	C	WB	YN	A	C	WB	YN
IFR	40	40						10		
IF			76.19				23.80			
AC			12.12	6.06		45.45	9.09			27.27
CO				50				50		
CC			100							

Table 4.38. Low negotiation functions by G1

G2	R				RC			
	A	C	WB	YN	A	C	WB	YN
IFR								
IF	80			·	20			
AC	9.67			45.16	12.90			32.25
CO	100							
CC								

Table 4.39. Low negotiation functions by G2

Table 4.40 and Table 4.41 show the proportions of each interactive role in each of the performed elaborate negotiation functions in relation to students' tool choice.

G1	IFR		IF	AC			CO	CC
	A	C	A	A	C	YN	C	A
I	100							
IC	66.66							
R		0.76	12.30	3.07	1.53	11.53	0.76	0.76
RC		0.76	3.81	2.29		6.87	0.76	

Table 4.40. Interactive roles of turns with relation to low negotiation functions and multimodal choices by G1

G2	IFR	IF	AC		CO	CC
		A	A	YN	A	A
R			29.26	1.82	8.53	9.14	
RC			9.02	3.007	7.51		

Table 4.41. Interactive roles of turns with relation to low negotiation functions and multimodal choices by G2

Table 4.42 and Table 4.43 show the proportions of use of each communication tool in the proportions of elaborate negotiation functions in relation to students' different interactive roles.

G1	IFR			IF		AC		CO		CC
	I	IC	RC	R	RC	R	RC	R	RC	R
A	1.02	1.02		8.20	2.56	2.05	1.53			0.51
C			4.16			8.33		4.16	4.16	
WB										
YN						46.87	28.12			

Table 4.42. Primary low negotiation functions of the different tools by G1

G2	IFR	IF		AC		CO	CC
		R	RC	R	RC	R	R
A		20.51	5.12	1.28	1.70	6.41	
C							
WB							
YN				46.66	33.33		

Table 4.43. Primary low negotiation functions of the different tools by G2

4.3.2.1.1. Information request

G2 did not make any attempts to request information. G1 made few attempts while initiating, reinitiating and building on each other's ideas (See Table 4.38 and Table 3.40). They used the audio tool to ask for information when initiating and reinitiating previous topics. However, they used the chat tool to engage in RC interactions.

4.3.2.1.2. Information provision

Table 4.37 showed that the frequencies of this low negotiation function were high which was expected since in learning contexts participants were supposed to spend a good

amount of time on sharing their views and experiences. Both groups shared information when engaged in R interactions (G1: 12.30, G2: 29.26%) more than when engaged in RC interactions (G1: 3.81%, G2: 9.02%). They used the audio tool only. Results indicated that audio is favoured over the other tools to perform this low negotiation function. The low proportion of RC interactions meant to share a low proportion of information indicated that RC interactions were attempts towards extended constructive discussions.

4.3.2.1.3. Acceptance

Students made the same multimodal choices except for the use of the chat tool by G1. Both groups used more than 45% of their YN contributions and low proportions of their audio contributions (G1: 2.05%, G2: 1.28%) to engage in R interactions. However, G1 used low proportions of their chat contributions too (8.33%). Finally, students accept each other's contributions when engaged in RC interaction using a high proportion of their YN tool (G1: 28.12%, G2: 33.33%). The use of YN tool is favoured over the use of the audio tool, which was expected since the main affordance of use of this tool is to show rapid agreements and disagreements without negotiation.

4.3.2.1.3. Corroboration

The frequencies of corroborations for both groups were low which indicates that students were more interested in negotiations and debate of ideas more than simply sharing and exchanging similar views and ideas. All G1's corroborations within the initiation and re-initiation categories were performed using the chat tool. The use of the chat tool instead of the

audio tool indicated that students avoided interrupting their mates. All G2's corroborations within initiation category were performed using the audio tool.

Like their tutors, they favoured the use of the audio tool to perform low negotiation functions.

4.3.2.1.4. Comprehension check

Generally speaking, tutors checked their students' comprehension. However, a very low proportion of G1's interventions within response category (0.76%) were comprehension checks where students used the audio tool (0.5%). The low frequency was expected since students were not supposed to check students' comprehensions, as this was a tutor's role.

4.3.2.2. Moderate negotiation functions

Tables from Table 4.44 to table 4.45 show the proportions of the moderate negotiation functions in interactive roles in relation to tutors' tool choice using each individual tool.

G1	I	IC	R				RC			
	A	A	A	C	WB	YN	A	C	WB	YN
EXR			66.66				33.33			
EX			44.44				55.55			
DS			30			25	30			15
RA										

Table 4.44. Moderate negotiation functions by G1

G2	R				RC			
	A	C	WB	YN	A	C	WB	YN
EXR								
Ex	100							
DS		22.22		44.44	33.33			
RA								100

Table 4.45. Moderate negotiation functions by G2

Table 4.44 to Table 4.45 show the proportions of each interactive role in each of the performed moderate negotiation functions in relation to tutors' tool choice.

G1	EXR	EX	DS		RA
	A	A	A	YN	
I					
IC					
R	1.53	3.07	4.61	3.84	
RC	1.53	3.81	4.61	2.29	

Table 4.46. Interactive roles of turns with relation to moderate negotiation functions and multimodal choices by G1

G2	EXR	EX	DS		RA
		A	A	YN	YN
R		4.87	1.21	2.43	
RC			2.25		1.50

Table 4.47. Interactive roles of turns with relation to moderate negotiation functions and multimodal choices by G2

Table 4.46 and Table 4.47 show the proportions of use of each communication tool in the proportions of moderate negotiation functions in relation to tutors' different interactive roles. Table 4.48 to Table 4.49 show the proportions

G1	EXR		EX		DS		RA
	R	RC	R	RC	R	RC	
A	1.02	0.51	2.05	2.56	3.07	3.07	
C							
WB							
YN					15.62	9.37	

Table 4.48. Primary moderate negotiation functions of the different tools by G1

G2	EXR	EX	DS		RA
		R	R	RC	RC
A		3.41	1.66	1.28	
C					
WB					
YN			13.33		6.66

Table 4.49. Primary low negotiation functions of the different tools by G2

4.3.2.2.1. Explanation request

G2 did not invite each other to explain their ideas and views. Low proportions of G1's interventions within the response (1.53%) and RC categories (1.53%) were explanation requests. To this end, G1 students used the audio tool to point out to dissonance and issues inviting their tutor and mates to provide explanations. This indicated that students were more interested in inviting each other to negotiation and debate of ideas than expressing disagreement and asking each other shallow explanation requests.

4.3.2.2.2. Explanation

Low proportions of G1's and G2's interventions within R categories (G1: 3.07%, G2: 4.87%) were explanations. Both groups used the audio tool. In addition, low proportions of G1's interventions within RC categories (3.81%) were explanations. Again, G1 students used the audio tool. Hence, we reached the same conclusion that the audio tool was favoured over other tools to perform low negotiation functions.

4.3.2.2.3. Disagreement

Table 4.37 show that the frequencies of disagreements for both groups were low. Students tended to extend discussions by showing their disagreement with the previous responses. Results showed that both groups engage in responses and successive responses in attempts to launch argumentation and negotiation processes. Results showed that the highest proportion of G1 students' disagreements was responses (25%) performed using (15.62%) of their YN contributions as well as a low proportion of their audio contributions (3.07%). G2

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students made the same multimodal choices. More than 40% of disagreements were responses to tutors where students used more than 13% of their YN contributions, and low proportions of their audio contributions (1.66%). Thence, the use of YN tool offered affordances for the expression of rapid agreements or disagreements where students did not have to interrupt other students to engage in the process of negotiation or argumentation. Compared to the YN tool, the use of the audio tool was insignificant in this case.

4.3.2.2.4. Rapid agreement

G1 students did not show rapid agreement which indicates their attempts to negotiate and debate ideas. However, a very low proportion of G2's interventions within the RC category was rapid agreements (1.50%) where students exclusively used the YN tool (6.66%). The low frequency of this low negotiation function indicated that both groups did not reach rapid agreement which reflected attempts towards negotiation and moving discussion up to high levels of meaning construction. In addition, the YN tool was used to avoid negotiated agreements and debates.

4.3.2.3. Elaborate negotiation functions

The different Tables (from Table 4.50 to Table 4.51) show the proportions of elaborate negotiation functions in interactive roles in relation to tutors' tool choice using each individual tool.

G1	IC	R		RC		
	A	A	WB	A	C	WB
EXPR	16.66				83.33	
CL		28.57		50	21.42	
AG		49.12	12.28	38.59		
RJ		45.45		54.54		
AS		20.83		33.33	25	20.83
CH		30		70		
JU				100		
CS				50	16.66	33.33
CSS				60	20	20

Table 4.50. Elaborate negotiation functions by G1

G2	R				RC (133)			
	A	C	WB	YN	A	C	WB	YN
EXPR					100			
CL	90.90				9.09			
AG	36.23	2.89			44.92	1.44	14.49	
RJ					100			
AS					83.33	16.66		
CH					88.88	11.11		
JU					85.71	14.28		
CS					60	20	20	
CSS					40	10	40	

Table 4.51. Elaborate negotiation functions by G2

Table 4.52 and Table 4.53 show the proportions of each interactive role in each of the performed elaborate negotiation functions in relation to tutors' tool choice.

G1	EXPR		CL		AG		RJ	AS			CH	JU	CS			CSS		
	A	C	A	C	A	WB	A	A	C	WB	A	A	A	C	WB	A	C	WB
I																		
IC	33.33																	
R			3.07		21.53	5.38	3.84	3.84			2.30							
RC		33.33	5.34	2.29	16.79		4.58	6.10	4.58	3.81	5.34	3.05	2.29	0.76	1.52	2.29	0.76	0.76

Table 4.52. Interactive roles of turns with relation to elaborate negotiation functions and multimodal choices by G1

G2	EX PR	CL	AG			R J	AS		CH		JU		CS			CSS		
	A	A	A	C	WB	A	A	C	A	C	A	C	A	C	WB	A	C	WB
R		12.19	15.24	1.21														
RC	3.75	1.50	23.30	0.75	7.51	6.76	11.27	2.25	6.01	0.75	4.51	0.75	2.25	0.75	0.75	1.50	0.75	1.50

Table 4.53. Interactive roles of turns with relation to elaborate negotiation functions and multimodal choices by G2

Table 4.54 and Table 4.55 show the proportions of use of each communication tool in the proportions of elaborate negotiation functions in relation to tutors' different interactive roles.

G1	EXR	CL		AG		RJ		AS		CH		JU	CS	CSS
	IC	R	RC	R	RC	R	RC	R	RC	R	RC	RC	RC	RC
A	0.51	2.05	3.58	14.35	11.28	2.56	3.07	2.56	4.10	1.53	3.58	2.05	1.53	1.53
C	20.83									25			4.16	4.16
WB				46.66						33.33			13.33	6.66
YN														

Table 4.54. Primary elaborate negotiation functions of the different tools by G2

G2	EXPR	CL		AG		RJ	AS	CII	JU	CS	CSS
	RC	R	RC	R	RC	A	RC	RC	RC	RC	RC
A	2.13	8.54	0.85	10.68	13.24	3.84	6.41	3.41	2.56	1.28	0.85
C				16.66	8.33		25	8.33	8.33	8.33	8.33
WB					47.61					4.76	4.76
YN											

Table 4.55. Primary elaborate negotiation functions of the different tools by G2

4.3.2.3.1. Exploratory request

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Table 4.37 showed that the frequencies of exploratory requests were relatively high for both groups. Students invited each other as well their respective tutor to negotiate by clarifying issues, arguing their views, challenging others' views and defending their ideas. Results showed that high proportions of G1's interventions within the RC category (33.33%) were exploratory requests. G1 and G2 students made different multimodal choices. G1 dedicated high rates of their chat contributions (20.81%) where G2 used the audio tool (2.13%). In addition, G1 initiated to ask a low proportion of exploratory questions (16.66%) using the audio tool.

Results showed that this elaborate negotiation function was most frequently performed when engaged in RC interaction to build on each other's ideas, mainly relying on the audio tool. The use of the audio tool was expected. Nevertheless, some attempts to use the chat tool were registered.

4.3.2.3.2. Clarification

Clarification was one of the most important negotiation functions that showed that discussions moved up to high phases of the collaborative meaning construction process. High proportions of G1's interventions within RC categories were clarifications. Results showed that more than 70% of G1's clarifications were produced when engaged in RC interactions using the audio tool, which indicates that G1 students engaged in the collaborative process of negotiation clarifying each other's ideas. However, high proportions of G2's clarifications were interventions within the R category. More than 90% of G2's clarifications served to respond to their tutor using the audio tool. Finally, G2 used a low proportion of clarifications when building on each other's ideas (9.09%) using the audio tool. The high frequency of clarifications meant to respond corresponds to the high frequency of T2's exploratory requests

performed when initiating new topics. This suggested that this high proportion of clarifications was not meant to engage students in the process of the collaborative process of meaning construction.

4.3.2.3.3. Argument

This was also one of the most important negotiation functions. The frequencies of arguments were relatively high. The highest proportions of G2's arguments were interventions within RC interactions (60.85%), which indicated that students engaged in extended discussions to defend their views by suggesting more arguments for consideration rather than simply adding new information. G2 students dedicated high proportions of their WB (47.61%) and audio (13.24%) contributions as well as a low proportion of their chat contributions (8.33%) to provide arguments while building on each other's ideas. The second highest proportion of G2's arguments served to respond to their tutor's exploratory requests (39.12%) using high proportions of their chat (16.66%) and audio (10.68%) contributions to provide arguments while responding. However, the highest proportion of G1's arguments was interventions within R (49.12%) more than RC (39.19%) categories. Students used high proportions of audio (14.35%) and WB (46.66%) contributions to provide arguments while engaged in R interactions and used (11.82%) of the audio contributions while engaged in RC interactions.

Thus, students favoured the use of the audio tool along with the chat and the WB tools to produce elaborate negotiation functions when engaged in RC interactions building on each other's ideas.

4.3.2.3.4. Rejection

Rejection was an elaborate negotiation function which reflected participants' engagement in the process of argumentation, debating their ideas. Debate of each other's ideas is important for learning to take place. I registered low frequencies of rejections for both groups, where G1 performed more rejections than G2 (See Table 4.37).

The highest proportions of G1's rejections were produced when engaged in RC interactions (54.54%) against (45.45%) when engaged in R interactions. G1 used the audio tool only to reject each other's ideas. All G2's rejections were performed when engaged in RC interactions using the audio tool as well. G1 performed more rejections than G2 because they were invited by their tutor T1 to challenge each other's ideas more than T2 did. Nevertheless, many of both groups' interventions within RC category were elaborate negotiation functions like rejections which indicate that students extended discussions to negotiate and debate each other's ideas rather than simply sharing views and experiences.

However, students did not use the writing tools as they did when performing other elaborate negotiation functions.

4.3.2.3.5. Assertion

Both groups asserted their ideas and views when building on each other's ideas. However, contrary to G2, G1 students asserted their ideas when responding (20.83%) using the audio tool. G1 students used 33.33% of their WB and 25% of their chat contributions as well as a small rate of their audio contributions (4.10%). G2 students used high proportions of their audio contributions (6.41%) and a high proportion of chat contributions (25%) to assert their ideas. Assertions were elaborate negotiation functions that reflected students' attempts to move discussion up to higher levels of construction by defending and asserting their ideas by providing more clarifications as well as arguments.

Contrary to G2, results indicated that G1 used the written mode more than the oral mode to assert their ideas. In doing so, they adopted the same behaviour as their tutor, simultaneously using the different written and the oral modes of communication to perform elaborate negotiation functions when engaged in extended discussions.

4.3.2.3.6. Challenge (counter-argument)

This skill reflected the attempts of students and tutors towards negotiation and argumentation before creating a shared and agreed upon meaning. Both groups produced this elaborate negotiation function challenging each other's ideas and views. All G1's challenges as well as a high proportion of G2's challenges (70%) were interventions within RC interactive category. Both groups used the audio tool to challenge each other's ideas. In addition, G2 students used a small proportion of their chat contributions (8.33%). However, G1 students challenged their tutor's ideas when engaged in R interactions using the audio tool.

Results indicated again that many of the students' interventions within the RC interactive category were elaborate negotiation functions rather than low negotiation functions. This confirms that RC interactive categories were attempts to extend discussion to engage in high phases of collaborative meaning construction.

4.3.2.3.7. Justification

The use of this elaborate function reflected greater efforts towards debate and argumentation. All of G1 and G2's justifications were interventions within the RC interactive category which confirmed the conclusion reached above about the importance of RC interactive categories. The difference between the groups' justifications frequencies was

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insignificant. However G1 students used the audio tool only to justify their challenges. However, G2 used mainly the audio tools and dedicated 8.33% of their chat contributions to this end tool too.

4.3.2.3.8. Concession (negotiated agreement)

After debating views and ideas, students finally accepted each other's ideas by reaching a common agreed-upon understanding when engaged in RC interactions. Despite the low frequencies of performance of this function (See Table 4.37), results indicated that RC interactions were occasions to engage in constructive discussions building on each other's ideas to create new agreed upon meanings. The groups made different multimodal choices switching between the oral and the written mode. Both groups relied mainly on the audio tool. Interestingly, G1 students dedicated more than 13% of their WB contributions to write more than 33% of their concessions. However, G2 devoted only 4.76% of their WB contributions to write 20% of their concessions. Furthermore, they used only a small proportion of their chat contributions (G1: 4.16%, G2: 8.33%) to express in the written mode more than 15% of their concessions.

Results showed again students' attempts to switch between the written and oral modes of expression when building on each other's ideas performing elaborate negotiation functions.

4.3.2.3.9. Consensus building

From a socio-constructivist view, reaching as well as declaring consensus at the end of the process of negotiation and argumentation is one of the crucial features of the meaning construction process. All G1 and G2's consensus building interventions were performed when

engaged in RC interactions. Both groups performed low proportions of this elaborate negotiation function, which was expected (See Table 4.37). From a socio-constructivist learning point of view, students are not expected to construct a new understanding at the end of each discussion. Both groups relied mainly on the audio tool to perform more than 50% of this elaborate negotiation function. Both groups used the chat (G1: 4.61%, G2: 8.33%) and the WB (G1: 6.66%, G2: 4.76%) tools to build consensus.

Despite the low frequencies of written concessions that accounted for low proportions of RC interactions, students needed to switch between the written and oral modes of communication to engage in discussions to build consensus.

4.3.2.3. Highly elaborate negotiation functions

Table 4.56 and Table 4.57 show the proportions of the highly elaborate negotiation functions in interactive roles in relation to tutors' tool choice using each individual tool.

G1	I	IC	R				RC			
			A	C	WB	YN	A	C	WB	YN
SM			40				60			
MCS			25					75		
AP			73.07				26.92			

Table 4.56. Highly elaborate negotiation functions by G1

G2	R				RC			
	A	C	WB	YN	A	C	WB	YN
SM								
MCS								
AP	61.90		38.09					

Table 4.57. Highly elaborate negotiation functions by G2

Table 4.58 and Table 4.59 show the proportions of each interactive role in each of the performed highly elaborate negotiation functions in relation to students' tool choice.

G1	SM	MCS		AP
	A	A	C	A
I				
IC				
R	1.53	1.53		14.61
RC	2.29		2.29	5.34

Table 4.58. Interactive roles of turns with relation to highly elaborate negotiation functions and multimodal choices by G1

G2	SM	MCS	AP	
			A	WB
R			7.92	4.87
RC				

Table 4.59. Interactive roles of turns with relation to highly elaborate negotiation functions and multimodal choices by G2

Table 4.60 and Table 4.61 show the proportions of use of each communication tool with relation to the proportions of the highly elaborate negotiation functions and students' different interactive roles.

G1	SM		MCS		AP	
	R	RC	R	RC	R	RC
A	1.02	1.53	0.51		9.74	3.58
C				12.5		
WB						
YN						

Table 4.60. Primary highly elaborate negotiation functions of the different tools by G1

G2	SM	MCS	AP
			R
A			5.55
C			
WB			38.09
YN			

Table 4.61. Primary highly elaborate negotiation functions of the different tools by G2

4.3.2.4.1. Summary

The use of elaborate negotiation functions showed that students were engaged in advanced phases of meaning construction, trying to synthesize their discussions and refine newly constructed meanings. Contrary to G1 students, G2 students did not make any attempts to summarize their discussions. Some attempts by G1 students to synthesize their discussions were as a response to their tutors' invitations to summarize the important points of their discussions using the audio tool. This suggested that T1 was more engaged with her students' contributions than T2. 40% of G1's summaries were performed when responding to their tutors. More interestingly, the highest proportion of students' summaries were performed when engaged in RC interactions (60%) building on each other's ideas using the audio tool only. This indicated that students summarized their discussions as a result of engagement in the process of negotiation and debate rather than as a response to their tutors' requests.

4.3.2.4.2. Meta-cognitive statements

This was a very important and elaborate negotiation function which showed that students were aware of the change in their understanding. After summarising and concluding newly constructed meanings, some G1 students reflected on their learning experience and the way their understandings changed. This implied that students were trying to internalize the newly constructed meaning. In addition, 70% of G1's meta-cognitive statements were performed when engaged in RC interactions using the chat tool. In addition, 30% of G1's meta-cognitive statements were performed when engaged in R interactions using the audio tool only. Contrary to G1 students, G2 students did not perform this negotiation function, which indicates that G1 students were more engaged in constructive discussions than G2

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students. Furthermore, T1 invited her students to reflect on their learning, which explains why G2 students did not perform meta-cognitive statements.

Results showed again that RC interactions were attempts to extend constructive discussions for collaborative meaning construction rather than simple exchange of ideas. Furthermore, students reflected on their experience of learning as a result of engagement in constructive discussions that reached high phases of meaning construction rather than simple compliance with the tutor's invitation to do so. Results indicated that the simultaneous use of the writing tools along with the audio tool helped students reflect on their learning experience while they were still engaged in the process of meaning construction.

4.3.2.4.3. Application

Application was the last elaborate negotiation function that showed that students were engaged in collaborative meaning construction, trying to apply newly constructed and already internalized understandings. Both groups performed high proportions of applications when engaged in R (G1: 14.61%, G2: 4.87%) because they were invited to apply new knowledge by their tutors. This indicates that students applied knowledge as a response to their tutors' requests rather than as a result of negotiation and debate as was the case with G1 students. G1 students were invited by their tutor to use the audio tool to apply new knowledge. However, G2 students were invited to use the audio as well as the WB tool.

However, the main difference between groups was that G1 students applied new meanings when engaged in RC interactions (5.34%). This indicated that G1 students applied collaboratively constructed new meanings as a result of engagement in the collaborative process of debate and negotiation rather than simply complying with their tutor's application requests. This suggested that G1 students were more involved in the collaborative process of

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meaning construction than G2 students. In the following sections, I tried to understand the factors behind this different behaviour.

4.3.3. Conclusion

So far, results showed that students performed high proportions of minimal as well as elaborate negotiation functions making different multimodal choices. They behaved in the same way as their tutors where each communication tool was attributed an interactive as well as a communicative function. Despite the overwhelming use of the audio tool to adopt the different interactive roles and performing the different types of negotiation functions, students used the written as well as the oral modes of communication to perform elaborate negotiation functions (clarifying, arguing, debating, challenging, negotiating agreements, building consensus and reflecting on and applying new understanding and meanings), when they engaged in R and particularly RC interactions building on each other's contributions.

Results indicated that students used the chat and the whiteboard tools to perform elaborate negotiation functions while building on each other's ideas. The simultaneous use of the different tools of communication offered positive affordances for the creation of opportunities for collaborative meaning construction.

The analysis of interactive and communicative functions of online interactions revealed that while both tutors mainly adopted I interactive role for providing information or making observations, T1 displayed a more balanced distribution of I (information provision and information requests) and I (exploratory requests). T1 used questions for starting discussions and stimulating. However, T2 focused more on providing information than asking exploratory requests at the start of exchanges.

In addition, the analysis showed that G1 students re-initiated discussions

It showed that both groups used RC mainly to clarify, argue, elaborate, challenge, counter argue, reject others' ideas, concede and build consensus, which suggested attempts to offer alternative perspectives for collaborative negotiation and debate with the aim of creating new shared understandings. The presence of RC interactive category associated with elaborate negotiation functions was a necessary element in the social constructivist learning process because it is a source of perturbation (von Glaserfeld, 1989) that prompts debate and reconsideration of ideas which signals effort at collaboration and meaning construction. It further indicated an awareness of a knowledge gap and attempts towards negotiation building on each other's ideas. So, the prevalence of this type of turns and negotiation functions may indicate that the interactional patterns of both groups reflect more closely the characteristics of exploratory talk (Wegerif and Mercer, 1997) as participants collaborate to share information yet contribute critical responses that prompt efforts from others to justify or explain their views.

As far as the use of communication tools was concerned, participants used the audio, the chat and the whiteboard tools to engage in I and IC (exploratory, reflective and application requests) as well as R and RC (challenge, reject, counter-argument, clarify, elaborate, argue, build consensus).

The analysis showed that participants performed different rates of minimal and elaborate negotiation functions making different multimodal choices. The use of the different tools of communication made it easy for students to engage in successive responsive turns to build on each other's contributions. To synthesize all the information provided in this section, it is important to consider the same contributions but from a broader angle which is the extent to which online discussion, where participants use different tools of communication to perform elaborate negotiation functions, may reach the different phases of meaning construction.

In the following section, the impact the multimodal choices of participants had on their participation in the collaborative process of meaning construction was checked and is now reported.

4.4. Classification of participants' turns in terms of Phases of meaning construction (Phases of meaning construction by tutors and students)

Building on earlier findings on participants' engagement with each other's contributions and the interactional and communicative functions of turns in exchanges, this section presents the results of a broader analysis of the meaning construction process defined as the presence of participation, information sharing, and topic development. The aim was to check which contribution using which communication tool moved the discussion up to high levels of communication that might enhance the meaning construction process.

Here, I attempt to answer the following research question:

- Do multimodal online synchronous interactions in audio-graphic conferencing support meaning construction process and if so to what extent?

Before describing the results of the analysis, there is a need to reconsider the definition and the characteristics of each phase of meaning construction.

Phase 1 (Ph1): as explained in Chapter Three, participants build on each other's contributions, adding their own information and constructing a body of shared knowledge and understanding, but they do not challenge or criticise each other's views.

Phase 2 (Ph2) is characterised by individuals trying to restate their own points of view while disagreeing or ignoring the views of others, adding their own information and constructing a body of shared knowledge and understanding, but they do not challenge or criticise each other's views. Phase 2 is characterised by limited attempts to offer constructive criticism. Differences of opinions are expressed but are neither negotiated nor resolved and information is only shared (Mercer, 1999). Participants try to maintain consensus and so points of disagreement are quickly sorted out and solved.

Phase 3 (Ph3) is more characteristic of educational discourse because it involves constant negotiation and argumentation. Reasons and explanations, elaborations and argumentations are made explicit where necessary and all participants make critical evaluations in order to reach joint conclusions. "Argumentation can be described as a reasoned debate between people, an extended conversation focusing on a specific theme which aims to establish the truth about some contentious issue" (Mercer, 2000, p. 96). Conflicting views are presented but the intention is to reach a resolution and consensus. This is a socio-cognitive conflict in which the presentation of challenges and variant perspectives has the potential to move the discussion on. Hence, phase 3 exchanges involve making reasons and explanations explicit where necessary, with all participants contributing critical evaluations in order to reach joint conclusions. It is an important element of the progressive discourse that enables learners to develop a shared understanding, because progressive discourse requires evidence to be brought to bear on propositions and all beliefs to be subject to criticism if necessary.

Phase 4 (Ph4) and Phase 5 (Ph5) enable participants to establish what they already know and have agreed. These phases represent knowledge building processes in which ideas and information from the present and previous discussion are united. The participants select and combine elements from previous turns in the exchanges and move the dialogue forward by

presenting this synthesis to the group. The technique promotes consensus, presenting new understanding as uncontroversial agreed-upon knowledge.

In sum, the model of analysis applied to code and analyze the data classifies negotiation functions of online interactions into four levels that correspond to five phases of meaning construction. The first level was qualified as low level interactions where discussion was at a basic level of simple exchange of information and opinions. This level corresponded to Ph1 of meaning construction. The second level was qualified as moderate interactions where there was a disagreement but no attempts to follow up. Discussion did not move up to high levels of debate. This level corresponded to Ph2 of meaning construction. The third type was elaborate or high level interactions where discussion moved up to high levels of debate and negotiation before participants could reach agreement and build consensus. This third level corresponds to Ph3 of meaning construction. The fourth level corresponds to Ph4 and Ph5 of meaning construction where participants test the new knowledge, internalize it and finally apply it. This fourth phase then goes through two phases of meaning construction; Ph4 for reflecting on the learning process and Ph5 for the application and internalization of new understandings and meanings.

4.4.1. Phases of meaning construction by tutors

Initially, the results showed that interactions were primarily at the lower level of meaning construction: sharing information and discovering dissonance. Higher levels involving negotiation, co-construction and agreement were identified but at lower frequencies.

Tables (from Table 4.62 to Table 4.63) show the extent to which each of the interactive roles using each of the different tools of communication reached the different phases of meaning construction.

T1	I			IC			R			RC					F					
	A+WB	A	WB	A+WB	A	C	A+C	A	C	A+C	A	C	WB	YN	A+WB	A+C	A	C	WB	YN
Ph 1	7.47	43.28		5.37	24.73	2.15		26.66	6.66					7.14			27.97	0.69	4.89	13.98
Ph 2		5.97			9.67												19.58			
Ph 3	7.47	26.86		5.37	16.45	4.30	6.66	20	33.33	14.28	39.28	25	14.28		2.79	4.19	14.68	6.29	5.59	
Ph 4							6.66													
Ph 5		2.98	7.46		6.45															

Table 4.62. The classification of interactive roles of turns into phases of meaning construction (T1)

T2	I 78			IC 27				R 15			RC 14				F 74				
	A+WB	A+C	A	A+WB	A+C	A	C	A+C	A	C	A	C	WB	YN	A+C	A	C	WB	YN
Ph1	6.41	2.56	47.43	3.70	11.11	44.44			13.33	0	14.28			35.71	6.66	42.66			13.33
Ph2		2.56	3.84	7.40	7.40				6.66							20.27			
Ph3	2.56	2.56	25.64	0		22.22	3.70	20	20	40		28.57	21.42		0	0	5.33	12	
Ph4																			
Ph5			6.41																

Table 4.63. The classification of interactive roles of turns into phases of meaning construction (T2)

Table 4.64 and Table 4.65 show the extent to which the different contributions made in each of the communication modalities with relation to interactive roles reached the different phases of meaning construction.

T1	A 237					C 29				WB 24			YN 22		A+WB 24			A+C 12		
	I	IC	R	RC	F	IC	R	RC	F	I	RC	F	RC	F	I	IC	F	R	RC	F
Ph1	12.23	9.70	1.69		16.87	6.89	3.44		3.44				9.09	90.90	20.83	20.83				
Ph2	4	9			28															
Ph3	7.59	16.45	1.26	4.64	8.86	13.79	17.24	24.13	31.03		16.66	33.33			20.83	20.83	16.66	8.33	33.33	50
Ph4																		8.33		
Ph5	0.84	2.53								20.83										

Table 4.64. The classification of multimodal contributions with relation to interactive roles into phases of meaning construction (T1)

T2	A 138					C 15				WB 12		YN 15		A+WB 10		A+C 19			
	I	IC	R	RC	F	IC	R	RC	F	RC	F	RC	F	I	IC	I	IC	R	F
Ph1	26.81	8.69	8.69	8.69	23.18							33.33	66.66	50	10	10.52	15.78		26.31
Ph2	2.17	8.69	8.69		10.86										20	10.52	10.52		
Ph3	14.49		0.72		10.86	6.66	40	26.66	26.66	25	75				20	10.52		15.78	
Ph4																			
Ph5			3.62																

Table 4.65. The classification of multimodal contributions with relation to interactive roles into phases of meaning construction (T2)

4.4.1.1. Phase 1 (Ph1)

As shown by Table 4.62 and Table 4.63, the highest proportions of T1's and T2's interventions that reached Ph1 of meaning construction were within high proportions of initiations (59.4%, 48.7%) and F interactions (64.64%, 35.99%). In addition, low proportions of their interventions that remained at a low level of meaning construction accounted for a low proportion of IC interactions (23.06%, 34.%).

These high frequencies were expected since both tutors performed high proportions of minimal negotiation functions: information provisions, information requests, acceptance of students' responses and comprehension checks. These were very important skills upon which constructive discussions were launched.

However, there was a significant difference between the proportions of interventions within R and RC interventions that remained at Ph1. A low frequency of interventions within R (19.04%) and RC (9.90%) interactive categories remained at a low level of meaning construction. The low frequencies of R, RC and IC interactive categories that accounted for low frequencies of Ph1 contributions indicated that T1 attempted to move discussions up to high levels of collaborative construction rather than simply exchanging information and opinions. Contrary to T1, relatively high proportions of T2's interventions within R and RC remained at a low level of meaning construction. The results indicate that T2 was less engaged in constructive discussions with her students than was T1. A good proportion of T2's R and RC interactive categories were meant to exchange information with students rather than to invite them to negotiate and debate ideas.

As is shown shown in section 4.2.3.1 of the present chapter and Table 4.64 and Table 4.65, both tutors predominantly used the audio and the YN tools to perform contributions within the different interactive categories that remained at low level of meaning construction.

In addition, T1 used a high proportion of her A+WB (more than 40%). T2 used high proportions of her A+C (more than 40%) contributions and a very low proportion of her chat contributions.

Despite this difference, it is clear that the A+WB and A+C clusters were very important for sharing information by posting pictures and pre-prepared texts. Furthermore, results indicated that it was important to initiate and evaluate students' contributions using all of the different tools with a good interplay between the written and the oral modes of communication.

4.4.1.2. Phase 2 (Ph2)

The frequencies of both tutors' contributions that reached Ph2 of meaning construction are very low. All T1's interventions that reached this low level of meaning construction accounted for low proportions of I, IC and F interactions using the audio tool exclusively (See Table 4.62 and Table 4.63). All T2's interventions that reached Ph2 of meaning construction accounted for low proportions of F, RC and finally IC interactions (See table 4.62 and Table 4.63). As it is shown in Table 4.64 and Table 4.65, multimodal contributions that remained at this second phase of meaning construction were mostly performed using the audio tool. However, T2 used moderate proportions of A+C contributions (21.04%) and A+WB (20%) to reveal dissonances, issues and disagreements. Finally, neither tutor initiated by pointing at dissonance and disagreements, which I expected.

4.4.1.3. Phase 3 (Ph3)

Table 4.62 and Table 4.63 show that high proportions of tutors' contributions reached Ph3 of meaning construction, which reflected tutors' attempts to create opportunities for active participation and engagement in collaborative constructive discussions that facilitate meaning construction.

Some differences and similarities were shown in the distribution of tutors' contributions in terms of phases of meaning construction. Three main differences are mapped out which have slightly different implications. Very high proportions of T1's and T2's RC interaction (T1: 90.89, T2: 57.13%) as well as high proportions of T1's and T2's IC contributions (T1: 46.17%, 52.37%) reached this high level of meaning construction. The high frequencies of both tutors' IC interactions that reached this high level of meaning construction indicated that tutors reinitiated previous topics to invite students to negotiate and debate students' ideas instead of simply exchanging information or sharing opinions. Furthermore, high proportions of T1's and T2's R contributions (T1: 80.92%, T2: 66.66%) reached the third high level of meaning construction. The high frequencies of tutors' R and RC contributions that reached Ph3 of meaning construction indicated that tutors extended discussions to provide students with the cognitive support, guidance and scaffolding they needed. Tutors were more involved in the discussion, debating and negotiating with students rather than playing the role of the master of the virtual class.

Results showed that high proportions of T1 and T2's contributions that reached Ph3 of meaning constructions were F interactions (T1: 50.65%, T2: 28.28%). Results then suggested that T2 made more constructive comments on her students' contributions than T1. This was exemplified by the high frequencies of clarifications and arguments she provided while evaluating her students' contributions.

Finally, results showed that relatively low proportions of T1's and T2's initiations (T1: 15.64%, T2: 18.72%) reached Ph3 of meaning construction. Results indicate that T2 initiated

new topics inviting students to negotiate and debate ideas more than T1 who initiated by inviting students to exchange information and views. This explains the difference in terms of frequencies of re-initiations. T2 did not need to reinitiate previous discussions since she spent more of her initiation contributions inviting her students to engage in constructive discussions.

Table 4.64 and Table 4.65 show that tutors made the same multimodal choices, using high proportions of chat (T1: 82.70, T2: 86.66), A+WB (T1: 58.32%, T2: 60%), A+C (T1: 100%, T2: 60%), audio (T1: 36.69, T2: 39.98%), and WB contributions (T1: 33.33, T2: 100%) to perform interventions that reach the third phases of meaning construction. However, some differences were mapped out. Tutors used the WB tool differently. All T2's WB contributions reached Ph3 level of meaning construction. However, only 33.33% of T1's WB contributions reached Ph3. This difference suggests that T2 used the WB tool to write down her students' contributions as well as her clarifications, arguments, and exploratory requests more than T1. T1 used the WB tool to post comments and pre-prepared texts more than writing up students' or her own contributions. Second, T1 used the chat tool along with the audio tool (100%) to engage in R and RC interactions that were meant to engage in high phases of meaning construction.

4.4.1.4. Phase 4 (Ph4)

Testing and reflection are important negotiation skills which have been found to be related to positive learning. In testing and reflecting, students are drawn to test their new knowledge which facilitates knowledge internalization and appropriation. Tutors' contributions did not fall into this high phase of meaning construction. Tutors did not make attempts to invite their students to reflect on their learning and thinking.

4.4.1.5. Phase 5 (Ph5)

As shown by Table 4.62 and Table 4.63, for both tutors, the proportions of tutors' contributions that reached Ph5 of meaning construction were low. Concerning T1, Ph5 accounted for a low proportion of initiations and an even lower proportion of re-initiations. Low proportions of T1's and T2's interventions within I interactive category as well as a low proportion of T2's interventions within IC interactive category were invitations to students to apply newly created meanings using the audio tool.

4.4.1.6. Summary

Results showed that both tutors used the different tools to provide information and support oral explanations and clarifications as if they needed to provide as much information as possible upon which students could build up constructive discussions. The results reveal a strong tendency towards the simultaneous use of the written and the oral modes to move discussions up to high levels of meaning construction. The written mode was used to support the oral mode whenever tutors needed to invite students to engage them in the collaborative process of meaning construction.

4.4.2. Phases of meaning construction by students

As seen in an earlier section (4.2.3.2.), the main interactive roles of students were response and response continuity. They barely initiated and reinitiated. However, they did actively engage in low and high phases of meaning construction when responding to the tutor's requests or when building on each other's ideas.

Table 4.66 and Table 4.67 show the extent to which each of the interactive roles using each of the different tools of communication reached the different phases of meaning construction.

G1	I	IC	R				RC			
	A	A	A	C	WB	YN	A	C	WB	YN
Ph1	100	66.66	16.15	2.30		11.53	6.10	1.52		6.87
Ph2			9.23			3.84	9.16			2.29
Ph3		33.33	34.61		5.38		45.80	12.21	6.10	
Ph4										
Ph5			16.92				7.63	2.29		

Table 4.66. The classification of interactive roles of turns into phases of meaning construction (G1)

G2	R				RC			
	A	C	WB	YN	A	C	WB	YN
Ph1	52.30			10.76	12.21			7.63
Ph2	6.15	1.53		12.5	2.29			1.52
Ph3	34.61	1.53			61.83	6.10	9.92	
Ph4								
Ph5	10		6.15					

Table 4.67. The classification of interactive roles of turns into phases of meaning construction (G2)

Table 4.68 and Table 4.69 show the extent to which the different contributions made in each of the communication modalities reached the different phases of meaning construction.

G1	A				C		WB		YN	
	I	IC	R	RC	R	RC	R	RC	R	RC
Ph1	1.02	1.02	10.76	4.10	12.5	8.33			46.87	28.12
Ph2			6.15	6.15					15.62	9.37
Ph3			23.07	30.76		66.66	46.66	53.33		
Ph4										
Ph5			11.28	5.12		12.5				

Table 4.68. The classification of multimodal contributions with relation to interactive roles into phases of meaning construction (G1)

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G2	A		C		WB		YN	
	R	RC	R	RC	R	RC	R	RC
Ph1	29.05	6.83					46.66	33.33
Ph2	3.41	1.28	16.66				13.33	6.66
Ph3	19.23	34.61	16.66	66.66		61.90		
Ph4								
Ph5	5.55				38.09			

Table 4.69. The classification of multimodal contributions with relation to interactive roles into phases of meaning construction (G2)

4.4.2.1. Phase 1

High proportions of G1's and G2's interventions within R interactions (G1: 30%, G2: 50%) remained at Ph1 of meaning construction. Students were busy sharing information, experiences and opinions with their tutors. Low proportions of both groups' interventions within RC interactions (G1: 14.49%, G2: 19.54%) remained at a low level of meaning construction. The low frequencies of RC interactions that remained at this very basic level of meaning construction indicated that RC interactions were opportunities for engagement in the collaborative processes of negotiation and debate rather than simply exchanging ideas and opinions.

Both groups used high proportions of the YN contributions (G1: 74.99%, G2: 79.99%) to show their agreement with the tutor's explanations or to respond positively to her comprehension checks. Both groups used high proportions of their audio contributions too. They used the chat tool because of problems with the quality of sound or because they were invited by their tutors to use it.

Finally, the very low frequency of G1's I and IC interactions remained at this low level of meaning construction which is expected since they were simply attempts from students to request information or to provide information using the audio tool.

So, generally speaking, discussions remained at a low level of meaning construction when students were invited by their tutors to respond by sharing information, ideas and experiences.

4.4.2.2. Phase 2

Table 4.66 and Table 4.67 show that the frequencies of interventions that reached the second level of meaning communication are very low. Students used the YN and the audio tools to engage in R and RC interactions to point at dissonance and issues and express disagreement. In addition, G2 students used the chat too to show their disagreements. Results showed that chat was used just like the YN tool where students write just the word 'no' without justifying their disagreements.

In sum, the low frequencies of RC interactions that reach Ph2 level indicated that RC interactions were opportunities to extend discussion to negotiate and debate ideas rather than simple exchanges of ideas and experience.

4.4.2.3. Phase 3

Results showed that high proportions of both groups' interventions within RC interactions (G1: 60.01%, G2: 63.86%) reached Ph3 of meaning construction. This confirms our assumption that RC interactions are attempts towards extending discussions towards high levels of negotiation and argumentation that facilitate collaborative meaning construction.

In addition, a relatively high proportion of G1's interventions (39.99%) and G2's interventions (36.14%) performed while responding to their tutors reached Ph3 of meaning construction. The relatively high frequency registered for G1 was expected since T1

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performed a high proportion of exploratory requests when initiating and reinitiating. Similarly, the moderate frequency for G2 was expected since T2 devoted a high proportion of her I and IC interactions to request information more than inviting them to negotiate and debate their ideas.

Tables 4.68 and Table 4.69 show that these interventions were mostly performed using of the audio, the chat and the WB tools. However, they did not use the YN tool. Both groups used high proportions of their audio contributions (G1: 23.07%, G2: 19.23%) to respond to their tutors' requests. Interestingly, results showed that high proportions of WB contributions reached this third phase of meaning construction when students engaged in R interactions (G1: 53.33%, G2: 61.90%) and RC interactions (G1: 46.66%). In addition, results showed that high proportions of chat contributions reached Ph3 when students engaged in R interactions (16.66%) and RC interactions (G1: 66.66%, G2: 66.66%). However, G1 students used the WB to write down their contribution because they were invited to do so by their tutor. G2 students used the chat to write down their contributions because they used it as an alternative to the audio because the quality of sound was not good. In addition, both groups dedicated the highest proportions of WB contributions as well as their chat contributions to engaging in RC interactions. Students did not reserve the use of the chat and the WB tools for sound problems only, rather, discussions seemed to be appealing and they were motivated to build on their peers' contributions while they were still talking without having to interrupt them.

Finally, a low proportion of G1's IC interactions reached Ph3 of meaning construction since students invited their tutors to clarify issues using the audio tool only.

In sum, students favoured the simultaneous use of the audio tool with writing tools (the chat and the WB tools) to build on each other's ideas. Hence, the simultaneous use of tools of communication offered affordances for engagement in high levels of collaborative meaning construction.

4.4.2.4. Phase 4

Tutors did not invite students to test new knowledge nor reflect on their learning. Internalization was a long process that takes time, which might be the reason behind tutors' reluctance towards inviting their students to test new understandings and knowledge. Consequently, students did not perform interventions that reached this very important level of meaning construction.

4.4.2.5. Phase 5

The general frequencies of this very elaborate phase of meaning construction Ph5 were low for both groups (G1: 13.15%, G2: 7.07%). Students applied their newly constructed meaning when responding to their tutors' application requests (G1: 9.92%, G2: 13.45%). G1 students used the audio tool. G2 used the audio tool and the WB tool as invited by their tutor. Concerning R interventions that reached Ph5 of meaning construction, students did not apply new knowledge as a result of their collaborative efforts to create and apply new agreed upon understanding. I found these contributions problematic. It was difficult to assess their collaborative aspect. It is not possible to know if the meanings they were invited to apply were the results of their collaborative constructions. Hence, these individual contributions were considered to have reached Ph5 level because students used elaborate negotiation functions which were retrieving new knowledge and applying.

However, the highest proportion of G1's interventions that reached the fifth level of meaning communication was performed when engaged in RC interactions. G1 students reflected on change in understanding, made meta-cognitive statements, summarised, concluded, and applied new agreed upon knowledge that resulted from their constructive

collaborative discussions. Thence, discussion moved up to Ph5 as a result of their collaborative efforts towards negotiation and meaning construction. This is expected because G1 students were more engaged in RC interactions than G2 students. As opposite to T2, T1 was more engaged with her students' interactions to reflect, summarize and conclude their discussions. To do so, students simultaneously used the audio and the chat tools. This indicates that students showed the same tendency towards the use of oral and writing modes to engage in high levels of collaborative meaning construction.

In sum, students favoured the use of the audio and the chat tools to engage in Ph5 of meaning construction.

4.4.3. Conclusion

In sum, we could map out three important conclusions:

1. High proportions of IC and RC interactions were attempts to extend discussions to high levels of negotiation and argumentation that lead to high levels of collaborative meaning construction. This supported our assumption that IC and RC were indicators of engagement in deep and constructive discussions.

2. Both tutors used the written mode along with the oral mode particularly when using elaborate negotiation skills to invite students to engage in the process of negotiation and debate that lead to high levels of meaning constructions. The use of writing tools (the WB and the chat tools) indicated withdrawal from direct involvement in interaction and inviting students to manage their interactions. Students shared the same tendency towards the use of writing tools to engage in elaborate negotiation skills building on each others contributions.

3. The switch between oral and written mode helped tutors to take on different roles, from controllers providing information and explanations using the audio, A+C and A+WB, to

facilitators, guides and scaffolders using high rates A+C cluster, chat and WB tools. In addition, the switch between oral and written modes of communication helped students to function as: respondents sharing information and ideas with their tutors using the audio and active negotiators building on each other's ideas using the audio, chat and WB tools.

Hence, tutors made different multimodal choices using the written mode along with the oral mode. The socio-constructivist learning framework adopted in this study assumes that knowledge construction is supported by initial scaffolding by the tutors and gradual withdrawal of learning support as students gain greater control of the discussion. Patterns in the use of extended exchange sequences by tutors could therefore indicate the attempts to collaborate or have control over discussion and the extent to which the tutors were involved in providing learning support.

However, the analysis of Ph5 of meaning construction showed that it was not possible to assess the collaborative aspect of R interactions that reach high levels of construction. This stimulated reflections on the necessity of assessing the quality of multimodal exchanges instead of focusing on just individual contributions. I needed to know if discussions, not just individual contributions, moved up to high levels of meaning construction as a result of using negotiation as well as argumentation processes. This was an opportunity to consider the possible affordances that might result from interactions between communication tools instead of focusing on individual tools' affordances as if they were working in isolation. There was a need to check the extent to which participants' multimodal choices contribute to moving discussions up to high levels of construction.

4.5. The analysis of online multimodal exchanges

The affordances of use of each tool of communication were shown to have positive and negative implications. Now, I examine the affordances of the simultaneous use of tools of communication.

4.51. Types of multimodal exchanges (Modal density of online exchanges)

Up to now, I have looked at individual contributions which have been classified in terms of elaborate, moderate and low levels of meaning construction. I have also looked at the tools used to perform the different interactive roles and their associated interventions in terms of negotiation functions. I explored the effects of how these individual contributions in terms of turns of communication interact and build up into exchanges. There was a need to move beyond the study of the quantity and the quality of turns in order to understand the way participants engage in meaning construction process using communication tools available for them. It was necessary to understand how individual turns relate to each other to build up into constructive discussions. I assumed then that it was necessary to examine the structure and the quality of exchanges to evaluate the quality of discussions from a socio-constructivist perspective.

I now look at the modal density of exchanges. Modal density was regarded as the extent to which tools were used. I examined the use of the different tools to build up exchanges.

G1	A-only	A+YN	A+C	A+WB	A+C+WB+YN
	75 (50.81%)	8 (5.40%)	20 (13.51%)	23 (15.54%)	22 (14.72%)

Table 4.70. The extent of modal density of online exchanges (G1)

G1	A-only	A+YN	A+C	A+WB	A+C+WB+YN
	75 (57.22%)	10 (7.89%)	18 (13.15%)	16 (11.84%)	16 (11.84%)

Table 4.71. The extent of modal density of online exchanges (G2)

I identified five possible multimodal exchanges. The first type was the audio-only exchange where participants used the audio tool only. This was the most frequent online exchange. This exchange displayed a low level of modal density since participants used only one tool of communication.

Results show the existence of some (A+YN) exchanges where participants simultaneously used the audio and YN tools. The proportion of this type of multimodal exchange was very low, which was expected since the frequencies of use of the YN tool are relatively low. In addition, the analysis showed the existence of (A+C) exchanges where participants used the audio tool while others contributed using the chat. Both groups shared the same tendency towards the use of the audio and the chat tools to construct online exchanges. The difference in frequencies of engagement of G1 and G2 in this kind of multimodal exchanges was insignificant. The fourth type was (A+WB) exchange where participants simultaneously used the audio and the whiteboard tools. Again, both groups shared the same tendency and engaged at a relatively low frequency in this kind of multimodal exchanges.

These exchanges were defined as displaying a moderate rate of modal density since participants simultaneously used only two tools of communication.

The fourth type is (A+C+WB+YN) exchange where participants engaged in discussion, building on each other's ideas using all the available communication tools. The difference in terms of rate of engagement between groups was insignificant. This last type was described as displaying a high level of modal density since participants used the different tools of communication.

I noticed that the use of the audio tool was predominant in all types of multimodal exchanges. This confirmed the assumption that the audio tool was the most important one. The remaining tools supported and complemented the use of the audio tool by the different participants.

Having mapped out the multimodal exchanges that characterized online discussions, there was a need to look at the respective interactive patterns of these exchanges. This was in order to understand the way they function as well as the possible affordances they offered to enhance or hamper the meaning construction process.

4.5.2. The structural organization of online exchanges

In previous sections of the present analysis I identified new types of online turns. Consequently, I identified four patterns for both groups:

G1	IRF	IRRCF	ICRF	ICRRCF
	45 (30.43%)	26 (17.43%)	54 (36.62%)	23 (15.51%)

Table 4.72. The interactive patterns of online exchanges (G1)

G2	IRF	IRRCF	ICRF	ICRRCF
	80 (59.21%)	27 (19.80%)	12 (19.15%)	16 (11.84%)

Table 4.73. The interactive patterns of online exchanges (G2)

4.5.2.1. I-R-F

As was explained in Chapter Three, the organization of pedagogical exchanges was distinctive for their three part structure I-R-F. Results showed an important difference between the proportions of I-R-F exchanges in both groups. The typical pattern of online talk consisted of a three-part exchange evoking the fairly consistent behaviour of tutors asking questions, students replying, then tutors providing feedback on students' responses. Students functioned as respondents only, complying with their tutors' instructions. The interactive roles of tutors were distributed more or less equally between the role of initiator and feedback provider which revealed the extent of tutor dominance over communication. Hence, exchanges were short and uni-directional under the direct control of tutors.

4.5.2.2. I-R-RC-F

This pattern represented 17.43% of exchanges for G1 and 19.80% for G2. Surprisingly, G2 participants showed a greater tendency to engage in this kind of online exchanges. Tutors initiated new topics, making open requests which triggered different related responses from different students and finally feedback by tutors. This pattern showed that students extended discussion to engage in the collaborative meaning construction process.

4.5.2.3. IC-R-F

Tutors reinitiated previous topics by asking closed questions inviting a particular student to respond, and closed the exchange by providing feedback. Despite the tutor's invitation to discuss previous topics, students did not engage in the process of debate and

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negotiation. Engagement in IC interactions indicated that tutors attempted to involve students in the process of interaction. However, inviting individual students to respond prevented students from engaging in the process of collaborative negotiation and argumentation. Hence, the analysis of individual IC contributions revealed attempts towards extending discussion to constructive levels of collaborative meaning construction. However, involvement in this kind of exchange did not create opportunities for collaborative meaning construction to take place because students did not get to work with each other. However, I registered higher levels of involvement by G1 participants than G2. This was expected since T1 reinitiated previous topics more than T2.

4.5.2.4. IC-R-RC-F

Tutors reinitiated previous topics. Students accepted their tutors' invitations to discuss and negotiate previous ideas. Tutors used open questions inviting all students to discuss. Consequently, they engaged in a sequence of consecutive and simultaneous responses building on each other's ideas, multiplying interaction opportunities for involvement in active collaborative meaning construction.

4.5.3. The extent of modal density of online exchanges

In this section (4.5.3.), I look at the correlation between the structure of exchange patterns and modal density to check the extent to which the affordances of use of the different communication tools helped in shaping the different multimodal exchanges and see whether and how these affordances helped to move discussions up to high levels of meaning construction.

Table 4.74 and Table 4.75 show the proportions of the interactive patterns and

structures of multimodal exchanges.

G1	A-only	A + YN	A + C	A + WB	A+ Ct+ WB + YN
I-R-F	30.66	62.5	35	43.47	0
I-R-RC-F	4	37.5	30	26.08	36.36
IC-R-F	58.66	0	20	17.39	9.09
IC-R-RC-F	6.66	0	15	13.04	54.54

Table 4.74. The proportions of the interactive multimodal exchanges (G1).

G2	A-only	A + YN	A + C	A + WB	A+ Ct+ WB + YN
I-R-F	80	60	44.44	37.5	0
I-R-RC-F	14.66	0	22.22	25	50
IC-R-F	4	40	16.66	12.5	0
IC-R-RC-F	1.33	0	16.66	25	50

Table 4.75. The proportions of the interactive multimodal exchanges (G2).

Figures from Figure 4.76 to Figure 4.77 show the extent of modal density of the

different types of exchanges.

G1	I-R-F	I-R-RC-F	IC-R-F	IC-R-RC-F
A-only	51.11	11.53	44	21.73
A+YN	11.11	11.53	0	0
A+C	15.55	23.07	7.40	13.04
A+WB	22.22	23.07	7.40	13.04
A+C+WB+YN	0	30.76	3.70	52.17

Table 4.76. The extent of modal density of the different types of exchanges.

G2	I-R-F	I-R-RC-F	IC-R-F	IC-R-RC-F
A (only)	75	40.74	25	6.25
A+YN	7.5	0	33.33	0
A+C	10	14.81	25	18.75
A+WB	7.5	14.81	16.66	25
A+C+WB+YN	0	29.62	0	50

Table 4.77. The extent of modal density of the different types of exchanges (G2)

4.5.3.1. I-R-F

I-R-F exchanges were short and unidirectional, which reveals an absence of collaboration. However, they were the most frequent exchanges. I mapped out four kinds of multimodal I-R-F exchanges. High proportions of I-R-F exchanges were mono-modal where participants exclusively used the audio tool. More than 50% of G1's I-R-F exchanges accounted for 30.66% of mono-modal audio exchanges. However, 75% of G2's I-R-F exchanges accounted for 80% of mono-modal audio exchanges.

Low proportions of A+YN (G1: 11.11%, G2:7.5%), A+WB (G1:15.55%, G2: 7.5%) and A+C (G1: 22.22, G2: 10%) accounted for low proportions of G1's exchanges and even lower proportions of G2's I-R-F exchanges. This was expected because results showed that tutors used high proportions of their WB contributions to introduce new topics, as well as inviting students to write their individual contributions on the whiteboard. In addition, tutors initiated by explaining new topics and inviting students to use the YN tool to check their comprehension. Whereas in I-R-F (A+C), typical exchanges were exchanges where students responded using the chat tool because of failure in their sound systems, or tutors providing feedback using the chat.

This type of multimodal exchange did not promote any kind of collaboration as there was no interaction between students. Interactions were restricted to the tutor and one particular student. However, I do not intend to undermine the importance of these multimodal online exchanges. Tutors and students needed to interact with each other before students could get to create their own zones of proximal development.

4.5.3.2. I-R-R-CF

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Participants made more multimodal choices when engaged in this type of long online exchange. High proportions of G1's and G2's I-R-RC-F exchanges were characterized by a high modal density as participants used the different tools of communication. They accounted for high proportions of A+C+WB+YN multimodal exchanges (G1: 36.36%, G2: 50%). Participants used the different tools of communication to engage in different RC interactions before tutors could provide feedback and close these exchanges. Building on each other's ideas was made possible by the availability of different tools of communication where different students could engage in this process at the same time commenting and building on the same contribution.

Relatively high proportions of A+WB and A+C exchanges account for high proportions of G1's I-R-RC-F exchanges, but low levels of G2's exchanges. G2 participants engaged in mono-modal IRRCF exchanges using the audio tool more than G1 participants. This was shown in the significant difference between the proportions of I-R-RC-F (audio-only) exchanges for both groups. More than 40% of G2's I-R-RC-F exchanges were mono-modal against just 11.53% for G1 that account for just 4% of mono-modal exchanges. I subsequently tried to understand this difference in terms of distribution of modal density knowing that students and their tutors used the different available tools of communications at almost the same proportions. Finally, a low proportion of G1's I-R-RC-F exchanges accounted for a relatively high proportion of A+YN. This was again expected because G1 students were more often invited by their tutor to use the YN tool than were G2.

All in all, results indicate that I-R-RC-F exchanges were highly multimodal and collaborative since students interacted with each other. Hence involvement in this kind of highly multimodal exchanges might provide better opportunities for the creation of zones of proximal development for students to collaborate and create meaning together.

4.5.3.3. IC-R-F

There was a significant difference in terms of IC-R-F exchanges proportions for both groups, which was expected as T1 engaged in IC interactions more than T2. IC-R-F exchanges were less multimodal than previous exchanges. As far as G1 was concerned, very high proportions of these short exchanges were audio-only (58.56%), which was expected because students used the different tools of communication to perform elaborate negotiation functions when engaged in RC interactions, which was not the case here. Low proportions of G1's IC-R-F exchanges accounted for moderate proportions of A+C (students responding using the chat because of sound problems, and tutors using the chat to provide feedback), A+WB (tutors used the WB tool to post pictures and comments as well as inviting individual students to write their individual contributions), and low proportions of A+C+WB+YN (where tutors used the audio and the WB tools to initiate new topics, students used the chat tool to respond and finally tutors used the YN tool to accept their contributions). As far as G2 was concerned, the highest proportions of IC-R-F accounted for high proportions of A+YN and A+C. In addition, relatively low proportions of IC-R-F accounted for low proportions of Audio and A+WB for the same reasons explained above.

In sum, when engaged in these particular kinds of multimodal exchanges, students did not build on each other's ideas, revealing that collaboration is almost absent. This indicated few attempts towards extending discussions to high levels of negotiation and debate despite the presence of IC interactions.

4.5.3.4. IC-R-RC-F

G1 students engaged in IC-R-RC-F more than G2. However, the frequencies for both groups were relatively low. The highest proportions of IC-R-RC-F accounted for high rates of A+C+WB+YN whereas low frequencies of IC-R-RC-F accounted for low proportions of mono-modal audio exchanges. In addition, moderate proportions of IC-R-RC-F accounted for moderate proportions of A+WB and A+C. Thus, results show that IC-R-RC-F displayed increased level of modal density, with participants engaged in IC and RC interactions building on each other's contributions simultaneously using the different tools of communications. Results showed that participants performed elaborate negotiation functions when engaged in IC and RC interactions, simultaneously using the different tools of communication. Results hence indicated that the high level of modal density of IC-R-RC-F means that participants had better opportunities to build on the same contribution at the same time. Furthermore, it seemed that the different types of IC-R-RC-F multimodal exchanges provided mediational support that created better opportunities for the creation of zones of proximal development and high levels of involvement in collaborative meaning construction.

4.5.4. Conclusion

All in all, results showed the existence of different types of online multimodal exchanges that displayed different levels of modal density. In the following, I explore the affordances of the different exchanges as well as the extent to which the different levels of multimodal density of the different exchanges affect participants' involvement in collaborative meaning construction.

4.6. Classification of online exchanges in terms of phases of meaning construction (Contribution of involvement in dense multimodal exchanges to meaning construction process)

There was a need to examine the level of modal density and the extent to which multimodal exchanges reached high levels of meaning construction. What was important was the creation of new meanings together, reaching consensus and applying them. This collaborative creation occurred only in I-R-RC-F and IC-R-RC-F exchanges, not I-R-F and IC-R-F.

4.6.1. I-R-F exchanges

Table 4.78 and Table 4.79 show some similarities and differences between the extents to which I-R-F multimodal exchanges from both groups reached the different levels of meaning construction.

G1	Ph1	Ph2	Ph3	Ph4	Ph5
I-R-F (A-only)	65.21	4.34	30.43		
I-R-F (A + YN)	40	60			
I-R-F (A+ C)	42.85	14.28	42.85		
I-R-F (A + WB)					100

Table 4.78. The classification of I-R-F multimodal exchanges into phases of meaning construction (G1)

Gr2	Ph1	Ph2	Ph3	Ph4	Ph5
I-R-F (A-only)	22.22	3.70	30		
I-R-F (A+YN)	50	16.66	33.33		
I-R-F (A + C)	62.5		37.5		
I-R-F (A + WB)					100

Table 4.79. The classification of I-R-F multimodal exchanges into phases of meaning construction (G2)

4.6.1.1. I-R-F (Audio-only)

Results showed that a high proportion of G1's and G2's I-R-F (audio-only) remained at Ph1 low level of meaning construction (G1: 15%, G2: 30%). On the other hand, moderate proportions of G1's and G2's moved up to the Ph3 of meaning construction. Finally, very low proportions of G1's exchanges remained at Ph2 of meaning construction. In contrast to G1, a high proportion of G2's exchange reached Ph2, which was expected since G2 participants made more attempts to point out dissonance and issues than G1.

Results suggested that I-R-F (audio) was mainly devoted to exchanging ideas and information. I-R-F exchange might be elaborate but non-extended in the sense that it was not collaborative. It was worth mentioning that even when I-R-F (audio-only) exchanges reached Ph3 of meaning construction, participants did not engage in collaborative meaning construction. The pattern was initiation, response by a student and then evaluation by the tutor. The tutor made exploratory requests inviting a particular student to negotiate, argue or challenge her ideas. Thence, only individual contributions were elaborate since participants performed elaborate negotiation functions but not discussion, as there were no collaborative efforts towards the creation of a common understanding.

4.6.1.2. I-R-F (A+YN)

The general frequency of this exchange was low for both groups. I reported different distributions for both groups. Concerning G1, 30% of G1's exchanges reached ph2 of meaning construction where students pointed at dissonance and issues. 35% of G2's exchanges remained at Ph1 for exchange of information and ideas. However, I-R-F (audio-only) did not reach upper levels of meaning construction. Concerning G2, a very high proportion of this

exchange was dedicated to exchanging information and ideas, hence discussions remained at a low level of meaning construction. In addition, a very low proportion of this type of exchange reached Ph3 of meaning construction.

In general this kind of exchange that displayed a low level of modal density was used to exchange information and indicate disagreements and dissonance. Only very few such exchanges reached high levels of negotiation but not collaboration.

4.6.1.3. I-R-F (A+C)

The frequencies of this exchange were low for both groups. The highest proportions of this exchange that displayed low level of modal density remained at a low level of meaning construction. Only a low proportion of this exchange reached Ph3 of meaning construction where students were engaged in the process of negotiation with their tutors. In addition, a low proportion of G1's I-R-F (A+C) reached Ph2 for expression of quick disagreements dissonance.

4.6.1.4. I-R-F (A+WB)

Both groups engaged in I-R-F (A+WB) to apply newly constructed meanings and knowledge, writing their individual contributions on the whiteboard. However, it seemed that this type of exchange reached high levels of construction whereas participants did not engage in any kind of collaboration. In other words, only individual contributions reached high levels of construction because students used elaborate negotiation functions to apply new understanding. Application of new meanings was not the result of engagement in collaborative discussions but the result of individual efforts as exemplified by the following extract:

Extract 4.1

T A	T C	T W B	A	C	WB
0.50.20		0.50.	(30) T1. Alors nous passons à faire un peu de grammaire maintenant F A 29 + A 28		(1) T1. **Les verbes impersonnels** En politique... Il arrive que Il est certain que Il est certain que Il est clair que Il s'agit de Il ne suffit pas que Il semble que Il faut Il est important que Il faut que Il est probable que Il suffit de
	0.50.35		(31) St1. Il semble que les femmes soient moins intéressées en politique R A 30		
		0.50.45			(2) St1. Il semble que les femmes soient moins intéressées en politique R A 30
0.50.55			(32) T1. Oui St2 maintenant F A 31 + IC A 30		

There was a difference between using new meanings as a result of collaborative negotiation and construction or as a result of tutors' direct invitations. This extract showed that T1 invited her students to apply newly constructed meaning, writing their contributions using the WB tool. Though students applied newly constructed meaning, they focused on their individual contributions without interacting or building on each other's using social negotiation functions. Consequently, it may be said that individual contributions reached Ph5 of meaning construction but not discussion itself.

The results then revealed that all types of I-R-F exchanges of different levels of modal density were non-extended and not collaborative exchanges. Interaction was a simple

exchange between tutors and individual students; collaboration between students was totally absent. Despite the fact that they reached Ph3 and Ph5 of meaning construction, focus was rather on individual contributions than collaborative construction. Students were invited by their tutors to focus on their ideas and individual contributions, clarifying and arguing their answers without making any attempts to engage in a collaborative process of meaning construction.

4.6.2. I-R-RC-F exchanges

Table 4.80 and Table 4.81 show many differences in terms of the extent of the modal density of I-R-RC-F exchanges of both groups.

G1	Ph1	Ph2	Ph3	Ph4	Ph5
I-R-RC-F (A-only)			100		
I-R-RC-F (A + YN)	33.33		66.66		
I-R-RC-F (A + C)	16.66		50		33.33
I-R-RC-F (A + WB)			66.66		33.33
I-R-RC-F (A + C + WB + YN)			62.5		37.5

Table 4.80. The classification of I-R-RC-F multimodal exchanges into phases of meaning construction (G1)

G2	Ph1	Ph2	Ph3	Ph4	Ph5
I-R-RC-F (A-only)	18.18		63.63		18.18
I-R-RC-F (A + YN)					
I-R-RC-F (A + C)			100		
I-R-RC-F (A + WB)			75		25
I-R-RC-F (A + C + WB + YN)			50		50

Table 4.81. The classification of I-R-RC-F multimodal exchanges into phases of meaning construction (G2)

4.6.2.1. I-R-RC-F (Audio-only)

All G1's I-R-RC-F exchanges reached Ph3 of meaning construction. I-R-RC-F exchanges were extended discussions where participants engaged in the collaborative process of meaning construction, negotiating and debating each other's ideas. In addition, very high proportions of G2's exchanges reached Ph3 of meaning construction were participants were actively engaged in the collaborative processes of negotiation and debate performing elaborate negotiation functions. Furthermore, 18.18% of this mono-modal exchange reached ph5 of meaning construction where students made attempts to summarize and apply new meanings that resulted from their collaborative constructive discussions as opposed to direct requests from their tutors. Finally, a moderate rate of this audio-only exchange remained at a low level of construction for exchange of ideas and information.

In sum, audio-only extended exchanges were characterized by collaborative constructive discussions that reached high levels of meaning construction rather than simple exchange of information and ideas. Results then indicated that engagement in successive responses facilitated the active creation of zones of proximal development for collaborative meaning construction.

4.6.2.2. I-R-RC-F (A+YN)

This exchange displayed a low level of modal density as participants mainly used the audio tool and sometimes used the YN tool with the audio tool. The frequency of this exchange was very low for G2. The highest proportion of this exchange moved up to Ph3 of meaning construction. A moderate proportion of this exchange served to exchange ideas and remained at Ph1 low level of meaning construction.

There is no evidence that the mediation of the YN tool used along with the audio tool helped interaction reach this high level of construction. However, results show that

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engagement in successive RC interactions helped students create their ZPD to engage in a collaborative process of negotiation and argumentation that paved the way towards meaning construction.

4.6.2.3. I-R-RC-F (A+C)

Results showed low proportions of I-R-RC-F (A+C) for both groups. G1 participants engaged in the process of debate and argumentation where discussions reached Ph3 of meaning construction. In addition, more than 30% of these exchanges reached Ph5 of meaning construction where students built consensus, constructed a new shared understanding and made attempts to apply it. Only a low proportion of I-R-RC-F (A+C) exchanges remained at Ph1, i.e. low level of meaning construction. In addition, all G2's I-R-RC-F (A+C) reached Ph3 of meaning construction. Finally, only very low proportions of both groups' exchanges reached Ph5.

Hence, high proportions of this exchange reached high levels of meaning construction which indicated that the simultaneous use of the audio and chat tools offered positive affordances for constructive engagement in successive responses for negotiation and debate of each other's ideas. This was illustrated in the following example:

Extract 4.2

A T	C T	WB T	A	C	WB
0.05		0.05	(5) T2. Dans votre pays est-ce que les femmes et les hommes ont le même statut en politique est-ce qu'il y a plus d'hommes que de femmes ou non **I**		Parité Où en est la parité dans votre pays? Les femmes sont-elles bien représentées? Que pensez-vous de la parité?
0.06			(6) St9. En Espagne c'est mieux maintenant qu'avant mais ce n'est pas le même nombre de femmes que les hommes dans le gouvernement mais il y en a pas mal **R A 4**		
0.06 .30			(7) T2. D'accord et en Angleterre est-ce que les femmes et les hommes ont le même statut **F A 6 + IC A 4**		
0.06 .55			(8) St10. Enfin la grande partie dans la politique c'est les hommes généralement les heures de travail sont un peu difficiles avec les femmes avec des familles les femmes ne sont pas bien présentées en Angleterre **R A 7**		
0.07 .10			(9) T2. D'accord je comprends expliquez moi s'il vous plait svp pourquoi les horaires sont un problème pour les femmes **F A 8 + IC A 8**		
0.07 .35			(10) St10. C'est parce que les heures ne sont pas fixes souvent il faut travailler très tard dans la nuit **RC A 7 + A 9**		
0.07 .58			(11) T2. c'est ça et au niveau local ce n'est pas un gros problème mais au		

			niveau national c'est un problème est-ce que vous pensez qu'il est possible à l'avenir d'obtenir la parité c'est-à-dire atteindre un nombre égal de femmes et d'hommes au parlement par exemple **F A 12 + I**		
0.08 .45	*0.09* *.02*		(12) St11. Est-ce que c'est possible d'avoir plus de parité c'est ça la question ok je pense il y a enfin on peut dire que les femmes s'intéressent moins à la politique *c'est pour ça il y a* moins de femmes elles ne s'intéressent pas à la politique autant que les hommes **R A 11**	(2) T2. *Oui* **R A 12**	·
0.09 .08	*0.09* *.20* *0.09* *.35*		(13) St12. Je ne dirais pas qu'elles s'intéressent moins mais je pense que c'est à cause des enfants peut-être comme l'a dit St10 c'est une carrière qui demande beaucoup de temps si on pense par exemple quand on avait *Margaret Thatcher* les livres nous disent qu'elle avait beaucoup de difficultés avec elle-même parce qu'elle savait qu'elle ignorait quand-même beaucoup ses enfants en étant politicienne elle savait qu'elle avait beaucoup de sacrifices à faire vis-à-vis des enfants c'est pour ça peut-être qu'elles ne vont pas loin ou peut-être *simplement* les hommes quand même continuent à ne pas prendre au sérieux les femmes je ne sais pas c'est une question ouverte **RC A 11 + A 12**	(2) St10. *Oui je suis d'accord* **RC A 13** (3) T2. *Très bien les enfants et les horaires* **F A 13**	
0.09 .57			(14) St9. Je suis d'accord et peut-être aussi que les femmes s'intéressent mais elles peuvent aller aux réunions locales que celles au niveau national c'est plus facile que de se déplacer tout le temps **RC A 13 + A 11**		·
0.10 .02	*0.10* *.32*		(15) St11. Ça m'est venu a l'esprit c'est possible que les femmes s'intéressent au niveau local parce qu'elles s'intéressent plus aux sujets qui touchent la communauté autour d'elles par exemple *comme les hôpitaux* les écoles elles s'intéressent à leurs communautés moins aux choses plus grandes vous comprenez ce que je veux dire **RC A 14**	(4) T2. *Sujets qui touchent la communauté locale très bien* **R A 15**	
0.11			(16) T2. Je suis d'accord et St10 à votre avis pourquoi on s'intéresse davantage au niveau local		

			F A 15 + IC A 15		
0.11 .20			(17) St10. Je suis d'accord avec St11 souvent les problèmes de la communauté par exemple les écoles toutes les choses avec la vie quotidienne et locale sont intéressantes pour les femmes pour la raison que normalement c'est les femmes qui s'occupent des enfants elles vivent plus que les hommes dans la communauté elles sont plus concernées et touchées par ces problèmes RC A 16 + A 15		
0.12 .02			(18) T2. Elles sont plus impliquées dans la communauté que les hommes parce qu'une partie des hommes ne travaillent pas sur place contrairement aux femmes à cause des enfants elles doivent être sur place elles s'intéressent davantage aux choses pratiques de la vie quotidienne maintenant à votre avis quelles sont les conséquences de la sous représentation des femmes au niveau national RC A 17 + A 15		
0.12 .45	0.12 .58		(19) St10. Je pense que c'est une chose très mal est que ce problème local comme les écoles avec la vie quotidienne qui sont importants pour les femmes ne sont pas représentées suffisamment dans le *niveau national* c'est le grand problème RC A 23	(5) T2. *Sous représentations des problèmes pratiques de la vie quotidienne* F A 19	
A T	C T	W B T	A	C	WB
0.13 .05	0.13 .25		(20) St9. Oui je suis d'accord il y a une sous représentation des femmes on n'écoute pas tous les opinions donc c'est difficile de savoir ce que les femmes demandent ou ce dont elles *ont besoin les opinions* des femmes qui peuvent être différents RC A 19 + C 5	(6) T2. *On ne tient pas assez compte de l'avis des femmes pour tout ce qui concerne la vie quotidienne* RC A 19 + A 20	
0.13 .55			(21) St11. C'est difficile à dire je dois dire d'abord que quand il y avait le gouvernement de Blair il y avait beaucoup de femmes dans le gouvernement et je n'ai pas trouvé que la présence de beaucoup de femmes a forcement donné de meilleurs résultats c'est vrai que les femmes ont une façon de penser et de raisonner différente elles sont plus pratiques elles ont un sens de	(7) T2. *Le sens pratique. Elles ont plus de sens pratique que les hommes* RC A 20 + A 21	

	0.14 *.15* *0.14.* *50*		pratique mieux que les hommes elles ont de l'expérience avec les choses pratiques comme *l'éducation des enfants* et côté médical les hôpitaux comme ça elles ont quelque chose certainement à apporter peut-être que les hommes les hommes ont d'autres atouts je pense que dans une vie idéale ça serait bien d'avoir une représentation égale mais en général quand les femmes ont du pouvoir c'est parce qu'elles ont un caractéristique très masculin donc ça n'apporte pas beaucoup de choses *à mon avis* RC A + C 7 + C6	(8) T2. *Ah un caractéristique masculin intéressant un nouveau point* RC A 21	
0.15			(22) St10. Oh un caractéristique très masculin oui T1 c'est intéressant mais ce n'est pas le cas de toutes les femmes il y a beaucoup de femmes politiciennes qui ont beaucoup fait pour leur villes et leur pays comme Thatcher et d'autres et elles étaient des femmes avec des caractéristiques très femmes RC A 21 + C 8		
0.15 .35			(23) St9. Moi je pense qu'elle veut dire que les femmes finissent par être influencées par les hommes comme elles sont une minorité comparée aux hommes ce n'est pas elles se comportent comme des hommes je pense RC A 22 + A 21		
0.15 .55			(24) St13. Oui je suis d'accord avec vous les deux mais après des femmes comme Thatcher il y en a pas beaucoup RC A 23 + A 22 + A 21		
0.16 .20			(25) St10. Oui je comprends ce que tu veux dire oui je pense que c'est un bon argument RC A 13 + A 24		
0.16 .56			(26) T2. Très bien donc la parité est quelque chose de souhaitable dans la politique dans la vie quotidienne en général. F A (the whole exchange)		

In this example, T2 posted a picture with a list of questions using the WB tool. She invited students to discuss the questions. Students mainly used the audio tool while making

few attempts to simultaneously use the chat. T2 initiated by controlling the flow of interaction, attributing turns and inviting students to respond to her exploratory questions. Then, she changed her behaviour, withdrawing from direct control of online interactions using the chat to monitor students' interactions. Discussion developed from I-R-F exchanges to more elaborate I-R-RC-F exchanges where students engaged in successive responses building on each other's ideas. The switch between the different types of exchanges was operated via the simultaneous use of the chat and audio tools. The switch created better opportunities for negotiations about ideas to gain a common understanding about the importance and the extent to which women participate in political life.

At turn (A 5), T2 asked an open exploratory question inviting all students to contribute. From turn (A 5) to turn (A 11), students were engaged in the process of cumulative negotiation which was defined as the process of adding positively to each other's ideas without challenging them. However, in turn (A 11) T2 asked an exploratory question that aimed at challenging her students' views. This reflected the tutor's attempts to engage students in the process of argumentation rather than cumulative negotiation. Her attempt was successful and students started to challenge each other's ideas (from A 18 to A 23), where they reached a negotiated agreement at turn (A 24) and built consensus at turn (A 25). Meanwhile, T2 withdrew from oral discussion using the written mode to guide and support her students' discussions by summarizing the most important points for students to build on. Students referred to the tutor's chat contributions as well as other students' audio contributions, building on them their own contributions. Furthermore, students explicitly stated in their contributions that their contributions built on others' contributions.

So the tutor's exploratory request and the simultaneous use of the audio and chat tools offered positive affordances for the creation of collaboration opportunities that served to move discussions up from cumulative negotiation to upper levels of collaborative meaning

construction where they started negotiating agreement that resulted in the creation of consensus and a common understanding concerning the role of women in political life.

Thus, this example highlighted the important role played by the tutor as well as the affordances of the simultaneous use of the chat and audio tools to promote students' engagement in I-R-RC-F and IC-R-RC-F. The simultaneous use of the chat and audio tools facilitated the smooth transition from a unidirectional cumulative discussion to a collaborative constructive discussion. T2 used the audio tool to launch the negotiation process, and the chat tool to monitor and support students' interactions in a less explicit and direct way. This extract showed that chat contributions provided the needed cognitive support to scaffold and facilitate students' collaborative efforts. Thus, the withdrawal of T1 from direct interactions using the chat tool to play the role of facilitator and scaffolder helped students to focus on each other's ideas, creating new understandings and meaning.

Thence, when engaged in I-R-R-F and IC-R-RC-F (A+C) exchanges, students could create their zones of proximal development where they supported each other by exchanging their understandings and building new ones. The chat tool provided tutors with the opportunity to adjust their roles according to the pace of discussions and their students' needs.

Nevertheless, focus on the importance of the argumentation process did not imply underestimation of the importance of cumulative discussions and negotiations. On the contrary, it paved the way to argumentation. This was demonstrated in this example by the way students carried on building on each other's ideas till they reached a point of disagreement that triggered a cognitive conflict.

4.6.2.4. I-R-RC-F (A+WB)

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The frequencies of this type of exchange were low for both groups. However, all I-R-RC-F (A+WB) exchanges reached high levels of negotiation, debate and application of new meanings. The simultaneous use of the audio and WB tools offered positive affordances for the enhancement of collaborations that led to the creation and application of new meanings (see Extract 4.3).

Extract 4.3

A T	WB T	A	WB
0.28.00	0.28.00	(67) St1. moi je pense que je réduirais les heures de travail à 32 heures par semaine **R A 66**	Si j'étais président... faire bâtir des habitations vertes réduire les inégalités transformer la société changer le système abolir le transport aérien informer les citoyens
	0.29.15		(4). St1. Si j'étais présidents je réduirais les heures de travails à 32h par semaine **R A 66**
0.29.45		(69) St3. Si tu réduisais le temps de travail les gens seraient mécontents **R A 66**	
0.30		(70) St2. Ah non je crois que les gens auraient beaucoup de temps pour leur famille pour eux c'est vrai moins d'argent mais plus de temps pour profiter **RC A 69**	
0.30.5		(71) St1. Mais pourquoi St3 pourquoi les gens seraient mécontents si on réduisait le temps beaucoup de gens aimeraient avoir du temps libre **RC A 68 + A 69**	
0.31.3		(72) St3. Oui je prends le cas de la France par exemple les gens ne sont pas contents de la réduction 35 heures parce qu'ils ne gagnent pas beaucoup d'argent **RC A 71**	

This example was similar to the first extract where students were invited to use the whiteboard and the audio tools to apply newly constructed meanings. In this example, T2 withdrew from explicit organization of students' interactions giving students more opportunities to interact and build on each other's ideas. Besides the use of the whiteboard as a visual and a cognitive support, the tutor's withdrawal involved students in the process of argumentation, spontaneously using the newly learnt knowledge rather than remembering and trying to restate the grammatical rule. In behaving in such a way, students demonstrated complete internalization of the grammatical rule as well as a good understanding of the meanings implied by the application of this rule. This indicated that the use of the audio and the whiteboard tools, the type of task but above all the tutor's strategies helped students to engage in this elaborate exchange where they spontaneously applied the grammatical rules showing their understanding of the rules.

4.6.2.5. I-R-RC-F (A+C+WB+YN)

Exchanges of type I-R-RC-F (A+C+WB+YN) displayed a high level of modal density, where participants used all of the available tools of communication. Both groups behaved in the same way. High proportions of this exchange reached Ph3 (G1: 62.5%, G2: 50%) and Ph5 (G1: 37.5, G2: 50%) of meaning construction. It seems that the affordances of the simultaneous use of the different tools provided opportunities for students to create ZPD to engage in collaborative constructive discussions to reach consensus and build new knowledge that they finally applied. The following extract (Extract 4.4) illustrates this point:

Extract 4.4

A T	C T	W B T	YN T	A	C	WB	YN
0.25. 50				(87) T2. Nous allons trouver des arguments pour ou contre vous allez essayer d'écrire sur le tableau donc nous allons avoir un débat sur la nourriture bio qui veut commencer I			
0.26. 45		0.		(88) St11. Je commence par contre ils sont chers et aussi la forme ils sont irréguliers et ils sont *difficiles à laver* et il est difficile de préparer les légumes bio **R A 87**		(5) St11. *Trop cher* RC A 87 + A 87	
0.27. 00	0.27. 55	0.27. 30		(89) St12. c'est vrai je ne savais pas que les légumes bios étaient difficiles à laver et travailler avec pour moi je crois *qu'il n'y a* pas une évidence scientifique pour dire que les produits bios sont beaucoup mieux que les produits fraiches qu'on achète *au supermarché* et c'est pour ça il ne vaut pas de payer plus cher **RC A 88**	(7). T. *produits frais* F A 89	(6) T2. *Difficile alimentation* F A 89	
0.28. 10		0.28. 35	0.28. 37	(90) St11. Mais c'est bien que les légumes *soient naturels* que les méthodes pour faire croître sont plus naturelles même s'il n'y a pas de preuves scientifiques **RC A 89 + RC WB**		(7) St11. *Pas de preuves* RC A 89	(15). St10. *oui* RC A 90
0.29. 00				(91) St12. Moi je ne trouve pas que les légumes sont plus naturels **RC A 90**			
		0.29. 45				(8) T. la nature F A 91	
0.29. 50				(92) St10. Moi je ne suis pas d'accord le bio est de meilleure qualité **RC A 91**			
		0.30. 38				(9) St10. Meilleures méthodes RC A 92 + A 91 + WB 7	
0.30. 45				(93) St9. Oui moi aussi je pense que le bio est très bon pour la santé il est plus naturel **RC A 92**			
		0.31. 10				(10) T2.	

						meilleure qualité F A 92	
0.31. 15				(94) St10. Oui c'est ça ils sont plus naturels parce que le niveau des pesticides est plus bas RC A 93			
		0.31. 40				(11) T2. bon pour la sante Plus sain F A 94 + A 93	
0.31. 45		0.31. 50		(95) St11. Avec les produits bios il n'y a pas de comment dire *ils ne sont pas* modifiés on ne met pas des produits affreux pour qu'ils soient plus grands et les rivières sont moins empoisonnées parce qu'avec les produits non bios pour les autres produits il y a beaucoup de choses qui meurent comme les poissons dans les rivières quelques plantes et tout ça RC A 94		*(12) T. moins chimiques* F A 94	
0.32. 50				(96) T2. Très bien dernière question est-ce que le bio permet de lutter contre le stress selon vous F A 95 + I			
	0.33. 20				(8) T. est-ce-que le bio permet de lutter contre le stress ? IC A 96		–
0.33. 40	0.34. 00			(97) St12. Pour moi je pense on devient plus stressée si on pense qu'il faut manger ça ou ne pas manger ça qu'est ce qu'il faut faire il faut manger des *aliments fraiches* je pense R A 96	(9) T. *aliments frais* F A 97		
0.34. 16	0.34. 17	0.34. 25		(98) T2. Les aliments frais c'est masculin oui très bien argument *continuez* F A 97 + IC 96	(10) St12. *merci* R C 9	(13) T. *On réfléchit trop Trop d'efforts* F A 97	
0.34. 27				(99) St10. Pour moi le stress est moins quand je mange les produits bio le stress n'est pas un problème avec moi avec le bio RC A 96 + A 97			
0.34. 56			*0.35.*	(100) T2. D'accord moins de stress avec le bio St13 est			(16). St13. *Oui*

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			05	d'accord F A 99 + IC			RC A 99
0.35. 25				(101) St10. Quand j'achète les produits bio je fais trop d'effort dans ma vie ça c'est bon pour ma vie je ne sais pas si c'est contre le stress RC A 100 + A 99			
0.35. 50				(102) St15. Le problème pour moi c'est qu'il faut manger bien des choses bonnes pour la santé moi je mange beaucoup de nourriture bio RC A 99			
0.36. 20				(103) St11. Je ne suis pas convaincue que le bio réduise le stress aussi produire les produits bio prend beaucoup de temps et beaucoup de travail pour donner à manger à tout le monde ça ne marche pas je crois RC A 102 + C8			
0.37. 10				(104) St15. Je me sens en très bonne santé quand je mange les produits bios RC A 103			
0.37. 30				(105) St11. Je suis sûr comme que les produits bio sont beaucoup meilleurs RC A 104			
0.37. 50				(106) St12. Les produits bio aident à lutter contre le stress pour ça peut-être si on pense on pense ou on essaie de cuisiner on pense que ce qu'on mange est mieux pour la santé et ça nous fait du bien peut-être ça réduit le stress mais je ne suis pas convaincue qu'on ne peut pas le faire avec n'importe quel produit frais RC A 105			
0.38. 45				(107) T. Excellent St13 est-ce que vous pouvez écrire j'adore le bio sur le tableau F A 107			
		0.40				(14) St13. J'adore le bio R A 107	
0.40. 02		0.40. 25		(108) St10. Moi je dirais je déteste le bio parce qu'il est cher et nous avons huit enfants et c'est beaucoup pour moi RC A 107 + A 106 + WB		(15) T. C'est le prix F A 108	

0.40. 40						Débat: pour ou contre le
						Pour la nature méthodes naturelles meilleure qualité bon pour la santé

In this example, T2 explicitly invited students to challenge each other's ideas using the audio as well as the WB tools. The nature of this task and the tutor's requests suggested that students were expected to provide conflicting views. T2 invited her students to provide their views and arguments and withdrew from direct interaction using the chat tool to comment on their contributions and correct their mistakes. In addition, she used the WB tool to summarize their important points inviting them to build on them. Hence, the WB tool was used as a visual and a cognitive support to students' collaborative efforts. T2 adjusted her tutorial roles using the different tools of communication. She provided feedback using the chat tool, invited students to negotiate and debate their views using the audio tool, and provided directions, guidance and scaffolding using the WB tool.

Discussion progressed from low levels of meaning construction where students cumulated information to high levels where they negotiated and debated cumulated information and ideas. Students used the audio tool and made few attempts to use the YN as well. Students started by expressing their views and providing arguments in support of them. In turn (A 90), St11 used the audio and the WB tools to disagree with St12's audio and written contributions, and defend her views. This rejection was justified and supported by St10's agreement using the YN tool. As a response, different students started challenging St12's views using the audio and the whiteboard tools to assert, defend, challenge and counter-argue

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each other's ideas. In turn (A 96), T2 used the audio tool to make an exploratory request inviting students to debate a particular idea when they were discussing. Students responded positively and engaged in the process of argumentation, debating their different views using the audio, the WB and the YN tools. St12 started by rejecting the idea proposed by T2. As a consequence, different students started using the audio tool, referring to their tutor's WB contribution, using elaborate negotiation functions (clarifications, assertions, challenges, counter-arguments and finally negotiated agreements and concessions) to construct new understandings and meaning. This example shows the extent to which the withdrawal of T2 from oral interactions by using the written mode using the WB and the chat tools fostered the negotiation process as well as autonomous learning activity. In addition, students referred to T2's WB contributions and build on them. This shows that the use of the WB tool by tutors and students offered positive affordances serving as a cognitive support. I reach the same conclusion as for the preceding examples: tutors switched to use the written mode to adjust their roles, providing more opportunities for students to create their ZPD where they engage in a collaborative process of negotiation and debate aiming to support each other to create new understandings and meanings. On the other hand, the simultaneous use of the audio, the chat and the WB tools offered positive affordances that facilitated engagement in successive and simultaneous responses (RC) that facilitated shared meaning construction.

This particular example thus showed that the simultaneous use of the different tools offered positive affordances that helped students actively engage in the collaborative process of meaning construction. Extract 4.5 exemplifies this conclusion:

Extract 4.5

T A	T C	T WB	T YN	A	C	WB	YN
		0.10 .45		(I) T1. ..... Je vous invite maintenant à discuter le développement technologique c'est-à-dire les avancées scientifiques et technologiques sont-elles bénéfiques pour la société Vous allez utiliser le tableau pour résumer les arguments les plus intéressants I			
		0.12 .10				(1) St2. Les avancés ne sont pas toujours bonnes **R A 1**	
T A	T C	T WB	T YN	A	C	WB	YN
0.1 2.1 5		0.12 .25		(2) St2. Les avancées sont beaucoup mais de temps en temps il y a des *problèmes avec les sciences et font* des choses qui ne sont pas bons **R A 1**		(2) St3. *Ordinateurs qui tombent en panne, perte des données, problèmes d'internet* **RC A 1 + WB 1**	
0.1 2.3 5	0.12 .55			(3) St3. Oui St2 je suis d'accord si on prend l'exemple des ordinateurs ils tombent en panne des fois on peut perdre *toutes nos données* et aussi il y a des personnes qui peuvent nous embêter sur internet donc il ya des avantages et des inconvénients **RC A 1 + A 2**	(1) St1. *Oui très bien mais on met sa dans l'introduction ?* **RC A 2 + A 3 + WB 1 +WB 2**		
0.1 3.1 0			0.1 3.3 5	(4) St1. Oui je pense que tout d'abord on peut faire une introduction sur le sujet le développement des sciences on dit qu'il y a beaucoup de			(1) St2, (2) st3, (3) st4, (4) st5, (5) st6. **Oui RC A 4 + C 1**

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				progrès puis parler de pour *et contre* qu'est-ce que vous en pensez RC A 2 + A 3 + WB1 +WB 2+ C 1		
0.13.40	0.14.05	0.13.45 0.14.13 0.14.20		(5) St4. Pour le développement Alors oui *alors on* peut dire que l'université souvent perd du temps et de l'argent à faire des études pour des choses qui ne sont pas bonnes pour *la société des recherches contre l'humanité comme le nucléaire et les OGM qui causent beaucoup de maladies* RC A 4 + C 2 + WB 3	(2) St1. *Oui mais il y a des choses positives !* RC A 5 WB 4	(3) St1. *Introduction. Il y a beaucoup de progrès et d'avantages* RC A 3 + A 4 +C1 (4) St3. *Que perdre du temps et de l'argent* RC A 5 (5) St1. *De temps en temps il y a des choses des études positives* RC A 5 + C 2 WB 5
	014.21					(6) St1. Des recherches sur des maladies graves RC A 5 + WB 4
0.14.35				(6) St2. Mais aussi la science maintenant fait beaucoup de mal comme les modifications des légumes et des fruits qui sont mauvaises et dangereuses RC C 5 + WB 5 + WB 6		
0.15.10	0.15.25 0.15.30	0.15.28 0.15.32		(7) St4. Oui je suis d'accord moi aussi par exemple internet est dangereuse pour les enfants ils passent leur temps à jouer sur *internet c'est dangereux pour leur développement physique et mental* RC A 6 + IC A 3 WB 2	(3) St1. *Oui mais internet est utile comme notre court !* RC A 6 + A 7 (4) St2. *Oui mais elle est plus dangereuse que bénéfique* RC C 3	(7) St2. *Fruits et légumes pas naturelles modifies !* RC A 6 (8) St1. *Communication moins chère et court en ligne* RC A 7 + C 3
0.15.43				(8) St5. Oui mais La communication est plus facile et moins		(9) St3. *Internet et les ordinateurs sont*

		0.15 .54		chère internet permet à tout le monde de communiquer même *à l'autre coté du* monde donc c'est un point positif pour la science RC A 7 + C 3 + WB 8 + WB 9		*parfois un problème* **RC A 7 + WB 8**	
0.1 6	0.16 .20			(9) St2. Oui ca c'est vrai mais il y a un autre problème je peux dire que la science ne respecte pas l'éthique pour faire des essaies comme le clonage qui n'est *pas très éthique* pour les êtres humains **RC A 8**	(5) St3. *Oui je suis d'accord bonne idée* **RC A 9**		
0.1 6.2 7	0.16 .50, 0.17 .0	0.16 .30, 0.16 .53		(10) St1. Je reviens sur notre idée précédente je ne suis pas d'accord ça ne veut pas dire qu'il n'y a pas de bonnes choses les recherches sur les cancers et le sida sont meilleures et les médicaments *sont mieux qu'avant et les recherches sont éthiques donc on ne peut pas généraliser il y a des domaines ou la science n'est pas éthique mais c'est très limité je pense St2* IC WB 6 + A 9	(6) St4. *Mais il n'y a pas des avancées pour les médicaments des maladies mentales par exemple !* **RC A 10** (7) St2. *Je suis d'accord St3 et St1 mais pour le clonage c'est éthique !?* **RC A 10**	(10) St2. *La science ne respecte pas l'éthique* **RC A 9** (11) St4. *Pas de médicaments pour les maladies mentales* **RC A 9**	
0.1 7.1 2	0.17 .18	0.17 .25	0.1 7.3 5	(11) St3. Je reviens sur ce que tu as dis St1 et ce que St4 a écrit en haut St1 je ne suis pas tout à fait d'accord il n'y a pas des avancées pour les problèmes psychiatriques par exemple mes deux parents ont l'Alzheimer et il n'y a toujours pas des médicaments pour ça	(7) St1. Oui je suis d'accord pas tous les domaines sont développés mais je pense que les OGM est une bonne idée RC A 11 + C 6 + WB 11	(12) St1. Il y a des médicaments mais pas pour toutes les maladies **RC A 11 + C7**	(6) St8. Oui RC A 11+ C 7 + WB 12

				donc il reste beaucoup à faire des domaines qui ne sont pas très développés .... Il n'y a pas égalité de subvention des domaines de recherche l'éducation, l'histoire la médecine... RC A 11 + WB 11			
0.17.45				(12) St7. Oui je suis d'accord avec toi aussi je reviens sur la même idée les organismes génétiquement modifiés qu'est-ce que vous pensez c'est une bonne chose ça St1 je ne pense pas RC A 11 + A 4 + C 7			
0.18.10	0.18.18	0.18.25		(13) St6. C'est une question avec beaucoup de discussion car il y a beaucoup *de personnes qui mangent* ça et ce n'est pas bon d'avoir des trucs modifiés pour *la santé il faut penser à* arrêter ça la science ici est dangereuse RC A 12	(8) St1. *Non pas tout à fait!* RC A 12 + A 13	(13) St2. *OGM mauvais pour la sante* RC A 12 + 13	
0.18.30				(14) St1. Oui c'est un problème avec les modifications génétiques et la qualité de la nourriture mais le problème dans le monde il y a beaucoup de gens et il y a pas assez de production pour tout le monde et ces modifications ne sont pas très mauvaises je pense qu'on exagère RC A 12 + WB 13			
0.19.10		0.19.20	0.19.2	(15) St2. Mais il y a des gens qui font des choses mauvaises avec ces *modifications c'est dangereux* pour		(14) St3. *Risque pour les prochaines générations* RC A 15	(7) St8. *Oui* RC A 15 + WB 14

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			8	l'avenir de nos enfants des prochaines générations moi j'ai peur pour mes enfants et mes petits enfants RC A 14			
0.1 9.3 2	0.19 .40	0.19 .32		(16) St8. Oui *je suis d'accord* je doute que ce soit une bonne idée et il y a dans la société nous avons des maladies et *les problèmes déjà* à cause de ça déjà RC A 15 + WB 14	(9) St2. *Je ne pense pas St1 !!* RC WB 15	(15) St1. *Mais Il y a des médicaments grâce a ces modifications* RC WB + A 15 + aud 16 + A 14	...
0.1 9.5 0				(17) St1. Le bénéfice de ces modifications c'est le développement des nouvelles techniques en termes de médicaments et la chirurgie esthétique par exemple RC A 16 + A15 + C9			
0.2 0.1 2				(18) St2. C'est dangereux oui les maladies ce ne sont pas améliorées avec ces médicaments au contraire les maladies se sont aggravées RC A 17 + WB 15			
0.2 0.1 8 .	0.20 .48	0.28		(19) St3. J'ai lu que les chercheurs introduisent des vitamines dans le riz qui est adressé à des pays pauvres *comme l'Afrique et* le monde moderne a prouvé que ce riz ne contient *pas les mêmes vitamines* que le riz naturel. Il est pauvre en vitamines RC A 18 + WB 15	(10) St1. *C'est pauvre mais ils ont quoi manger, donc il y a des inconvénients mais beaucoup d'avantages* RC A 19 + WB 16	(16) St4. Fruits et légumes modifiées pauvres en vitamines RC A 19	
			0.2 0.5 0				*(8) St8 (9) St7 Oui*
0.2 0.5				(20) St1. Oui donc on est d'accord que la			

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2				science a des avantages et des inconvénients et que les avantages sont beaucoup plus que les inconvénients RC A 19		
0.2 1.0 5	0.21 .10 0.21 .15			(21) St3. *Oui je suis d'accord je vais l'écrire sur le tableau* RC A 20 + C 10	(11) St2. *Oui tout a fait* RC A 21 (12) St4. *Absolument* RC A 21 +C 11	
0.2 1.2 0		0.22		(22) T1. Excellent *travail...* F (the whole exchange)		(17) St1. *Les avancées scientifiques ont des inconvénients et des avantages et les avantages plus que les inconvénients et RCA 21 + A 20*

This example showed how the different tools of communication were simultaneously used to create a common understanding of concepts and experiences. To realize this task, T1 invited students to negotiate the concept of technology using the WB tool to write their contributions. She completely withdrew from interaction, adopting the role of observer rather than a controller. The topic of this task was such that students might have conflicting ideas and engage in the process of argumentation.

The extract shows that students started responding to T1's invitations using the WB tool which triggered different conflicting views. As a response, students started building on each other's ideas, performing highly elaborate negotiation functions simultaneously using the different tools of communication as shown in the analysis of students' contributions. This extract shows that students referred to and built on each other's audio, chat, WB as well as YN contributions. What is interesting about this extract is the interplay between tools. Audio contributions triggered chat contributions that were accounted for by WB contributions that were accounted for by audio contributions and YN contributions and so on. For instance, St2

used the WB to write her idea which triggered an audio contribution where St3 built on St2's suggestion and wrote it on the whiteboard as well. Simultaneously, St1 used the chat tool to express his agreement adding on a new suggestion then switched to use the audio to justify his suggestions. At the same time, other students used the YN tool to express their agreement and then switched to use the audio tool when available to engage in the processes of negotiation and argumentation. Students used the WB tool to assert their ideas, to challenge others' ideas as well as to summarize their classmates' arguments. The simultaneous use of the WB, the audio, the chat and the YN tools to perform these elaborate negotiation functions boosted discussion up to high levels of meaning construction. This is further seen in St3's (A 11) contribution where she explicitly stated that she was commenting and challenging St1's chat contribution (C 7). For instance, St2 (C 6 and WB 10) and St3 (C 7 and WB 11) used the chat as well as the WB tools while St1 (A 10) was contributing using the audio tool, to express their disagreement and challenge his views. St1 carried on defending his views and counter-challenging St2 and St3 through posting in the chat tool. This indicated that students were able to contribute and at the same time absorb information from different tools being simultaneously used. Then, St3 (A 11) used the audio to challenge St1, who responded using the chat and the WB tools to defend and assert his ideas and counter-argue their ideas. St8 used the YN to agree with St3. Discussion showed increased levels of collaboration as students used the chat and the WB tools not just to assert their views but others' views as well. Students kept on using the chat, the audio, the YN and the WB tools until they reached a negotiated agreement and built consensus that they summarized using the WB tool. This indicated that the switch between the oral and written modes of communication helped students to organize their thinking and ideas to collaboratively construct new understandings and meanings.

This example showed how the simultaneous use of the different tools of communication offered positive affordances for the creation of interaction opportunities for every individual student to contribute and engage in the collaborative processes of meaning construction.

Furthermore, this example showed that different students (St1, St2, St3, St4, and St5) were better able than other students to contribute simultaneously using the different tools and at the same time absorbing information from these different tools of communication. This suggested that the simultaneous use of different tools of communication does not necessarily cognitively overload students. However, St6, St7 and St8 did not contribute like the other students. They demonstrated their presence and interest in the discussion by making only audio contributions. In addition, they tended to withdraw from discussion when the different tools were simultaneously used. This indicated that students demonstrated different multimodal competencies. St6, St7 and St8 had less developed multimodal competencies than their fellow students. They did not make any attempts to use the other tools apart from the audio. This was an important point to be checked when we come to the analysis of students' questionnaires.

Finally, this extract shows that the type of task also had an impact on students' extent of collaboration. This topic was appealing to students because they had very different views which triggered all these attempts to challenge each other's ideas before they could finally build consensus. Finally, the role of the tutor was also important. The decision to play the role of observer helped students assume their learning responsibilities and take charge of their own learning.

4.6.3. IC-R-F exchanges

Table 4.84 and Table 4.85 show huge differences in terms of the extent to which the different IC-R-F exchanges for both groups reached the different levels of meaning construction. G1's IC-R-F exchanges tended to reach higher levels of meaning construction than G2's exchanges.

G1	Ph1	Ph2	Ph3	Ph4	Ph5
IC-R-F (A-only)	77.27	4.54	18.18		
IC-R-F (A + YN)					
IC-R-F (A + C)	50		50		
IC-R-F (A + WB)	50	50			
IC-R-F (A + C + WB + YN)	50		50		

Table 4.82. The classification of IC-R-F multimodal exchanges into phases of meaning construction (G1)

G2	Ph1	Ph2	Ph3	Ph4	Ph5
IC-R-F (A-only)	66.66		33.33		
IC-R-F (A + YN)	50				
IC-R-F (A + C)	66.66		33.33		
IC-R-F (A + WB)					100
IC-R-F (A + C + WB + YN)	50	50			

Table 4.83. The classification of IC-R-F multimodal exchanges into phases of meaning construction (G2)

4.6.3.1. IC-R-F (A-only)

One of the possible variations in turn sequence takes the form of IC-R-F where an IC functions as a reinitiating turn with respect to the preceding element and as an initiation with respect to the following one.

We registered higher proportions of this exchange for G1 than G2, which was expected since T1 re-initiated more than T2. High proportions of both groups' exchanges remained at a low level of meaning construction. Only low proportions of both groups exchanges reached Ph3 phase of negotiation and debate of ideas. Tutors' re-initiations succeeded in moving individual contributions up to high levels of construction and negotiation. Finally only a very

low proportion of G1s' exchanges remained at Ph2 where participants expressed their disagreement without any negotiation.

4.6.3.2. IC-R-F (A+YN)

For Gr1, I could not make any records of contributions that corresponded to IC-R-F (A + YN) exchanges. However, concerning Gr2, all exchanges remained at a low level of exchange of ideas, opinions and information. Hence, this pattern is characterized by low level of discussion.

4.6.3.3. IC-R-F (A+C)

For both groups, the pattern related to this particular multimodal choice was an exchange where a high proportion of limited short discussions was dedicated by tutors to exchange ideas and information, as well as to engaging in the process of negotiation with her students. Despite the slight difference between the frequencies of this exchange for both groups, the use of the audio and the chat tools to reinitiate previous topics helped move individual discussions up to high levels of construction, although no opportunities for collaboration were created.

4.6.3.4. IC-R-F (A+WB)

There was an important difference between the purposes of G1's and G'2s IC-R-F (A+WB) exchanges. T1 re-initiated previous topics using the WB and the audio tools to provide more information and invite students to express more opinions as well as point out

dissonance. However, a low proportion of IC interactions moved up to Ph5 of meaning construction. The simultaneous use of the oral and written modes helped students to engage in elaborate interactions. However, their focus was on their individual contributions rather than collaborative meaning construction (see Extract 4.6).

Extract 4.6

T A	T WB	A	WB

0.50.20	0.50.00	(30) T1. Alors nous passons à faire un peu de grammaire maintenant
		F A 29 + A 28
			(1) T1.
			Les verbes impersonnels
			
			En politique...
			Il arrive que
			      Il est certain que
			Il est certain que
			      Il est clair que
			    Il s'agit de
			Il semble que Il ne suffit pas que
			      Il est important que
			Il faut
			     Il est probable que
			Il faut que
			      suffit de

0.50.35		(31) St1. Il semble que les femmes soient moins intéressées en politique **R A 30**	
	0.50.45		(2) St1. Il semble que les femmes soient moins intéressées en politique **R A 30**
0.50.55		(32) T1. Oui St2 maintenant **F A 31 + IC A 30**	
0.51		(33) St2. Il est clair que les femmes sont moins représentées dans la politique que les hommes **R A 30**	(3) St2. Il est clair que les femmes sont moins représentées dans la politique que les hommes **R A 32**
	0.51.15		
0.51.25		(34) T1. Oui très bien **F A 33 + IC A 30**	
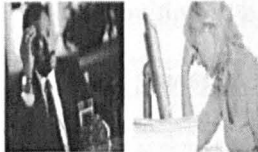
One type of meanings that students were invited to construct was the situation of use of different grammatical rules. Extract 4.6 shows that T1 had control over the distribution of

turns inviting each student to use the audio tool to reply and then write her reply using the whiteboard tool. This was an invitation for students to focus on their own contributions without building on each other's ideas. Their individual contributions were at a high level since they used an elaborate negotiation function which was application. However, exchanges themselves remained at a low level of construction since students did not collaborate to apply any new knowledge. Thence, despite the use of the different tools of communication and performance of elaborate negotiation functions, exchanges remained at a low level of construction due to the exclusion of collaboration where multimodal exchanges were reduced to a simple exchange between the tutor and an individual student. Results indicated that the high degree of control exercised by the tutor on the organization of interaction limited students' opportunities for collaborative applications of their shared new meanings. In addition, there was no evidence that students were building on others' contributions as there were no explicit references to each other's whiteboard contributions. T1 did not explain the aim behind using the written mode. This might explain the fact that students used it just to write their answers without referring to others' WB contributions.

4.6.3.5. IC-R-F (A+C+YN+WB)

As was the case with the preceding pattern, T1's re-initiations were meant to share information as well to engage in the process of negotiation with her students. Some of G1's exchanges remained at a low level of meaning construction while others reached high levels (Ph3). However, T2 devoted these exchanges to sharing information (Ph1) and discussing points of dissonance and disagreements (Ph3). G2 exchanges did not reach higher levels of meaning construction (see Extract 4.7).

Extract 4.7

A	WB	A	WB
0.45	0.45	(84) T2. On passe à un autre sujet à votre avis que devraient ces deux personnes faire pour être mieux dans leur peau F A 83 + I	**La forme** Que devraient-ils faire pour être mieux dans leur peau? *Il pourrait...* *Elle devrait...* *Je leur recommanderais...*
0.45 .30		(85) St9. Je pense qu'ils devraient manger plus R A 84	
0.45 .45		(86) T2. Comme vous ce soir St10 vous voulez rajouter quelque chose F A 85 + IC A 84	
0.46		(87) St10. Ils devraient manger sainement et bio R A 86	
0.46 .15		(88) T2. Ah très bien et Anna vous avez une suggestion pour l'homme par exemple St12 une suggestion F A 87 + IC A 84	
0.46 .25		(89) St12. Ils devraient aller danser ce soir R A 88	
0.46 .45		(90) T2. ah c'est une très bonne idée oui danser ce soir très bien et qu'est-ce qu'elle devrait faire pour qu'elle se sente bien dans sa peau cette femme oui St11 F A 89 + IC A 84	
0.47 .10		(91) St11. Peut-être ils devraient faire du yoga et du sport les deux RC A 90	
0.47 .25		(92) T2. faire du sport oui de l'exercice et vous St13 qu'en pensez-vous F A 91 + IC 84	
0.47 .45		(93) St13. Elle devrait travailler moins et passer plus du temps avec ses amis R A 93	
0.47 .57		(95) T2. Exactement elle devrait travailler moins et passer du temps avec ses amis et famille et maintenant St14 oui F A 94 + IC A 84	
0.48 .10		(96) St14. Pour la femme je crois qu'elle devrait changer de métier parce que la vie est très courte pour l'homme je lui recommanderais de boire du bon vin parce que la bière ce n'est pas bon RC A 95	

In this example, T2 made exploratory requests inviting students to apply previously built grammatical knowledge. She posted a picture on the whiteboard and invited each individual student to comment on it using the audio tool. There was an exclusive use of the audio tool that was supported by the use of the whiteboard by T2. The whiteboard served as a visual as well as a cognitive support for students. Pictures helped students to imagine the situation, inferring meaning to construct the appropriate suggestions using the appropriate grammatical rule.

As far as the level of meaning construction is concerned, students used elaborate negotiation functions trying to retrieve and apply newly constructed meaning which made their individual contributions reach Ph5 of meaning construction. Despite the repetitive exploratory requests of T2, collaboration between students did not take place as she reinitiated to ask the same exploratory question, aiming at evaluating students' individual contributions and achievements. There was no follow up on previous contributions, in the sense that each student focused on her/his own contribution without building up on others' contributions as requested by their tutor. We have I-R-F + IC-R-F (A+WB) patterns that were at a low level of construction despite the fact that students used elaborate negotiation function. Despite the use of different tools of communication, this example shows that the type of task and the tutors' strategies have a direct impact on the progression of discussions to high levels of meaning construction. The high degree of control by T2 on the organization of interactions and the distribution of turns limited students' interaction opportunities.

4.6.4. IC-R-RC-F exchanges

Table 4.86 and Table 4.87 show more similarities than differences in terms of the extent to which the different exchanges reached the different levels of meaning construction for both groups.

G1	Ph1	Ph2	Ph3	Ph4	Ph5
IC-R-RC-F (A-only)			80		20
IC-R-RC-F (A + YN)					
IC-R-RC-F (A + C)			100		
IC-R-RC-F (A + WB)			100		
IC-R-RC-F (A + C + WB + YN)			50		50

Table 4.84. The classification of IC-R-RC-F multimodal exchanges into phases of meaning construction (G1)

G1	Ph1	Ph2	Ph3	Ph4	Ph5
IC-R-RC-F (A-only)			100		
IC-R-RC-F (A + YN)					
IC-R-RC-F (A + C)			66.66		33.33
IC-R-RC-F (A + WB)			50		50
IC-R-RC-F (A + C + WB + YN)			62.5		37.5

Table 4.85. The classification of IC-R-RC-F multimodal exchanges into phases of meaning construction (G2)

4.6.4.1. IC-R-RC-F (A-only)

The frequencies of this pattern were low for both groups. Tutors initiated previous topics by inviting participants to build on already suggested ideas where students engaged in successive RC interactions to build on each other's contributions. Results showed that IC-R-RC-F were collaborative exchanges where students work together to construct a shared meaning. These exchanges may be described as exploratory exchanges where students built on their tutors' exploratory exchange to explore each other's ideas and opinions. Some of G1's exchanges reached Ph3 of meaning construction while others reached Ph5 where consensus was reached and new knowledge was summarized and applied. These exchanges are

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collaborative and students reached this high level of construction as a result of their collaborative efforts clarifying, arguing and challenging each other's ideas. All G2's exchanges reached Ph3 of meaning construction, negotiating and debating their views.

4.6.4.2. IC-R-RC-F (A+YN)

There were no such exchanges therefore they do not appear in my data.

4.6.4.3. IC-R-RC-F (A+C) and IC-R-RC-F (A+WB)

As was the case with previous IC-R-RC-F patterns, this exchange reached high levels of meaning construction: G2's discussions reached Ph3 of negotiation and debate. However, G1's discussions move up to Ph5 of meaning construction where students reached consensus, reflected on their newly constructed knowledge and tried to apply it (see Extract 4.8).

Extract 4.8

A T	C T	A	C
0.13.00		(48) T1. Un jardin communautaire euh c'est formidable très bien et Janice est-ce que vous pouvez dire quelque chose sur Jn **F A 46+ IC A 38**	
0.13.25	0.13.35	(49) St2. Oui bonsoir alors St4 habite à B avec sa famille .... mais St4 disais qu'avec les enfants c'était difficile *de garder la* maison bien arrangée c'est plutôt bordélique surtout les chambres des enfants voilà **R A 48**	(2) T1. *Un jardin Terrassé* **F A 49**
0.13.50	0.13.50.	(50) T1. Très bien pour ceux d'entre vous qui ne connaissent pas ce mot (rire) *bordélique* ça veut dire a big mess nous passons à St5 **F A 49 + IC A 38**	(3) St2. *!!!* **RC A 50**
0.14	0.14.03	(51) St2. Est-ce qu'il y a un autre *mot c'est le seul* mot qui me revenait **IC A 49 + A 50**	(4) T1. *Pas bien rangée bordelique* **F A 51**
0.14.15		(52) T1. St3 qu'est-ce que vous diriez au lieu de bordélique **RC A 51**	

0.14.25		(53) St3. Bordélique c'est aussi l'état de ma maison et ben probablement mal rangée ou désordonnée R A 52	
0.14.40	*0.14.55*	(54) T1. Désordonné ça c'est très rangée à côté de *bordélique* mais je trouve bordélique c'est bien quand il y a une famille dans la maison ça décrit bien ce qui se passe donc voilà Ga vous avez une autre suggestion pour désarrangée non rangée ou mal rangée peut-être RC A 52 + F C 5	(5) St4. *Desarrange !* RC A 5
0.15.15	*0.15.16*	(55) St1. *le désordre peut être* RC A 53	(6) St6. *Pas bien entretenu !* RC A 53 (7) St3. *Oui* RC A 53
0.15.20		(56) T1. En désordre oui et pas bien entretenue oui John mais en fait c'est plus que ça quoi d'autre comme expressions F A 55 + C 6	
		(58) St2. En désordre pas désordre d'accord RC A 58	
0.15.40	*0.15.40*	(59) St2. *On dit le bazar aussi* RC A 53	(8) T1. *En désordre* RC A 58
	0.15.50		(9) St5. Ce sont des expressions très utiles pour les anglais RC A 59
	0.15.55		(10) T1. le Bazar le chantier RC A 59
	0.16		(11) St6. ah on dit le bazar! Je ne savais pas RC A 59 + C 9
0.16.05		(60) T1. Oui le bazar aussi le chantier F A 59	
0.16.15	*0.16.17* *0.16.22*	(61) T1. c'est très utile pour les Anglais merci St5 très bien je *vous remercie tous* de ce que vous avez écrit St5 et St6 *ne nous ont pas* parlé de leur conversation St6 F A 53 + A 55 + A 58 + C	(12) St5. *J'en ai trois maintenant* RC A 60 + A 59 (13) St6. *Oui merci des expressions utiles je ne connaissais pas avant* RC A 60 +C9

In this example, St2 used an informal word that triggered a long discussion where participants were drawn to use the oral and the written modes. As a result of active

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involvement of all students in collaborative negotiations, discussion moved up to high levels of construction where students reflected on the change in their understanding making meta-cognitive statements using the written and the oral modes of communication. This extract showed that all participants participated using the chat and the audio tools. In turn (A 50), T1 invited another student to reply to her question. However, the same student St3 (A 15) took the floor and invited her tutor to clarify the meaning of a word St2 used, and this was commented on by the tutor. This clarification request engaged T1 and students in the process of negotiation simultaneously using the chat and the audio tools (from A 51 till C 14). Finally, students used the written mode, using the chat tool to make different meta-cognitive statements reflecting on their learning and stating explicitly that their understanding changed as a result of this discussion. This example hence showed the importance of the simultaneous use of tools of communication to engage in the process of collaborative negotiation and argumentation. The use of the chat tool created opportunities for students to contribute without waiting for their turn to speak. In addition, T1 used the chat to write down students' contribution to sustain their memories and provide them with the cognitive support they needed to focus their attention and motivate their perception and thinking processes.

In this case, participants engaged in the process of negotiation and argumentation simultaneously using the oral and the written modes.

4.6.4.4. IC-R-RC-F (A+YN+C+WB)

Students used all the available tools to engage in successive responses to build on each other's ideas as a result of their tutors' re-initiations. An advantage of this pattern using these channels is that it supported the steady construction of shared knowledge by helping groups to reach agreement gradually. This was the only exchange patterns where meaning construction

went through the three high phases of meaning construction simultaneously using all of the tools of communication. Discussions were characterised by collaboration, negotiation, debate, argumentation, and consensus building. At the end of these discussions, students reflected on their learning experience before they summarised and applied the newly constructed agreed upon meaning.

All in all, IC and I interactions that succeeded in engaging students in RC successive interactions motivated students to use the different tools of communication to engage in high levels of meaning construction.

Extract 4.9

A	C	WB	A	C	WB
0.55.1 2		0.55.10	(97) T1. Maintenant nous revenons à notre sujet on va travailler ensemble pour ou contre le bio dites moi des arguments pour et contre le bio organic food commençant par le pour **F A 96 + IC**		Débat: pour ou contre le bio ?
0.55.3 2			(98) St4. C'est meilleur pour l'environnement **R A 97**		
0.55.4 5		0.55.55	(99) T1. oui c'est mieux pour l'environnement d'accord je vais écrire environnement St7 et les autres *dites moi* les points pour et les points contres et pourquoi **F A 98 + IC A 97**		(4) T1. *Mieux pour l'environnement* **F A 97**
0.56.1 0			(100) St7. Ils sont de meilleure qualité **R A 99**		
0.56.2 0		0.56.20	(101) St3. Les produits *bios ont un* meilleur goût **R A 99**		(5) T1. *meilleure qualité* **F** **A 100**
0.56.3 0		0.56.32	(102) St2. Je suis contre parce *que le bio* est trop cher **R A 99**		(6) T1. *meilleur gout* **F A 101**

0.56.4 0		0.56.42	(103) St5. Je suis pour c'est *mieux pour* la santé R A 99		(8) T1. *ils sont chers* F A 102
0.56.5 0		0.56.52	(104) St6. Le bio on utilise *moins de produits* chimiques RC A 99		(9) T1. *mieux pour la santé* F A 103
0.57	.	0.57.02	(105) T1. Ah oui maintenant qui peut me donner *des arguments* contre St1 F A 104 + IC 98		(10) T1. *moins de produits chimiques* F A 104
0.57.0 7			(106) St1. Je pense que peut-être quelques produits bios sont transportés par les avions R A (105)		
0.57.2 0		0.57.22	(112) St2. L'argument en *défaveur* ce n'est pas prouvé RC A 105		(11) T2. *Transports ne sont pas locaux*
0.57.4 2	0.57. 46	0.57.48	(114) St3. Les produits bios sont parfois difficiles à trouver *que ce soit dans les supermarchés ou dans les magasins* RC A 105	(6) St3. *Oui il n y a pas de preuves scientifiques* RC WB 12	(12) T1. *pas de preuves scientifiques* F A 112

In Extract 4.9, T1 kept asking them the same questions, and students suggested different ideas without building on each other's answers that were written by the tutor using the WB tool. Students used the audio tool to contribute whereas T1 used the whiteboard to accept her students' contributions. St3 used the chat tool but this contribution did not trigger any response from his classmates. Despite the use of the different tools of communication, discussion remained at a low level of construction where participants exchanged ideas and suggestions. Discussion was cumulative where students added to each other's ideas rather than exploratory where collaboration was excluded. At this level, the high level of modal density did not help to boost discussion up to high levels of meaning construction. This task invited students to debate and negotiate each other's views. However, the types of tutor requests made students engage in cumulative rather than exploratory exchanges for collaborative negotiations and debates. She invited them to provide information and share their experiences rather than

debating their different views. This implies that technology needs monitoring from tutors who have an important role in providing scaffolding.

The following example (Extract 4.10) shows how interaction moved to upper levels of meaning construction using the different tools of communication.

Extract 4.10

A T	C T	WB T	T YN	A	C	WB	YN
1.05 .15				(124) T1. J'ai une question liée à ma première question ceux qui achètent les produits bios est ce que vous achetez tous les produits bios ou vous achetez juste des produits bien particuliers non pas tous **IC A 98**			
1.05 .35				(125) St3. Moi j'achète la viande les œufs et le lait parce qu'il y a beaucoup d'hormones dans ces produits que je ne veux pas consommer **R A (124)**			
1.05 .58				(126) T1. D'accord et est-ce que c'est important d'avoir ces produits quand il y a des enfants **IC A 125**			
1.06 .15				(127) St3. Oui pour moi c'est très important et je préfère ne pas manger de viande qui n'est pas bio **R A (126) + RC A 125**			
1.06 .40	*1.07*			(128) St4. Comme Laurence viande et beaucoup plus le poulet ils mettent beaucoup d'hormones à cause des méthodes d'élevage par contre les produits transformés comme les biscuits le pain j'en *ne vois pas pourquoi avoir peur* c'est moins important **RC A 126 + A 125 + A 127**	(4) St3. *Je suis tout à fait d'accord avec toi ST4* **RC A 128**		
1.07 .45			*1.07 .35*	(129) St1. Mais il est écrit sur le tableau qu'on n'utilise pas les produits chimiques pour les produits bio donc les produits chimiques pour faire *pousser le blé* ne sont pas les mêmes			*St5: oui* **RC A 129**

				produits pour faire pousser le blé bio non RC A 128 + 127 + A 126 + WB			
1.08 .05	1.08 .13	1.08 .10		(130) St5. Je ne suis pas sûr mais moi je suis d'accord avec St1 parce que c'est plus important *concernant les* produits qui viennent des animaux comme le lait et la viande on a vu des gens mourir à cause de ça RC A 129, 128, 126	(5) St2. *Oui je suis d'accord les produits chimiques sont dangereux pour le blé avec toi St1* RC A 129	(13) T1. _moins de produits chimiques_ *RC A129*	
1.08 .45				(131) T1. Oui on sait s'ils sont bios ils sont dans la nature dans de meilleures conditions les animaux ne doivent pas être malades donc ils doivent être dans de bonnes conditions mais pour les biscuits comme souligné par St2 et St1 RC A 131 + C			
1.09.09				(132) St3. Enfin moi je veux dire que les produits frais et notamment le lait et les viandes sont encore plus dangereux que les autres produits transformés RC A 131			
1.09 .24		1.09 .30		(133) St1. Oui je suis d'accord mais cela ne veux pas dire que les *produits transformés* n'ont pas de risque ils ont toujours les effets des produits chimiques RC A 132		(14) St4. *Oui c'est juste* RC A 133	
1.10.		1.10 .23	1.10 .28	(134) St3. Oui je suis d'accord mais le risque des produits frais et qui ne sont pas bios est beaucoup plus *élevé et les conséquences sont plus apparentes et rapides je pense* RC A 133		(15) T1. *les produits frais qui ne sont pas bio conséquences rapides et apparentes oui* F A 133	8. St1. *oui* RC A 134
1.10 .32		1.10 .38		(135) St1. On devrait ajouter ce point à notre liste d'arguments je ne suis pas convaincu que le bio est essentiel *pour tout moi aussi* j'ai peur que si tous devient bio il y aura pas assez pour tout le monde il doit y avoir assez de nourriture correcte pour tout le monde c'est des produits adressés à des élites qui ont plus d'argent et c'est une façon de faire une différence entre les riches et les pauvres mais de l'autre côté c'est important aussi comme l'a expliqué		*T. le bio n'est pas essentiel pour touts les produits* FA 143	

				Laurence je suis d'accord je ne voyais pas les choses comme ça avant voilà RC A 134			
1.11 .30				(136) T1. Voilà très bien nous avons notre liste des arguments pour et contre ..... F A (whole exchange)			

This extract was an exhaustive example of IC-R-RC-F (A+C+WB+YN) multimodal exchanges. Participants used the different tools of communication to move discussion up from low levels of construction where they started by cumulating ideas to higher levels of construction debating each other's ideas. Based on students' contributions, T1 made an exploratory request without inviting all students to negotiate and debate ideas. Discussion started to be more interesting for everybody and students started defending and asserting their ideas using the different tools, especially the audio and the chat tools, but referring to answers written on the whiteboard. This means that students paid attention and took into consideration the WB and chat contributions.

St3 (A 125) responded by giving her point of view and defending it. T1 reinitiated the same question building on St3's response. Once again, St3 (A 127) responded and her views triggered different reactions: some supporting her ideas and others challenging them using the audio, the chat and the YN tools. T1 used the WB tool to write St3's view, and highlighted it, which triggered further reactions where students started using the chat tool to express their disagreement with St3's views, challenging them and justifying their challenges (C 4 and A 129). From turn (A 125) till turns (A 128 + YN 8), students engaged in the process of negotiation. However, starting from turns (A: 129 + C 5) they engaged in the process of argumentation, challenging and counter-arguing each other's ideas till they reached a

negotiated agreement at turn (A 132, YN 9) and built consensus, expressing it using the oral as well as the written modes (A 133 and WB 14).

In sum, while students were engaged in this process of collaborative negotiation and argumentation using different tools of communication, T1 used the whiteboard to highlight the most important points discussed by students. The analysis of tutors' negotiation functions showed that they used the whiteboard tool to provide feedback. This extract demonstrates the use of the WB tool to provide feedback where T1 summarized her students' contributions as an invitation for further discussions. The use of the WB tool enabled her to adopt different tutorial functions from controller to guide and facilitator of interactive and collaborative discussions. The withdrawal of the tutor from discussion created different opportunities for students to take responsibility for their learning, controlling the flow of interactions. They used the different tools of communication to express their views without having to interrupt or wait till other students finished their oral contributions. Students referred to and built on each other's contributions made using the different tools, which indicated that they paid attention to contributions made in the different tools, not just the audio.

This example therefore shows that modal density was important whenever there was an appeal for negotiation and particularly debate. Modal density was relevant to launch and engage students in collaborative argumentation processes.

4.7. Conclusion

The last section (4.6) of the analysis showed the existence of different patterns of online discussions that were characterized by different levels of modal density. Some were at a low level of modal density since participants used the audio tool only. Some exchanges showed a moderate level of modal density since two different tools were simultaneously used.

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Some others showed a high level of modal density where all the different tools of communication were used.

I-R-F and IC-R-F exchanges can be described as cumulative dialogues. Engaged in by students, this type resulted in a steady progress of effective construction of common knowledge, but students avoided the challenges, counter-challenges and explanations that were important features of exploratory dialogues. Analysis suggested that I-R-F and IC-R-F synchronous online exchanges encouraged learners to engage in cumulative rather than exploratory constructive exchanges.

I-R-RC-F and IC-R-RC-F exchanges were long and comprised at least five elements: initiate (IC), Response (R), and at least one response continuity (RC). I-R-RC-F was an extended exchange where students and tutors collaboratively worked to build on each other's contributions, moving up online discussions to high levels of collaborative meaning construction. When engaged in the process of debate and negotiation, students engaged in successive RC interactions, simultaneously using the different tools of communication to accommodate and reflect on the perspectives of others; they challenged and refined those perspectives. When areas of disagreement or conflict became explicit, participants were able to restructure their thinking. As their own perspectives were challenged, they worked together to produce shared meanings, switching between oral and written modes of communication thanks to the availability of writing and oral tools. Hence, students created their zone of proximal development where they supported each other's efforts towards the creation of new understandings by debating, negotiating, challenging, arguing and finally building a consensus, hence a new agreed upon meaning thanks to the availability of different tools of communication. Students could engage simultaneously, building on their peers' ideas without

having to wait for their audio turn. They could use the chat, the YN or the WB tools of communication to contribute.

So, the results showed:

- Modal density was important whenever there was an appeal for negotiation and particularly debate. Modal density was relevant to launch active participation in collaborative argumentation process.

- Switching between the oral and written modes of communication using the audio, the chat and the WB tools provided better opportunities for students to build their ZPD to engage in constructive collaborative process of meaning construction. Chat and WB were not just used to correct mistakes or as a substitute to the audio in case of sound problems. They were rather used as a visual and a cognitive support to audio contributions.

- Results showed that tutors switched to the written mode using the chat and the WB to adopt different tutorial roles. On one hand, when engaged in I and IC interaction, they tended to use the audio to play the role of controller and knowledge holder. On the other hand, to engage in R and RC interactions, they tended to switch to the written mode to play the role of guides, facilitators and scaffolder. The use of the chat and the WB provided positive affordances as cognitive support to students' contributions. The analysis showed that students responded positively to the withdrawal of their tutors via the written mode. They built on their tutors' written contributions to co-construct new understandings and meanings.

- However, students displayed different levels of multimodal competencies. Some students showed more advanced multimodal competencies than others. Some students showed elaborate capacities to engage in the collaborative process of meaning construction simultaneously using the different tools of communication while at the same time absorbing

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information from different tools. The ease of use of different tools building on their fellows' multimodal contributions indicated that they have elaborate multimodal competences. On the other hand, some students were hesitant and avoided participation in highly multimodal exchanges. Whenever they participated, they used the audio tool. This suggested two things: either they feel cognitively overloaded because they have to participate and at the same time absorb information from different tools, or they did not know how to use the different tools. For this reason, I invited students to reflect on their online experience by completing questionnaires that are analyzed in the next chapter.

- Last but not least, the analysis showed that tutors' style and the use of the different tools of communication have different impacts on engagement of students in different types of exchanges. Besides tutors' styles and the synchronous medium, the analysis showed that the type of tasks do have an important impact on engagement of students in collaborative processes of negotiation and argumentation. The analysis of extracts shows some instances where students used the different tools and where the tutor was playing the role of facilitator, but discussion did not move to elaborate levels of construction. This had to do with the type of task and topics students were invited to discuss.

In the following chapter, the questionnaires submitted to students and the interviews carried out with tutors are analyzed. There is a need to understand the way students viewed their online learning experience with the aim of validating the results of the present chapter, with particular focus on the way students viewed the affordances of use of the different tools of communication.

Chapter Five

The analysis of students' questionnaires and tutors' interviews

5.1. Introduction

The preceding chapter (Chapter Four) showed that the use of the different tools of communication helped in shaping different patterns of interaction and exchanges. The different participants' modal choices offered different affordances, which have positive as well as negative impacts on engagement of students in the collaborative process of meaning construction.

Furthermore, results indicated that individual students showed different levels of development of their multimodal competencies in making different multimodal choices. This implied that individual students might have different views towards their online learning experience. In order to get some insights into individual participants' own views of interacting in this environment, they were asked to fill out questionnaires. In the following, their answers were analyzed by relating them to two analytical concepts that were central to my thesis which were: affordances and collaborative meaning construction.

Socio-constructivist theories of learning suggest that learning is both social and individual where the social precedes the individual (internalization). The analysis of online tutorials served to examine the social aspect of the collaborative meaning construction. Hence, Chapter Four aggregated behaviours and treated students as coherent groups (G1 and G2). To analyze the individual process of learning, questionnaires were administered to students to examine their own perceptions about their online learning experiences. Thus, Chapter Five

takes individual differences into account, by comparing the actual behaviours of each student

(as evidenced by the video transcripts) with their self-reported behaviours (as provided by the

questionnaire responses). Hence, for reasons of validity and objectivity, the outcomes of the

analysis of questionnaires are examined in relation to the results obtained from the analysis of

the online tutorials and the analysis of the individual contributions of each student. The

following sections cover statistical analysis of actual use to link what students do with what

students believe and perceive.

I start by the analysis of students' questionnaires.

5.2. The analysis of students' questionnaires

This first section of the present chapter is organized around each item of the

questionnaire.

5.2.1. The frequency of use of tools of communication by each student

Question 1 of the questionnaire asked students to what extent their tutors invited them

to use the different tools of communication.

Question 2 of the questionnaire asked students to what extent they spontaneously used

the different tools.

These questions were a first step towards determining the effects of the extent of modal

density on students' involvement in the collaborative meaning process. Hence there was a

need to check the frequency of actual use of the different tools by each student and to know if

the use of the different tools was the students' choice or the tutors' choice. The frequencies of

actual data of use of tools (obtained from the analysis of online conferencing) helped in

identifying active students as well as less active students, in order to ascertain which students

made more modal choices than others. The difference between active students and less active

students is explained below.

The following tables show what students think they did.

G1 +G2	Yes	No
1.1. Text chat	St8, St7, St14, St13	St1, St2, St3, St4, St5, St6, St9, St10, St11, St12, St13, St15, St16
1.2. Whiteboard		All students
1.3. Yes/no button	All students	

Table 5.1. Students' self reports about their tutors' invitations to use the different tools of communication

G1 + G2	Yes	No
2.1. Text chat	St1, St2, St3, St4, St5, St9, St10, St11, St12, S13, St14, St15	St6, St7, St8, St16
2.2. Whiteboard		All students
2.3. Yes/no button	All students	

Table 5.2. Students' self reports about their spontaneous use the different tools

The following Tables (Table 5.3 and Table 5.4) show the total frequencies (based on

actual data from online conferencing) of use of each tool of communication by each student

from both groups.

G1	A	C	WB	YN
St 1	13.40	29.16	20	11.75
St 2	14.94	25.20	20	11.62
St 3	13.38	17.66	20	12.75
St 4	12.82	17.50	13.33	11.94
St 5	10.25	10.48	6.66	12.77
St 6	10.86	0	6.66	12.47
St 7	11.69	0	6.66	12.85
St 8	12.60	0	6.66	12.85

Table 5.3. The frequency of individual use of the different tools of communication by G1

G2	A	C	WB	YN
St 9	14.30	18.46	16.48	11.22
St 10	13.44	18.70	16.20	10.92
St 11	13.35	16.44	16.55	11.85
St 12	12.02	13.50	15.33	12.96
St 13	12.37	11.48	10.45	12.77
St 14	11.20	10.92	8.33	12.47
St 15	11.20	10.50	8.33	13.85
St 16	13.10	0	8.33	13.90

Table 5.4. The frequency of individual use of the different tools of communication by G2

The different tables showed that St1, St2, St3, St4, St9, St10, St11, St12, and St13 were more active and made more multimodal choices than the rest of the students. However, results showed that all students showed the same tendency to use the audio tool. The differences between the frequencies of engagement of individual students in oral interactions were insignificant. In addition, students' frequencies of use of YN tool were similar to a certain extent. However, results showed significant differences in terms of use of the chat and whiteboard tools. St1, St2, St3 and St4 from G1 and St9, St10, St11, St12, St13 from G2 made more than 70% of chat contributions as well as more than 60 % of WB contributions within their respective groups. Hence these students were considered as active students. Some students made very little use of the chat and the WB, for instance, St5 and St15. St6, St7 and St8 from G1 and St16 from G2 did not use the chat tool and made very few attempts to use the WB tool.

Hence, students who made fewer multimodal choices were considered as less active students in terms of their limited modal choices rather than in terms of participation rates. Students who made more multimodal choices were described as active students in terms of their active use of the different tools of communication rather than their rate of participation. The following section helps determining active students and less active students in terms of their spontaneous versus tutor instigated uses of each communication tool by each student.

As was explained above, there was a need to check the frequency of use of the different tools by each student and to know if the use of the different tools was the students' choice or the tutor's choice. Table 5.5 and Table 5.6 show the general frequencies of the actual spontaneous versus tutor-instigated uses of each communication tool by each student.

G1	A		C		WB		Y/N	
Spontaneous (SP) Vs Tutors' Invitation (IV)	SP	T's IV	SP	T's IV	SP	T's IV	SP	T's IV
St 1	9.61	3.79	24.16	5	13.34	6.66	3.40	8.35
St 2	7.30	7.64	18.5	6.7	13.34	6.66	3.27	8.35
St 3	7.30	6.08	13.06	4.60	13.34	6.66	4.4	8.35
St 4	7.30	5.52	5.35	12.15	6.67	6.66	3.59	8.35
St 5	6.30	3.95	5.77	4.71	0	6.66	4.42	8.35
St 6	7.30	3.56	0		0	6.66	4.12	8.35
St 7	7.30	4.39	0		0	6.66	4.5	8.35
St 8	7.30	5.30			0	6.66	4.5	8.35

Table 5.5. The general frequencies of the actual spontaneous versus tutor-instigated uses of each communication tool by each student (G1)

G2	A		C		WB		YN	
Spontaneous (SP) Vs Tutors' Invitation (IV)	SP	T's IV	SP	T's IV	SP	T's IV	SP	T's IV
St 9	8.61	5.69	16.86	1.6	12.66	3.82	4.45	6.77
St 10	6.30	7.14	16.35	2.35	14.34	1.86	3.80	7.12
St 11	7.30	6.05	13.22	3.22	13.86	2.69	3.75	8.10
St 12	7.30	4.72	5.65	7.85	12.34	2.99	4.50	8.46
St 13	7.30	5.07	6.77	4.71	7.88	2.57	5.67	7.10
St 14	7.40	3.80	5.90	5.02	0	8.33	4.62	7.85
St 15	7.45	3.75	6.12	4.38	0	8.33	5.20	8.65
St 16	7.30	5.80			0	8.33	5.55	8.35

Table 5.6. The general frequencies of the actual spontaneous versus tutor-instigated uses of each communication tool by each student (G2)

According to students, neither tutor invited them on a regular basis to use the chat and the WB tools, which correlated with the results displayed in Figures 5.13, 5.16, 5.18, and 5.20. This explained the low frequencies of use of these tools by students obtained in section 4.2 of

Chapter Four (see Table 4.2). However, students stated that they were constantly invited by their tutors to use the YN tool to check their understanding, which confirms the analysis of the tutorials (see section 4.2). Students stated that they did not use the WB tool without their tutor's invitation, which correlates with the results of the analysis of students' spontaneous use of the different tools. Students might think that this tool was difficult to use or could not perceive its importance.

St1, St2, St3, St4, St5, St2, St9, St10, St11, St12, St13, St14 and St15 stated they spontaneously used the chat tool. The analysis of their individual contributions showed that high frequencies of their contributions were spontaneous. St6, St7, St8, St16 stated they did not voluntarily use the chat tool without the tutor's invitation, which was confirmed by the analysis of their individual contributions.

The analysis of the tutorials showed that in the instances where students used the WB and chat tools, exchanges moved up to high levels of meaning construction (see extracts: 4.2, 4.3, 4.4, 4.5, 4.8, 4.9). There was thus a need to understand why tutors did not encourage students to use these tools. Tutors were invited to reflect on this particular point in section 5.3.

Finally, all students stated they used the YN tool with and without their tutor's invitation. The ease of use of this tool probably explained the fact that all students used it; students did not need to interrupt each other and did not have to write, explain, clarify and defend their ideas.

Hence, results show that St1, St2, St3, St4, St5, St2, St9, St10, St11, St12, St13, St14 and St15 used the different tools spontaneously and as a response to the invitations of their tutors. Hence, they were considered as active students. However, St6, St7, St8 and St16 did not use the chat and the WB tools if they were not invited to by their tutors. Hence, they were considered as less active students.

The analysis showed no discrepancies between students' answers and the results of the analysis of the social process of meaning construction in relation to modal choices of individual students and participation opportunities.

Generally speaking, there were slight differences between G1 and G2 students' behaviours. Active and less active students made different modal choices. Active students used all of the tools of communication whereas less active students spontaneously used the audio tool and made very few attempts to use the other tools as a response to their tutor's invitations. This indicated that active students have more developed multimodal competencies than less active students. Hence, there was a need to identify the impact this had on their engagement in the collaborative meaning construction process (section 5.3 and section 5.5).

5.2.2. The use of tools of communication to perform different interactive roles

The different Tables (Table 5.7 to Table 5.10) show the frequencies of actual spontaneous as well as tutor-instigated use of the different tools of communication by each individual student to engage in R and RC interactions. The frequencies were obtained from the analysis of actual data from online conferencing. This analysis served to determine the interactive roles the different students ascribed to each tool of communication. To check the extent to which students' perceive their online learning experience, the obtained frequencies were needed then to be compared to students' self reported responses displayed in Table 5.3 to compare between what students actually did and what they think they did.

	R				RC			
	A	C	WB	YN	A	C	WB	YN
St1	13.5	28.60	10	13.5	17.90	35	26	35
St2	13.5	24.70	10	13.5	16	25	26	25
St3	12.5	18.40	10	12.5	14.45	23	23	25
St4	12.5	18.30	10	12.5	16.30	17	25	15
St5	12	7	10	12.5	8.10	0	0	0
St6	12	1	10	12.5	7.40	0	0	0
St7	12	1	10	12.5	7.20	0	0	0
St8	12	1	10	12.5	8.40	0	0	0

Table 5.7. The frequency of individual use of the different tools of communication to perform the different interactive roles (G1)

	R				RC			
	A	C	WB	YN	A	C	WB	YN
St9	11.60	24.20	12	10.5	18.60	33	24	23
St10	11.5	22.50	12	13.5	16.45	23	24	20
St11	10.5	17.40	10	12.5	15.20	21	21	19
St12	10.5	17.30	10	12.5	14.50	15	23	10
St13	13	7	10	13.5	10.10	2	2	12
St14	13	5	10	14.5	8.20	3	2	10
St15	12	4	8	12.5	8	3	0	5
St16	12	1	8	13	4.80	0	2	0

Table 5.8. The frequency of individual use of the different tools of communication to perform the different interactive roles (G2)

G1	Tools	R		RC	
		SP		T's IV	
S1	A	1.3	12.20	15.70	2.2
	C	24.15	4.45	2.20	32.80
	WB	0	10	26	0
	YN	1.0	12,5	33.40	1.6
S2	A	1.3	12.20	13.90	2.35
	C	21.66	3.04	22.99	2.01
	WB	0	10	26	0
	Y/N	1.0	12.5	23.90	1.1
S3	A	0.30	12.20	11.55	2.9
	C	15.25	3.15	21.5	1.5
	WB	0	10	23	0
	YN	0	12.5	23.90	1.10
S4	A	0.30	12.20	13.99	2.31
	C	14.90	3.4	15.5	1.5
	WB	0	10	25	0
	YN	0	12.5	13.75	1.25
S5	A	0.20	11.80	8.10	0

	C	1.40	5.60	0	0
	WB	0	10	0	0
	YN	0	12.5	0	0
S6	A	0.30	11.70	6.10	1.30
	C	0	1	0	0
	WB	0	10	0	0
	YN	0	12.5	0	0
S7	A	0	12	5.57	1.63
	C	0	1	0	0
	WB	0	10	0	0
	YN	0	12.5	0	0
S8	A	0	12	6.80	1.60
	C	0	1	0	0
	WB	0	10	0	0
	YN	0	12.5	0	0

Table 5.9. The general frequencies of the actual spontaneous versus tutor-instigated uses of each communication tool by each student to perform the different interactive roles (G1)

G2	Tools	R		RC	
		SP	T's IV	SP	T's IV
S9	A	2.30	9.30	16.20	2.4
	C	20.15	4.05	2.40	30.60
	WB	0	12	24	0
	YN	1.0	9,5	20.60	2.40
S10	A	3.3	8.20	14.90	1.55
	C	19.44	3.04	20.21	2.79
	WB	10	12	21.40	2.60
	YN	3.0	10.5	18.10	1.90
S11	A	2.30	8.20	13.55	1.65
	C	14.15	3.25	20.5	2.5
	WB	0	12	21	0
	YN	2.30	10.20	16.70	2.30
S12	A	2.30	8.20	12.80	2.70
	C	14.70	3.60	15.5	1.5
	WB	0	10	23	0
	YN	0	12.5	9.35	0.65
S13	A	1.40	11.60	10.10	0
	C	1.80	5.20	2	0
	W	0	10	0	2
	YN	1.5	12	12	0
S14	A	0.30	11.70	6.10	2.30
	C	0	5	3	0
	WB	0	10	0	2
	YN	0	12.5	10	0
S15	A	0	12	6.57	1.63

	C	0	4	3	0
	WB	0	8	0	2
	YN	0	12.5	5	0
S16	A	0	12	2.90	1.90
	C	0	1	0	0
	WB	0	8	0	2
	YN	2.5	10.5	0	0

Table 5.10. The general frequencies of the actual spontaneous versus tutor-instigated uses of each communication tool by each student to perform the different interactive roles (G2)

Based on actual data from online conferencing, I started by examining the extent of use of each tool by each student to perform their different interactive roles. Results showed that students shared the same tendency towards the prominent use of the audio tool to engage in R interactions. Active students from both groups used the chat tool to respond without their tutors' invitation which indicated their attempts to build on audio contributions. However, less active students like St15 and St16 used the chat only when invited to by their tutor.

As was shown by the analysis of online tutorials, all students predominantly used the audio tool to engage in RC interactions (see section 4.2.3.2). Active students engaged in RC interactions more than less active students using the written as well as the oral modes of communication. Less active students (St6, St7, St8 and St16) engaged in RC interactions using a high frequency of audio contributions and a very low frequency of use of the WB and the chat tools to respond to their tutors' invitations. In this case, students used the chat and WB tool as a response to their tutors' requests. Finally, all students used the YN tool to show their agreement and disagreement before engaging in the process of negotiation and argumentation.

The analysis of the social process (see section 4.2.3.2) showed that students used the chat and the WB tools to engage in RC interactions. However, the analysis of individual contributions showed that only active students used the chat and WB tools to engage in RC interactions switching between the oral and the writing mode. The very few attempts made by less active students to use the chat and WB tools were triggered by their tutors.

5.2.3. Students' perceptions of their contributions to online discussions

The second set of questionnaire items (from question 3, see Appendix 4) aimed at gaining a general idea about students' perceptions of their participation opportunities and extent of engagement in collaborative constructive discussions.

The overall responses to these questions were positive where students either strongly agreed or agreed with the availability and importance of participation opportunities in online discussions. Students' responses indicated their satisfaction with participation and interaction opportunities. However, very few students indicated their disagreement with some of the suggested proposals (see Table 5.11).

G1 + G2	Strongly Agree	Agree	Disagree	Strongly Disagree
3.1. I have plenty of opportunities to participate in the discussion	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13, St14,	St6, St7, St8, St15, St16		
3.2. I am able to take advantage of the opportunities for participation offered	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13, St14		St6, St7, St8, St15, St16	
3.3. I usually prefer to build on others' ideas	St1, St2, St3, St4, St9, St10, St11, St12, St13, St14	St5, St6 St7, St8, St15, St16		
3.4. I usually prefer to contribute my personal ideas	St6, St7, St8, St16, St15	St2, St3, St4, St12, St13, St14	St1, St9, St10, St11	

3.5. I usually respond to others' contributions	St1, St2, St3, St9, St10, St11, St12	St3, St4, St13, St14	St5, St6, St15	St7, St8, St16
3.6. Others usually respond to my contributions	St4, St5, St6, St9, St10, St11, St12	St1, St2, St3, St7, St8, St13, St14, St15, St16		.
3.7. I have learnt from other students' contributions	St1, St2, St3, St9, St10, St11, St12, St14	St4, St5, St6, St7, St8, St13, St15, St16		

Table 5.11. Students' self reports and reflections on participation opportunities (G1+G2)

Concerning the first item (3.1), active students strongly agreed and less active students agreed with the availability of different participation opportunities in online discussions. Their responses indicated their satisfaction with participation opportunities. The analysis of online tutorials and the high frequencies of individual contributions showed that all students could participate.

Active students strongly agreed with the second item (3.2) and stated they could take advantage of interaction opportunities. The high frequencies of engagement in R and RC interactions using the different tools of communication (see Tables from 5.7 to 5.10) indicated that students could participate at any time using any tool of communication. However, less active students disagreed with this statement. Their reflections correlated positively with their low frequencies of engagement in RC interactions where they mainly used the audio tool (see Tables from 5.7 to 5.10). The analysis of online tutorials showed that multimodal exchanges reached high levels of meaning construction. Less active students avoided using the chat and WB tools which indicated they could not take advantage of participation in multimodal exchanges for meaning construction.

The fourth item (3.4) sought to find out the extent to which students collaborated with each other and the way they perceived collaborative work. Active students strongly agreed that building on each other's ideas is important, which is reflected in their high frequencies of RC interactions. Despite their low rates of engagement in RC interactions (see, Tables from 5.7 to 5.10) less active students still believed and agreed with the importance of building on each other's ideas.

Students provided different responses to the fourth statement. Four active students disagreed and seven active students agreed with the fourth item which correlated positively with their high frequencies of engagement in RC interactions. However, less active students strongly agreed they preferred to contribute their own ideas, which explained their low frequencies of engagement in RC interactions compared to R interactions.

The analyses of tutors' elaborate and highly elaborate negotiation skills (see section 4.3.1.3 and section 4.3.1.4) showed that both tutors invited their students to contribute their personal ideas and opinions. One of the most important features of collaboration was the contribution of individual ideas upon which the process of collaborative negotiation and argumentation was built. Hence, less active students' responses could not be interpreted as attempts to avoid collaboration.

The fifth item (3.5) aimed at checking the way students viewed the importance of collaboration. Students provide different responses. The same active students, who disagreed with the fourth item, strongly agreed with this statement and stated they usually responded to their peers' contributions. This was again demonstrated by their high rates of engagement in R and RC interactions (see Tables from 5.7 to 5.10). The remaining active students agreed too with this statement. The results of the analysis of tutorials, the results of their individual contributions, and their responses indicated that active students perceived positively the

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importance of collaborative work and took advantage of all participation opportunities to build on each other's ideas.

However, some less active students strongly disagreed and others disagreed with this fifth item. Their responses indicated that less active students avoided building on other students' ideas and focused on their individual contributions. The sixth item (3.6) shed more light on their behaviours. The sixth item was designed to check the extent to which students felt integrated and involved in the collaborative processes of meaning construction. Responses are predominantly positive. St4, St5, St6, St9, St10, St11, St12 strongly agreed and St1, St2, St3, St7, St8, St13, St14, St15, St16 agreed with this statement. This is expected since all students engaged, though with different frequencies, in RC interactions (see Tables from 5.7 to 5.10). This implies that students provided support to each other when engaged in ZPD for collaborative meaning construction (see extracts: 4.2, 4.3, 4.4, 4.5, 4.8, and 4.9).

The last item (3.7) aimed at checking the extent of involvement of students in the social process of meaning construction. The overall responses to this statement were positive, where half of respondents strongly agreed and the second half agreed with the learning advantages drawn from students' contributions. These results indicated that active as well as less active students perceived positively the role of collaboration and engagement in social interactions for the collaborative meaning construction.

The main conclusion of this section was that to perform each particular interactive role, students made particular modal choices. For R interactions, students predominantly used the audio tool. The analysis of actual data from online conferencing showed that the chat tool was used to replace the audio in case of technical problems which explained the low frequencies of use of this tool. The YN tool was used to convey quick non-negotiated agreements or disagreements. For RC interactions, the more they felt integrated in the online discussion

building on each other's ideas, the more they needed to use all of the available tools of communication.

However, the behaviours of less active students were quite surprising. Despite their willingness to engage in collaboration, their rates of contribution in RC are low. Their opportunities to engage in RC interactions seem to be restricted by their limited multimodal choices.

In what follows, I tried to check if students showed different multimodal preferences to perform different negotiation functions.

5.2.4. The use of the different tools to perform the different negotiation skills

The fourth question of the questionnaire sought information on the way students perceived the affordances of use of the different tools of communication. The analysis of the social process of meaning construction showed that students attributed different interactive as well as communicative functions to the different tools. This section aimed at checking which tools students used to perform low, moderate and elaborate negotiation functions.

Based on actual data from online conferencing, I started by classifying each student's individual contributions in terms of phases of meaning construction. Hence, the Figures between brackets show the total frequencies of the performance of each negotiation function (pertaining to a particular phase of meaning construction) using each communication tool.

5.2.4.1. Sharing ideas

G1+G2	A	C	WB	YN
4.1. Share ideas	St1 (2.10), St2 (2.10), St3 (2.10), St4 (2.10), St5 (2.10), St6 (2.10), St7 (2.10), St8 (2.10), St9 (2.22), St10 (2.22), St11 (2.22), St12 (2.22), St13 (2.22), St14 (2.22), St15 (2.22), St16 (2.22)	St1 (3.42) St2 (3.25) St3 (3.10) St9 (4.12) St10 (3.15) St11 (3.89) St12 (3.23)		St1 (6.33), St2 (6.25), St3 (6.43), St4 (6.33), St5 (6.33), St6 (6.33), St7 (6.33), St8 (6.33), St9 (4.33), St10 (4.33), St11 (4.33), St12 (4.33), St13 (4.33), St14 (4.33), St15 (4.33), St16 (4.33),

Table 5.12. Self-reported reflections and actual frequencies of individual students' performance of low negotiation functions (sharing ideas) by G1 and G2

The aim of item 4.1 was to check which tools students used to perform minimal negotiation functions: provision of information, acceptance and corroboration.

The analysis of tutorials showed that the frequencies of performance of low negotiation skills were relatively high. Students predominantly used the audio tool. They used the YN tool to show their comprehension and rapid agreement. Only low frequencies of their chat contributions were dedicated to perform low negotiation skills. Students stated that they did not use the WB, which might be expected because tutors did not invite them to use it to share their ideas. Their responses matched positively with the results of the analysis of their individual contributions (Table 5.12).

Students think that the use of the chat and the WB tools offered very limited affordances when sharing ideas and opinions. Results of the analysis of online conferencing (Chapter Four) indicated then that the use of the chat tool was believed to offer technical affordances only.

5.2.4.2. Expressing disagreement

G1+G2	A	C	WB	YN
4.2. Express my disagreement	St1 (0.38), St2 (0.40), St3 (0.26), St9 (0.33), St10 (0.15), St11 (0.20%)	St9 (0.33), St10 (0.33)		St1 (5.66), St2 (5.33), St3 (5.25), St4 (5.90), St5 (6.33), St6 (6.25), St7 (6.45), St8 (6.66) St9 (5.90), St10 (5.88), St11 (6.66), St12 (6.90), St13 (6.33), St14 (7.75), St15 (7.90), St16 (8.33),

Table 5.13. Self-reported reflections and actual frequencies of individual students' performance of intermediate negotiation functions (disagreement) by G1 and G2

All students stated they preferred to use the YN tool to show their disagreements with others' views without having to justify their views. Only active students indicated they used the audio and the chat tools to express their disagreement. Their answers correlated with the results of the analysis of online tutorials (see section 4.3.2.2) and their individual contributions. Hence, the results imply that the use of the YN was perceived as offering affordances to avoid engaging in critical negotiations and argumentation. This is checked in section 5.2.10 of the present analysis.

5.2.4.3. Asking exploratory questions

G1+G2	A	C	WB	YN
4.3. Ask for explanations and clarifications	St1 (0.33), St2 (0.25), St3 (0.33), St7 (0.09), St8 (0.12) St9 (0.12), St10 (0.10)	St1 (1.02), St2 (0.55), St3 (0.45)		

Table 5.14. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions (exploratory request) by G1 and G2

Elaborate functions are very important. Results of the analysis of tutorials (see section 4.3.2.3.1) showed that students used the different tools of communication and not just the audio to perform elaborate negotiation functions, particularly when engaged in RC interactions. The use of the chat and the WB tools provided them with the opportunity to build on each other's ideas without interrupting each other.

The frequencies of use of exploratory questions were very low where students used the audio tool. Active students stated they used the chat tool to invite participants to engage in the social process of meaning construction. Again, their answers matched with the results of the analysis of the social process of meaning construction (section 4.3.2.3.1) and their individual contributions (Table 5.13)

Students did not perceive the potential affordances of use of the chat and the WB tools to perform this negotiation function.

5.2.4.4. Clarifying ideas

G1+G2	A	C	WB	YN
4.4. Explanations + clarifications of my ideas	St1 (1.480), St2 (1.35), St3 (1.42), St4 (1.20), St5 (1.38), St6 (1.45), St7 (1.40), St8 (1.50), St9 (1.52), St10 (1.46), St11 (1.49), St12 (1.35), St13 (1.39), St14 (1.44), St15 (1.44), St16 (1.50)	St1 (3.84), St2 (3.35), St3 (3.40), St4 (2.90),		

Table 5.15. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions (explanations and clarifications) by G1 and G2

Similarly to the results of the analysis of online tutorials and students' individual contributions, all students expressed their preferences towards the use of the audio tool to clarify ideas. In addition, St1, St2 and St3 stated they preferred to use the chat tool to clarify

their ideas. Results of the analysis of actual and self reported preferences of use of tools showed that active students spontaneously used the chat and the audio tools, switching between the oral and the written mode to engage in constructive discussions. Active students believed that the use of the chat and the audio tools to perform this elaborate negotiation function resulted in positive affordances for sustaining collaboration and enhancing engagement in constructive discussions.

Students were then invited in the last section of students' questionnaire (questions 10, 11, and 12 in Appendix 4) to reflect on the importance of use of the different tools of communication to sustain collaboration to check the truthfulness of this conclusion. Results are reported in sections 5.11, 5.12 and 5.13 of the present chapter).

5.2.4.5. Rejecting and challenging others' ideas

G1+G2	A	C	WB	YN
4.5. Reject and challenge others' ideas	St1 (1.40), St2 (1.33), St3 (1.50), St4 (1.15), St5 (1.10), St9 (1.54), St10 (1.35), St11 (1.40), St12 (0.90), St13 (1.06)	St9 (0.54), St10 (0.66), St11 (0.35), St12 (0.15),		St7 (0.20), St8 (0.10)

Table. 5.16. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions (reject and challenge others' ideas) by G1 and G2

Online discussions reached high levels of meaning construction (argumentation) when students performed these elaborate negotiation functions. All students stated they preferred to use the audio tool to reject and challenge each other's views and ideas with the aim of creating a new agreed meaning. Besides the use of the audio tool, active students stated their

preference to use the chat tool too. Their responses were confirmed by the actual results of the analysis of the online conferencing and their actual individual contributions displayed in Table 5.8. The analysis of videos showed that students engaged in the process of argumentation simultaneously using the audio, the WB and the chat tools. Only active students performed this elaborate negotiation function. Results indicated that active students believed that the simultaneous use of the different tools provided positive affordances for enhancing the collaborative process of argumentation. However, less active students did not seem to perceive the same affordances and did not perform these elaborate negotiation functions.

5.2.4.6. Defending ideas

G1+G2	A	C	WB	YN
4.6. Defend ideas	St1 (1.66), St2 (1.45), St3 (1.40), St4 (1.45), St5 (1,25), St6 (0.90), St7 (0.40), St8 (0.35) St9 (1.70), St10 (1.60), St11 (1.55), St12 (1.50), St13 (1.55), St14 (1.25), St 15 (0.60), St16 (0.35)	St1 (2.52), St2 (1.95), St3 (1.80), St4 (2.10) St9 (2.90), St10 (2.45), St11 (2.66), St12 (2.25), St13 (2.10)	St1 (10.35), St2 (8.90), St3 (7.10), St4 (6.20), St9 (10.10), St10 (9.95), St11 (7.30), St12 (5.66) St13 (6.66)	

Table 5.17. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions (Defend ideas) by G1 and G2

The analysis of actual online tutorials (see sections 4.3.2.3.5, 4.3.2.3.6, and 4.3.2.3.7) showed that students from both groups used the audio as well as high frequencies of chat and WB contributions.

The majority of students stated they preferred to use the audio tool to defend their ideas. Additionally, active students stated their preference to use the chat and the WB tools to

defend their ideas. Results of the analysis of tutorials and students' individual contributions showed that less active students produced low proportions of this elaborate negotiation function despite their agreement with the importance of engagement in the collaborative processes of negotiation and argumentation. In addition, less active students did not use the WB tool to assert their ideas despite their tutors' invitation to use it. The results revealed two important points: students did not know how to use the WB or they were unable to understand the affordances of use of these tools offered for the creation of opportunities for interaction and contribution to the collaborative process of meaning construction. The simultaneous use of the audio, the chat and the WB tools helped students to build on each other's ideas without interrupting each other. Active students demonstrated more developed multimodal competencies than less active students, since they demonstrated the understanding of the affordances of use of chat and WB tools as a back up to the audio tool when engaged in constructive discussions.

5.2.4.7. Justifying opinions

G1+G2	A	C	WB	YN
4.7. Justify my opinions	St1 (1.40), St2 (1.33), St3 (1.50), St4 (1.15), St5 (1.10), St9 (1.54), St10 (1.35), St11 (1.40), St12 (0.90), St13 (1.06)	St9 (3.55), St10 (3.80), St11 (3.70), St12 (1.20)		

Table 5.18. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions: justify my opinions

Students stated that to justify their opinions they used the audio tool and G2 students stated they used the audio and chat tools, which correlated with their actual individual contributions displayed in Table 5.10. The analysis of students' individual contributions

showed that only active students performed this elaborate negotiation function when engaged in RC interactions. The self-reported results were expected since the frequencies of engagement of less active students in RC interactions were low. Furthermore, students justified their opinions and ideas when engaged in RC interactions where the different tools of communication were simultaneously used. Less active students did not take part in multimodal constructive discussion to justify their opinions. This indicated that less active students have limited multimodal competencies which made it difficult for them to understand the affordances of use of the different tools to engage in collaborative constructive discussions.

5.2.4.8. Accepting and building on others' ideas (concession and consensus building)

G1+G2	A	C	WB	YN
4.8. Accept and build on others' ideas	St1 (1.12), St2 (1.25), St3 (1.12), St4 (0.66), St5 (0.66) St9 (1.25), St10 (1.15), St11 (0.99), St12 (0.33), St13 (0.33), St14 (0.33),	St1 (2.33), St2 (2.45), St3 (2.10), St4 (2.25), St9 (1.86), St10 (1.30), St11 (1.03), St12 (0.33), St13 (0.33)	St1 (2.55), St2 (1.99), St3 (0.66), St9 (2.25), St10 (1.62), St11 (1.55), St12 (0.99)	

Table 5.19. Self-reported reflections and actual frequencies of individual students' performance of high negotiation functions: consensus and concession

Both groups made the same multimodal choices to build consensus, using all of the available tools of communication except the YN tool. The majority of students stated they preferred to use the audio tool to negotiate concessions and build consensus. However, only active students used the chat and the WB tools to perform these elaborate negotiation functions as was shown by the analysis of their actual individual contributions displayed in Table 5.11. Less active students did not perform these elaborate negotiation functions, as was

expected. The analysis of the tutorials showed that students performed these elaborate negotiation functions when engaged in multimodal constructive discussions where all tools were simultaneously used. The analysis showed that less active students avoided participating in multimodal discussions, which suggested that their limited multimodal competencies prevented them from perceiving the different affordances offered by the use of the different tools of communication.

Contrary to less active students, active students could understand and benefited from the facilitative affordances of the simultaneous use of the different tools of communication. The Chat and WB tools were used as a back up to the audio tool when engaged in constructive discussions performing elaborate negotiation functions thanks to their developed multimodal competencies.

5.2.4.9. Restating agreed positions and applying new meanings

G1+G2	A	C	WB	YN
4.9. Restating the agreed position and apply new knowledge	St1 (1.12), St2 (1.25), St3 (0.99), St4 (0.66), St5 (0.33), St6 (0.33), St7 (0.33), St8 (0.33) St9 (1.03), St10 (0.80), St11 (0.85), St12 (0.66), St13 (0.66), St14 (0.66), St15 (0.66), St16 (0.66)	St1 (1.33), St2 (1.33), St3 (0.66)	St1 (1.35), St2 (1.15), St3 (1.15), St4 (0.99), St5 (0.99), St6 (0.99), St7 (0.99), St8 (0.99) St9 (0.99), St10 (0.85), St11 (0.80), St12 (0.80), St13 (0.80), St14 (0.80), St15 (0.80), St16 (0.80)	

Table 5.20. Self-reported reflections and actual frequencies of individual students' performance of highly elaborate negotiation functions: application by G1 and G2

This item sought to check students' modal preferences to restate and apply newly constructed meanings. The analysis of the tutorials showed that all students used the audio tool and made few attempts to use the chat tool to restate and apply new meanings. Besides the audio tool, G1 students used the chat tool.

All students stated they preferred to use the audio tool to perform these elaborate negotiation functions. In addition, only active students stated they preferred to use the chat tool to restate agreed positions which is conformed by the analysis of their individual contributions displayed in Table 5.20. Finally, all students stated they used the WB tool to apply newly constructed understandings. However, active students used the WB more than less active students. The analysis of less active students' individual contributions showed that they never used the WB without their tutors' invitations (see Tables: 5.17 to 5.20). The analysis (see Extracts 4.8 and 4.9) showed some instances where active students spontaneously used the WB tool, and reached Ph5 of meaning construction as a result of engagement in collaborative negotiations and debates. The results indicated that active students took advantage of the affordances offered by the use of the different tools of communication thanks to their developed multimodal competencies.

In sum, active students simultaneously used the audio, the chat and the WB tools when engaged in the collaborative process of meaning construction. Less active students used the audio tool to perform all types of negotiation functions. The WB tool was used when students were invited to do so by their tutors.

One of the conclusions of the analysis of online conferencing in Chapter Four was that the more discussion moved up to high levels of meaning construction, the more participants simultaneously used the different tools of communication and switched between the written and the oral modes. However, students' self reported responses to the questionnaire and the

analysis of their individual contributions to online conferencing proved that only active students used the different tools of communication when engaged in RC interactions. Less active students withdrew from participation the more discussions tended to be multimodal.

Thus results indicate that students, with different multimodal competencies, perceived differently the affordances offered by the use of the different tools. Active students were more able to perceive and take advantage of the offered facilitating affordances; they viewed the affordances as a cognitive support for the creation of ZPD for collaborative meaning construction. These same affordances were perceived more as constraints limiting less active students' participation opportunities in constructive discussions. One possibility was that modal density was more a cognitive overload for less active students than a cognitive support.

This conclusion needed to be checked against students' reflections: I do this in the last section of the present chapter. More insights into students' views as far as the affordances of the simultaneous and individual use of the different tools of communication were needed. Hence the following questions were asked (see Appendix 4 for the actual questions).

5.2.5. Students' perceptions of the importance of the simultaneous use of more than one tool to make constructive contributions

First, there was a need to go through the analysis of the extent of participation of each student in multimodal exchanges that reached low level as well as high levels of meaning construction before the consideration of self report responses. Based on actual data from online conferencing, the figures between brackets show how many time (in frequencies) each students contributed to each type of multimodal online exchanges using different tools of communication. Hence, the figures show the frequencies of actual individual contributions each student in each type of multimodal online exchanges. Engagement in audio-only

exchanges by each student was also considered to check if students preferred to participate in

audio exchanges more than multimodal exchanges, if so, for what reasons.

G1 +G2	Yes	No
5.1. Audio	St1 (3.12), St2 (3.22), St3 (2.66), St4 (1.68), St5 (2.30), St6 (2.68), St7 (2.98), St8 (3.12) St9 (3.55), St10 (3.35), St11 (2.55), St12 (2.65), St13 (2.10), St14 (2.85), St15 (2.98), St16 (3.38)	.
5.2. Audio + chat	St1 (3.32), St2 (2.40), St3 (2.06), St4 (1.68), St5 (1.30), St6 (1.08), St7 (1.78), St8 (1.98) St9 (3.90), St10 (3.35), St11 (3.15), St12 (2.99), St13 (1.90), St14 (1.85), St15 (1.89), St16 (1.55)	
5.3. Audio + Yes and No tool	St1 (1.60), St2 (1.70), St3 (0.67), St4 (0.67), St5 (0.67), St6 (0.67), St7 (0.74), St8 (0.74) St9 (1.90), St10 (1.55), St11 (1.60), St12 (1.99), St13 (1.66), St14 (1.25), St15 (1.80), St16 (1.75)	
5.4. Audio + whiteboard	St1 (2.60), St2 (2.44), St3 (1.94), St4 (1.94), St5 (1.63), St6 (1.63), St7 (1.63), St8 (1.63) St9 (2.66), St10 (2.35), St11 (2.25), St12 (2.55), St13 (1.60), St14 (1.25), St15 (1.70), St16 (1.55)	.
5.5. Audio + chat + Yes and No + whiteboard	St1 (1.34), St2 (1.29), St3 (0.94), St4 (0.94), St5 (0.55) St9 (1.80), St10 (1.77), St11 (1.25), St12 (1.33), St13 (1.45), St14 (0.99),	St8, St7, St6, St15, St16
5.6. Text chat and whiteboard		All students
5.7. Text chat and yes/no button		All students
5.8. Text chat, yes/no button and whiteboard		All students
5.9. Whiteboard and yes/no button		All students

Table 5.21. Self reported responses and actual frequencies of the extent of participation in multimodal exchanges

For a better understanding of students' self-reported reflections, there was a need to check the extent of their individual contributions in constructive multimodal discussions that reached high levels of meaning construction. Thus, Table 5.13 shows the students' self-reported answers with relation to the frequencies of their actual individual participation in the different multimodal exchanges that reached the different five levels of meaning construction.

5.2.5.1. Audio-only exchanges

G1 +G2	Ph1	Ph2	Ph3	Ph4	Ph5
A-only	St1 (2.80), St2 (2.60), St3 (2.45), St4 (1.90), St5 (2.35), St6 (2.70), St7 (3.40), St8 (3.40), St9 (2.60), St10 (2.66), St11 (2.50), St12 (2.47), St13 (2.20), St14, St15 (2.78), St16 (2.90)	St1 (0.25), St2 (0.20), St3 (0.25), St4 (0.25), St5 (0.35), St6 (0.40), St7 (0.60), St8 (0.40) St9 (0.33), St10 (0.15), St11 (0.45), St12 (0.35), St13 (0.25), St14 (0.35), St15 (0.50), St15 (0.50)	St1 (3.85), St2 (3.60), St3 (3.70), St4 (3.10), St5 (3.15), St6 (3.60), St7 (2.32), St8 (2.40), St9 (3.25), St10 (3.33), St11 (3.15), St12 (2.77), St13 (2.10), St14 (1.70), St15 (1.85), St16 (2.15)		St1 (2.90), St2 (2.10), St3 (1.40), St4 (1.95), St5 (1.05), St6 (1.05), St7 (0.60), St8 (0.50) St9 (2.10), St10 (2.20), St11 (1.66), St12 (1.25), St13 (0.88), St14 (0.75), St15, St16 (1.25)

Table. 5.22. The classification of actual students' individual contributions in terms of high and low level of meaning construction (A-only exchanges) by G1 and G2

Analysis of social as well as individual contributions of students showed that all students took part in audio-only exchanges, which is confirmed by their self-reported responses to the questionnaire. Less active students registered high frequencies of participation in audio-only exchanges. All students participated to a similar extent in audio exchanges that

reached the different levels of meaning construction. Students stated they found it easy and helpful to engage in discussions where only the audio was used.

5.2.5.2. A+C exchanges

G1 + G2	Ph1	Ph2	Ph3	Ph4	Ph5
A +C	St1 (0.65), St2 (0.70), St3 (0.45), St4 (0.50), St5 (0.20), St6 (0.20), St7 (0.30), St8 (0.10) St9 (0.66), St10 (0.78), St11 (0.65), St12 (0.70), St13 (0.55), St14 (0.60), St15 (0.64), St16 (0.62),	St9 (0.15), St10 (0.15)	St1 (1.90), St2 (1.75), St3 (1.21), St4 (0.98), St5 (0.90), St6 (0.68), St7 (0.78), St8 (0.90) St9 (2.10), St10 (1.88), St11 (1.60), St12 (1.85), St13 (0.90), St14 (1.12), St15 (0.95), St16 (1.25)		St1 (0.40), St2 (0.25), St3 (0.40), St4 (0.20), St5 (0.20), St6 (0.20), St7 (0.20), St8 (0.28) St9 (0.33), St10 (0.25), St11 (0.45), St12 (0.15), St13 (0.18), St14 (0.10), St15 (0.15), St16 (0.15)

Table 5.23. The classification of actual students' individual contributions in terms of high and low levels of phases of meaning construction (A + C exchanges) by G1 and G2

The analysis of the social and the individual contributions of students showed that all students engaged in this kind of multimodal exchanges. Active students were more involved in such exchanges than less active students. All students agreed on the importance of multimodal exchanges and stated it was helpful to simultaneously use the audio and the chat tools to participate in constructive discussions. A+C exchanges reached different levels of meaning construction. Less active students engaged actively in A+C exchanges that remained at low levels of meaning construction, which was expected since they used the chat as a substitute for the audio rather than engaging in RC interactions to build on others' ideas. Active students used the chat tool simultaneously with the audio tool to build on others' ideas.

Despite the low frequencies of the use of the chat tools and participation in A+C exchanges, less active students found it helpful to engage in such multimodal exchanges. There was a need to understand why they avoided using the different tools if they believed they were important and helpful. They were invited to reflect on their reasons behind avoiding using the chat and WB tools (see question 10, 11, and 12 of the students' questionnaires in Appendix 4).

5.2.5.3. A+YN exchanges

G1 +G2	Ph1	Ph2	Ph3	Ph4	Ph5
A+YN	St1 (0.60), St2 (0.60), St3 (0.67), St4 (0.67), St5 (0.67), St6 (0.67), St7 (0.74), St8 (0.74) St9 (0.50), St10 (0.85), St11 (0.65), St12 (0.70), St13 (0.68), St14 (0.60), St15 (0.66)				

Table 5.24. The classification of actual students' individual contributions in terms of high and low levels of phases of meaning construction (A + YN exchanges) by G1 and G2

The analysis of individual contributions of students showed that all students engaged in A+YN exchanges. Students used the YN tool to show agreement, disagreement or comprehension, which were low negotiation functions. The analysis of students' individual contributions showed that students engaged in A+YN exchanges at similar frequencies to a certain extent. Students shared the same beliefs and stated they found it easy and helpful to participate in A+YN exchanges. Results showed that A+YN were I-R-F exchanges where tutors heavily controlled interactions, thus limiting collaboration opportunities. However, the ease of use of the YN tool, where students did not have to make any linguistic efforts, made students believe in the importance of A+YN tools to show their commitment to their learning community rather than contributing to constructive discussions.

5.2.5.4. A+WB exchanges

G1 + G2	Ph1	Ph2	Ph3	Ph4	Ph5
A + WB	St1 (0.15), St2 (0.15), St3 (0.15), St4 (0.15), St5 (0.15), St6 (0.15), St7 (0.15), St8 (0.15) St9 (0.10), St10 (0.10), St11 (0.10), St12 (0.10), St13 (0.10), St14 (0.10), St15 (0.10), St16 (0.10)		St1 (0.97), St2 (0.92), St3 (0.60), St4 (0.78), St5 (0.66), St6 (0.45), St7 (0.60), St8 (0.54) St9 (1.10), St10 (0.67), St11 (0.90), St12 (0.85), St13 (0.90), St14 (0.45), St15 (0.45), St16 (0.45)		St1 (0.88), St2 (0.83), St3 (0.79), St4 0.66), St5 (0.58), St6 (0.63), St7 (0.53), St8 (0.54) St9 (0.70), St10 (0.55), St11 (0.45), St12 (0.33), St13 (0.23), St14 (0.05), St15 (0.15), St16 (0.10)

Table 5.25. The classification of actual students' individual contributions in terms of high and low levels of phases of meaning construction (A + WB exchanges) by G1 and G2

All students indicated they believed in the importance of A+WB exchanges. They stated their beliefs in the facilitative affordances offered by the simultaneous use of the WB and audio tools. All students from both groups used the WB when invited to by their tutors. No one voluntarily used it without their tutors' permission. However, the analysis of their individual contributions showed that active students used it more than less active students. The analysis of the social process of meaning construction showed that a high frequency of A+WB exchanges reached the highest levels of meaning construction (Ph5) when all students participated. The analysis of extracts showed that some of the A+WB exchanges reached Ph5 of meaning construction because tutors invited students to apply newly constructed meanings using the WB tool. Some A+WB exchanges reached Ph5 of meaning constructed as a result of collaborative efforts of students building on each other's ideas that result in the creation of an

agreed upon new understanding. Only active students used the WB tool to participate in the second type of A+WB exchanges. Again, there was a need to understand this confusing behaviour on the part of less active students who, on one hand, found it helpful to engage in A+WB, but, on the other hand, avoided participating in A+WB exchanges without their tutor's invitation. This was reflected on by students, as reported in sections 5.2.11, 5.2.12, and 5.2.13 of the present chapter.

5.2.5.5. A+C+WB+YN exchanges

G1 + G2	Ph1	Ph2	Ph3	Ph4	Ph5
A + C+ WB + YN	St1 (0.58), St2 (0.54), St3 (0.55), St4 (0.52), St5 (0), St9 (0.66), St10 (0.78), St11 (0.66), St12 (0.55), St13 (0.55), St14 (0.60)				St1 (0.60), St2 (0.65), St3 (0.55), St4 (0.36), St5 (0.44), St9 (0.45), St10 (0.55), St11 (0.45), St12 (0.55), St13 (0.30)

Table 5.26. The classification of actual students' individual contributions in terms of high and low levels of phases of meaning construction (A + C + WB + YN exchanges) by G1 and G2

All students answered positively concerning participation in engagement in A+C+WB+YN exchanges. They expressed their agreement with the importance of the simultaneous use of the four different tools. The analysis of online tutorials (see section 4.6.2 and section 4.6.4) showed that the few instances where participants engaged in highly multimodal exchanges boosted up online discussions to high levels of meaning construction. In addition, constructive discussions reached Ph5 of meaning construction as a result of students' engagement in collaborative negotiations and debates rather than as a response to simple invitations from their tutors to apply newly learnt knowledge. Less active students indicated they found the simultaneous use of the four different tools of communication

helpful. However, the analysis of their individual contributions shows that they did not participate in A+C+WB+YN exchanges despite their beliefs.

I might suggest that these students have less developed multimodal competencies than other students. The combined use of the different tools of communication was helpful for less active students but at the same time cognitively overloading if they had to participate and at the same time assimilate knowledge from the different tools being used.

In sum, I would conclude that students had different understandings of the affordances of the individual tools as well as the simultaneous use of the different tools of communication. Active students believed in the complementarity between tools. Writing tools (the chat and WB tools) were used to cognitively support their oral contributions to sustain collaborative constructive discussions. The chat, the WB and the YN tools were essentially a back up to the audio tool. However, less active students could not develop this understanding of these same affordances. On the contrary, the simultaneous use of the different tools were seen as offering affordances that were more constraints than opportunities. The simultaneous use of the different tools of communication was seen rather as a source of cognitive overload. Results thus indicated that the multimodal competencies of less active students were not appropriate for engagement in highly multimodal exchanges.

5.2.6. Students' perceptions about the relationship between the use of the different tools and the extent of enhancement of constructive discussions

Question 6 shed more lights on this point where students were invited to reflect on the extent to which they believed the use of the different tools promoted participation in constructive discussions.

G1+G2	Strongly Agree	Agree	Disagree	Strongly Disagree
6.1. Constructive discussions are enhanced by the use of the audio channel	All students			
6.2. Constructive discussions are enhanced by the use of the chat text	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13	St6, St7, St8, St14, St15, St16		
6.3. Constructive discussions are enhanced by the use of the white board	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13	St6, St7, St8, St14, St15, St16		
6.4. Constructive discussions are enhanced by the use of the yes/no button	All students			
6.5. Constructive discussions are enhanced by the simultaneous use of more than one communication tool	St1, St2, St3, St4, St9, St10, St11, St12, St13, St14,	St5, St6, St7, St8, St15, St16		

Table 5.27. Students' self reported perceptions about the relationship between the use of the different tools and the extent of enhancement of constructive discussions

It is not surprising that all students strongly agreed that online discussions were enhanced by the affordances of use of the audio tool. As foreign language students, they showed their shared preference towards the use of the audio tool since they needed to be exposed to and to use the target language. This tendency was confirmed by the high frequencies of use of this tool as well as active participation in audio-only exchanges by all students. In addition, active students strongly agreed and less active students agreed with the facilitative affordances of use of the chat and the WB tools. We find the responses of less

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active students surprising as the frequencies of their use of the chat and WB tools were very low. This endorsed our conclusion that students did not know how to use these tools to perform elaborate negotiation skills and engage in constructive discussions. Finally, less active students strongly agreed and active students agreed with the importance and facilitative affordances offered by the use of the YN tool to enhance constructive collaborative discussions. This was expected because all students engaged in A+YN exchanges with similar frequencies.

Hence, all students believed in the importance of the facilitative affordances offered by the use of the individual tools of communication.

Active students believed in the importance of the facilitative affordances of the simultaneous use of the different tools of communication, which was also expected. However, it was not expected that less active students would agree with the importance of the facilitative affordances of the simultaneous use of tools and learning opportunities offered by multimodal exchanges.

One of the issues that emerged from this analysis was the reticence of less active students to use writing tools. However, the results showed that students participated in the different exchanges, which indicated they were not passive. An implication of this issue was the existence of other possible factors, besides the use of tools, which motivated students' engagement in the different multimodal collaborative exchanges. Hence, I explored the following issues.

5.2.7. Students' perceptions about the factors that affected their participation

Motivation to participate was very important. There was a need to understand the factors that motivated students to engage in constructive discussions apart from the use of the different tools of communication. Previous research in the field of online teaching showed that tutor's scaffolding and the type of tasks did have an impact on the quantity as well as the quality of students' interactions. Consequently, I thought of checking the effects of the mediation of tutor's scaffolding, the synchronous medium and task type on students' modal choices and engagement in multimodal exchanges.

G1+G2	Strongly Agree	Agree	Disagree	Strongly Disagree
7.1. The tutor invites me to do so	St7, St8, St6, S16	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13, St14, St15		
7.2. There is collaboration with other students	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13, St14, St15	St6, St7	St8, St16	
7.3. The task or topic appeals to me	St1, St2, St3, St4, St5, St6, St7, St8, St9, St10, St11, St12, St13, St14, St15, St16			
7.4. Apart from the audio, I can use different communication tools to express my ideas	St1, St2, St9, St10, St11, St12	St3, St4, St5, St13, St14, St15	St6, St7, St8, St16	

Table 5.28. Students' self-reported perceptions about the affordances of tutors' scaffolding, tasks and the synchronous medium

Results show that the identified mediational factors were positively viewed by students. Less active students strongly agreed that they felt motivated to participate when

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invited by their tutors. Less active students did not engage in participation if they were not encouraged by their tutors. Active students agreed too with this statement.

The second factor is collaboration. Similarly to their previous answers, active students strongly agreed that they felt more motivated to participate when opportunities for collaboration and creation of ZPD were offered. Less active students agreed too with this statement. This indicated that less active students did not avoid participating in multimodal interactions because they avoided collaboration.

The third factor is task type. All students strongly agreed that the type of topics and tasks affected their motivation towards participation. Students stated that the more tasks were appealing, the more they were motivated to participate and interact. The analysis of tutorials showed that tutors proposed the same tasks, and students engaged in the same way to realize these tasks. The analysis of the tutorials showed that students contributed to tasks that invited students to debate ideas more than others. For some topics, the tutor made many efforts to make students participate. For other topics, the majority of students engaged in discussion without their tutor's invitation.

Concerning the availability of different tools of communication, active students strongly agreed that opportunities for interaction and collaboration were made available thanks to the availability of writing and audio tools. Despite the low frequencies of less active students' chat and WB contributions, they agreed too with the importance of use of tools of communication. It is concluded then that students had problems with the simultaneous use of the different tools of communication.

Thus, the results of the analysis of the three different data sets showed the importance of the positive affordances of use of the individual tools, tutors' scaffolding and task type as far as participation in online discussions is concerned. However, as opposed to active students,

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less active students did not understand nor take advantage of the affordances of the combined use of the different tools of communication.

I tried to check the impact of tutors' scaffolding, students' collaboration and the simultaneous use of the different tools on collaboration and engagement in constructive discussions.

5.2.8. Students' perceptions about the factors that promoted their constructive contributions to online discussions

The analysis of the tutorials showed instances where students did not engage in multimodal exchanges, yet discussion moved up to high levels of meaning construction. I needed to check the extent to which the identified factors affected students' motivation to participate.

G1+G2	Strongly Agree	Agree	Disagree	Strongly Disagree
8.1. The tutor clarifies issues raised during the discussion	All students	0	0	0
8.2. The tutor builds on students' contributions	All students	0		0
8.3. The other students clarify issues raised during the discussion.	St1, St2, St3, St4, St5, St9, St10, St11, St12, St13, St14, St15	St5, St6, St7, St8, St16	0	0
8.4. Students build on each others' ideas	St1, St2, St3, St4, St9, St10, St11, St12, St14	St6, St5, St13, St15	St8, St7, St16	0

Table 5.29. Students' self-reported perceptions about the factors affecting easiness of engagement in collaborative discussions

Students found their tutors' scaffolding very important. All students stated that they felt more engaged in constructive discussions when their tutors provided feedback clarifying issues raised during online discussions. Furthermore, they felt more engaged when tutors invited them to collaborate and build on each other's ideas rather than focusing on their individual contributions.

The analysis of tutors' interactive roles and the elaborate negotiation functions they performed confirmed students' responses. Tutors performed high frequencies of exploratory requests inviting students to negotiate and debate rather than simply exchanging information and opinions. They performed elaborate negotiation functions like assertions, clarifications, arguments, challenges that indicated that they engaged in the process of negation and argumentation building on their students' ideas. This was also shown by the high frequencies of IC and RC performed by both tutors and particularly T1.

To re-assess students' reflections about the importance of collaboration, I asked them two further questions. Active students strongly agreed and less active students agreed that they felt easily motivated to participate when other students clarified and explained issues that were raised during online discussions, responded to their contributions and built on their ideas and vice versa. It became clear then that less active students did not avoid participating in multimodal constructive discussions because they did not like collaborating with students. They stated they appreciated collaborative work and other students' support.

In general, in students' views, the role of students' support and tutors' scaffolding were very important and facilitated their engagement in collaborative interactions. Students responded positively to their tutors' scaffolding and collaboration with their peers.

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The same conclusion thus emerged which was that less active students felt motivated to engage in multimodal discussions but did so to a lesser extent because they were unable to participate and at the same time absorb information from different tools of communication. This indicated that less active students had difficulties handling highly multimodal discussions but not collaborative work itself. Consequently, in an attempt to understand the different reflections of students and particularly students who seemed more negative towards the simultaneous use of different tools, further questions were asked.

5.2.9. Students' perceptions on the impact of modal density on engagement in collaborative discussions

The following table displays two questions meant to understand the extent to which modal density impacted upon students' engagement in collaboration and constructive discussions.

G1+G2	Strongly Agree	Agree	Disagree	Strongly Disagree
9.1. I find it easy to absorb information conveyed via two or more communication tools simultaneously	St1, St2, St3, St9, St10, St11, St12	St4, st5, St6, St7, St13, St14, St15	St7, St8, St16	
9.2. I find it easy to contribute to a discussion while absorbing information conveyed via two or more communication tools simultaneously	St1, st2, St3, St4, St9, St10, St11, St12	St5, St13, St14,	St6, St15	St7, St8, St16

Table 5.30. Students' self-reported perceptions on the impact of modal density on engagement in collaborative discussions

Students were invited to reflect on how they perceived the effect of the extent of multimodality of online discussions on ease of participation and information assimilation. The

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majority of students' responses were positive concerning ease of understanding while absorbing information from different tools at once. Some active students strongly agreed and others agreed with the first statement. It is not a surprise that the majority of active students, who showed developed multimodal competencies, strongly agreed with the second statement. Other active students (St5, St13 and St14) agreed with this statement. The analysis of actual extracts showed that active students could actively engage in multimodal exchanges simultaneously using the different tools to contribute their personal views as well as build on others' contributions.

However, less active students' responses were different from active students' responses, which was expected. Their responses finally brought insights into their behaviours towards participating in multimodal online discussions. They disagreed with ease of understanding of information conveyed via different tools and they strongly disagreed with the second statement and found it confusing and difficult to engage in participation while other participants simultaneously used the different tools to negotiate and debate different ideas and views. Their responses indicated that it was difficult to absorb information different tools and they felt cognitively overloaded if they had to participate too. The different responses of students endorsed our preliminary conclusions that individual students displayed different multimodal competencies that were at different levels of development. Therefore, I invited them to reflect more on their modal choices as well as their multimodal competencies.

5.2.10. Some students' examples to illustrate their perceptions

The tenth item of the questionnaire (see item 10 in Appendix 4) invited them to reflect more about the items covered in Table 5.21, providing examples if possible. Active students and less active students provided different answers.

Generally speaking, not all students could provide examples. However, active students confirmed again the ease of contribution to interaction and assimilation of information conveyed through the simultaneous use of the different tools of communication. They provided justifications of how the simultaneous use of the different tools facilitated their collaborative efforts and contribution to constructive discussions:

Information was given by the tutor on the whiteboard, the tutor gave instructions in audio, and we responded to a yes/no answer and then had a verbal discussion with other students and added to the information on the whiteboard.

Extract 1 (St1) from students' questionnaires

In extract 1, St1 provided examples about how the use of the different tools was helpful exemplifying the positive affordances provided by the simultaneous use of the audio, the WB and the YN tools. The YN and the WB were used to support their audio contributions.

I don't remember any specific examples, but I know that I am able to take in what's going on 'on screen' at the same time as I listen to others speak or even when speaking myself. The yes/no button is useful because it helps you to get feedback from listeners. The text chat is useful because you can communicate without interrupting the speaker. However, I would not be able to use the text chat (ie. type) and speak at the same time!! Without feedback from the other students via yes/no button/ text chat etc it can feel like you are speaking into a void.

Extract 2 (St19) from students' questionnaires

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Writing in the chat and the whiteboard helped a lot in absorbing ideas

In extracts 2 and 3, St9 and St2 explained it was easy for them to grasp all information conveyed by the different tools of communication. Based on these extracts, we can draw three conclusions about the affordances of the simultaneous use of tools: the chat tool used with the audio tool served to support audio contributions by providing feedback on each other's contributions, enhancing the processes of negotiation and argumentation without interrupting each other. The chat and the YN tools simultaneously used with the audio tool served to provide each other with the cognitive support and sustain collaboration and engagement in constructive discussions. Finally, they confirmed that the chat tool was a good substitute to the audio tool when different students were actively engaged in discussions using the audio tool. Instead of having to interrupt or wait for their turn, they could alternatively use the chat tool. In other words, the chat and the YN tools used along with the audio offer positive affordances for sustaining collaborative meaning construction. It emerges from these extracts that the simultaneous use of tools offered cognitive support to students.

Other students reflected about other important factors. The following extract is an illustration:

In any of them I am used to utilize internet and computer programs

In extract 4, St3 raised another important feature which was familiarity with technology. He stated that he was very familiar with technology and was able to use computer

software like Elluminate which made it easy for him to use the different tools at the same time, grasping information from different tools when used together.

On the other hand, less active students stated that they could grasp information conveyed through different tools.

For example, it is helpful to have information displayed on the whiteboard that supports what the teacher is discussing and likewise it is helpful when the teacher writes in the text chat area words or expressions that have been mentioned that may be new or difficult to understand so that students can see the spellings.

Extract 5 (St8) from students' questionnaires

St8 stated that she found it helpful when the tutor used the WB and the chat tools to provide examples and explanations in support of what was being explained orally. This extract showed that less active students could grasp information displayed via different tools used at the same time. However, they stated they felt unable to participate when different tools were used. They stated they could not contribute to highly multimodal exchanges because they felt cognitively overloaded. They provided different reasons.

Generally, I find that I have to concentrate on what people are saying in a discussion. Occasionally it is helpful for issues to be raised in the text chat box, however, I find this somewhat distracting

Extract 6 (St5) from students' questionnaires

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You could talk and write or read at the same time- although it is somewhat distracting, bearing in mind that we are also not communicating in our maternal language.

<div align="right">Extract 7 (St13) from students' questionnaires</div>

I find it extremely difficult to concentrate on what people say and respond using a different tool. I am not good at technology, I feel stressed if I have to listen to the tutor or other students and respond in a different tool at the same time.

<div align="right">Extract 8 (St7) from students' questionnaires</div>

Students found it distracting to absorb information and at the same time contribute to highly multimodal discussions. They felt cognitively overloaded. St7 pointed to unfamiliarity with technology. Unlike active students, less active students felt hesitant to contribute to highly multimodal exchanges because they were not good at technology. For less active students, the use of the WB and the chat tools is a demanding task. They could not manage using them while at the same time concentrating on their tutor's and students' contributions.

5.2.11. Students' reflections on their preferences to use one communication tool over another

As was shown by the analysis of the data, students showed their preferences to use the audio tool more than the other tools. They provided the following justifications:

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The audio is the best, I suppose I prefer the text chat as well because it feels less formal and I feel I can express myself more freely there, also you get an instant response from others. With the audio, you have to wait your turn to speak and people can't 'chip in' ideas. The yes no button is very useful but its usefulness is quite limited, it is really only helpful to find out if everyone has understood or if everyone can hear. Which are important things of course but there's not much else you can communicate using that tool. I feel least confident using the white board. I really feel like that is the area for the tutor's content and I find it strange to write there myself. However it is helpful to make notes there as it facilitates the discussions which follow.

Extract 9 (St1) from students' questionnaires

Audio is best and whiteboard is very useful for sharing discussions in small groups with larger group. yes/no button is quick for asserting understanding and text chat, I think, is useful, if audio fails, or when I need to respond to students while they are talking.

Extract 10 (St9) from students' questionnaires

I find the chat a very good support I use it when somebody else is talking

Extract 11 (St11) from students' questionnaires

Active students confirmed the conclusions reached above, namely the use of the audio and the chat tools as a cognitive support to sustain collaboration. Students stated that chat provided opportunities for free participation and interaction, unlike the use of the audio which

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is under the control of tutors. Hence, one of the constraints on the use of the audio tool was the high level of control exercised by tutors on the distribution of audio turns and organization of audio based group collaboration.

Students benefited from the written and oral modes of communication made possible by the use of audio and writing tools to escape the control of their tutors on audio contributions. They could exploit the opportunities offered by the hybrid nature of online discourse by using the chat tool to overcome breaks in conversation caused by technical problems, but also to consciously engage in collaborative discussions building on others' ideas, commenting and providing feedback. They used the chat tool to support corrections, debate misunderstandings, or negotiate meaning. They believed that the use of the YN tool offered a limited communicative affordance which was showing agreement, disagreement and comprehension.

Students were aware of the positive and facilitative affordances of use of the WB tool (taking notes and writing downs ideas and arguments). Despite the ease of use of the WB, they stated they were not confident using it. They believed that the WB was more a tutor tool or a tutor's property. Thanks to the fact that tutors typically controlled the use of the WB tool, students developed the belief that the WB was a tutor's property and thus avoided using it.

Less active students provided different reasons.

Basically I prefer to concentrate on the audio channel for the reason already given. However, the text chat was a 'life-saver' when I lose aural communication. The whiteboard I have found most useful for stating and clarifying teaching points. To write effectively, I prefer to have more time than is possible in an online class situation

Audio is easily the best. The yes/No has the obvious advantage for the tutor and for students in summing up a situation. The whiteboard is best used by the tutor to write the questions, I feel. I have only used it when the tutor asked me to write something. I have only used the text when something is amiss that I want the tutor to be aware of but not the other students.

I prefer the audio and yes/no button are they are easy to use and mirror normal conversation. The text chat is more of a social tool really and I only used the white board once to contribute although it was used by the tutor to give examples, make notes or provide pictures, etc.

I prefer the YN and the audio over the text chat to express opinions since the text chat content can distract you from listening and understanding what is been said, however, text chat is very useful when tutor uses it to correct mistakes.

I mostly preferred the audio. This seemed the most relevant to the tutorial.

I feel a bit shy to use audio because of my pronunciation, text chat is more immediate and white board is not easy as I am not very familiar to it.

Students expressed their preference for the audio tool. They believed that the audio tool was more relevant since the aim behind online tutorials was to practise the language. However, St15 stated that he avoided using the audio tool because of his shyness. He tried to use the chat tool whenever he needed to participate. So responses illustrated that linguistically less able learners often used text chat in the context of audio-graphic conferencing to compensate for a perceived lack of fluency and that it was a welcome backup when problems with the audio connection occurred.

They found writing using the chat or the WB tools demanding and time consuming, hence distracting. They rather found them more beneficial when used by their tutors. An important point hence emerged from their answers which was the misunderstanding of the relevance of the chat and the WB tools to online discussions and collaborations.

In sum, all students believed that the YN tool was helpful because of its ease of use to express opinion and show understanding. However, there was a common agreement among active and less active students that the whiteboard was a tutor's property since it was typically controlled by tutors.

However, all students stated that the chat tool was also used as a social tool to exchange greetings and personal information. They restricted the written chat to a minimum because it was not conversation in the strict oral sense.

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The findings of the analysis of active students' responses indicated that the multimodality of the synchronous medium provided learners with tools and strategies (e.g., change of modality of communication by making selective use of the chat, the WB and/or the audio tools) that helped them garner increased opportunities for collaborative meaning construction.

5.2.12. Students' reflections on the reasons behind their multimodal choices

Active students did not respond to this question, which was expected since they engaged in online discussions using the different tools of communication as was shown by the analysis of their individual contributions. Nevertheless, two active students raised two important points:

I try not to over-use the text chat as I don't want to distract the attention of others who may be speaking or preparing to speak.

Extract 18 (St3) from students' questionnaires

Students were aware of less active students' difficulties handling technology. Hence, they avoided over-using technology so as not to distract and split other students' attention. They attempted to moderate the use of the chat tool for instance. This indicated that students cared about the mainstream of interaction and collaboration.

Less active students provided reasons for avoiding the use of certain tools which confirmed the conclusions reached above.

White Board as I don't know exactly how to use it.

Perhaps it's because I'm male, but I find multi-tasking difficult!

I avoided using the whiteboard because I was unsure how to use it. I used the text chat box infrequently.

I preferred to focus on what the tutor and the other students were saying.

The white board is too complicated at times to use quickly and efficiently during conversation.

All students agreed they avoided using the WB tool because they did not know how to use it. Furthermore, they believed the simultaneous use of the different tools was difficult, demanding and time consuming, hence distracting.

Less active students' responses explained their reluctance to participate in highly multimodal exchanges using the different tools of communication. Results showed that students did not avoid collaboration and collaborative construction with other students. Rather, two important factors affected their modal choices and the way they engaged in online interactions. The first factor was the lack of understanding of the affordances of use of the

different tools. In this regard, less active students stated they did not find the chat and the WB, tools relevant for students' use. They were rather viewed as tutors' properties and more relevant to online discussions when used by tutors more than students. The lack of understanding of the affordances of use of the different tools stemmed from the lack of understanding of their functionalities and affordances. Less active students did not know how to use the WB tool for instance.

Thence, less active students were not able to make an informed use of the tools available in Elluminate. Hence, they did not manage to fully act upon the communicative affordances of use of tools. These conclusions indicated that the multimodal competencies of more active students were more developed than less active students who were not confident users of technology. As such, successful use of the different tools was as described by Hauck and Young (2008)

> [s]eems to indicate advanced levels of multimodal competencies as the efficient use of tools requires students to read and write while at the same time concentrating on the audio input and/or potentially looking at what is displayed on one of the graphic interfaces. (Hauck and Young, 2008, p 12)

Active students used the different tools to aid discussion. So, the results indicated that students engaged in a high degree of interactivity as well as all types of cognitive presence. Students progressed in their understanding by collaboratively constructing new meanings using the different tools. The use of the chat and the WB tools were perceived to offer cognitive and social supports. Concerning the regulation aspect, they did not want to interrupt the tutor nor their classmates who were contributing using the audio. On the cognitive level, they needed to write their ideas before forgetting them.

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In general, active students and less active students perceived and attributed different affordances to use of the different tools of communication. Less active students were unable to perceive the positive affordances offered by the simultaneous use of the different tools because of their underdeveloped multimodal competencies.

5.3. Analysis of Tutors' Interviews

I invited tutors to answer some questions related to the multimodal choices of students, and the way they perceived the importance of the synchronous medium as far as the meaning construction process is concerned.

5.3.1. Preferred tools for tutors

I started by inviting them to talk about their preferred tools.

I would use the audio 80%, the chat I do not use very much. Because they come to these tutorials to speak I do write things for spelling or if they have not understood something the sound is bad then obviously it is good to write it

Extract 1 from T1's interview

The Whiteboard is an excellent tool there is not a lot on it but it does give an excellent support it does

give and provide good ideas for participation and discussion. It is useful to put on probes and give them

something to look at if they forget something it works as a visual support

Extract 2 from T1's interview

I use the chat a lot because I need to monitor students' participation and the use of the chat between

students because as a monitor I can see what is going I do not use the yes and no button that much but definitely I

use the audio because I am leading the tutorial so I have to use the audio however as a tutor it is important to give

the best opportunities for students to participate and practice the language so I should be talking less but as a tutor

you find yourself you have to interfere to invite them to participate and ask for contributions the chat is definitely

useful

Extract 3 from T2's interview

This is something I want to improve the next academic year I think having students to collaborate using

the whiteboard is a quite good way to enhance their collaborative writing skill but also collaborative learning get

involved together doing or presenting things together I have not done much this year but which needs to be done

next year but the course does not give importance to the development of collaborative writing so I will have to

develop my own tasks so that students use collaboratively the board and this is also something I will have to

explain to then and teach because they students do not know really how to write on the whiteboard.

Extract 4 from T2's interview

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Both tutors insisted on the importance of the audio tool which was expected. Moreover, both tutors praised the use of the chat tool as a means to monitor students' interactions as well as theirs. Both tutors used the chat tool to correct students' mistakes and provide feedback. T1 described the whiteboard as a visual support where she wrote ideas and posted pictures that help engaging students in participation and collaboration. T2' stated she did not invite her students to use it very often but asserted the importance of this tool to engage students in collaborative discussions and particularly collaborative writing. She stated that the chat tool was a good means to control the quantity of their discourse to give the chance to students to participate. This correlated with the results of the analysis of videos that showed that tutors withdrew from oral interactions, using writing tools to give students the opportunity to engage in collaborative discussions.

5.3.2. Tutors' perceptions about students' interactive and communicative purposes for using the different tools

I invited tutors to give their opinions concerning the multimodal choices of students.

The use of the different channels affect positively interaction and participation, they do not use the white board, they use the yes and no button obviously to answer questions and they use the chat quiet a lot to speak to each other, they do use it especially for social contact, and the audio tool obviously to participate in the class. Some students use the chat you can see it getting bigger and bigger at the end of the class to write things when they want to back up others ideas or when they do not understand or cannot hear it depends I think on the tutors and tasks

Extract 5 from T1's interview

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The audio is the most important one it is used to do everything. They tend to use the chat just to communicate technical problems or to say hello for quick chat the chat is not is not really useful for them it works like messages in mobile phones quick messages about technical problems you know or ask some thing they need but I do think it is important as a tutor to use it to write down the vocabulary spelling mistakes meaning of words at least everybody can see the chat and comment it, I think the chat is nice to get social contact also if they have problems or need to ask a question so they seem to like the chat quite lot

Extract 6 from T2's interview

Tutors' replies correlated positively with the results of the analysis of tutorials. Both tutors asserted the importance of the audio tool over the other tools. They stated that the chat tool was used as a substitute to the audio tool in case of technical problems. Both tutors confirmed that students avoided using the WB tool. However, they believed that students used the chat tool as a social support rather than a cognitive support. However, results of the analysis of the videos as well as students responses showed that students did use it as a cognitive as well as a social support. Furthermore, T2 shared the same belief as less active students and stated she found the chat tool more relevant for tutors' use than students. This indicated that T2 did not perceive the affordances offered by the use of the chat tool which explained the low frequencies of the use of the chat tool by her group.

5.3.3. Tutors' perceptions about the reasons behind inviting students to use each of the different tools

As a response to tutors' replies, I invited them to explain when and why did they invite their students to use the different tools of communication.

I leave them to use the chat but personally I do not encourage them to use it unless I cannot understand what they are saying, in this case I do ask them to write their answers. I invite them to use the audio to give an answer to speak, to report what they have done the exercises that kind of thing. I believe that online tutorials are to give them a chance to speak, I believe the audio is the priority when they learn at a distance they have no other way of practicing the oral they need to practice and this is the only way to practice I believe they have a lot of opportunities to write but not to speak The whiteboard is an excellent tool but I have not really encouraged them to use it I think that I should encourage them to speak more than writing.

Extract 7 from T1's interview

When we do debate they are invited to use the audio. Personally I do not like the yes and no when they have to be engaged in discussion debating and giving ideas and opinions and if they tend to rely on the yes and no button they will not have any conversation, so I do not like the yes and no button when we do speaking activities or debates. The audio matches my teaching style for me the speaking skill is the most important when learning a language you need to practice a lot if you do not practice you lose a language you forget the vocabulary the grammar and I think this is the purpose of students using Elluminate they need to speak and practice I may be criticised for it but the audio is the priority so the audio is the most important tool

Extract 8 from T2's interview

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I do not encourage them to use the chat because you cannot spend the lecture writing this is not the purpose of having an online tutorial, if the purpose is the development of the writing and the reading skills yes then the use of the chat is important but the purpose of using Elluminate for online tutorial is to contribute to the language using the language actively it is better not to rely too much on the chat, I think it would be a disaster then to use Elluminate to read a book together or focus on writing because the target is the speaking skill. I ask them to use it when they cannot use the audio when they have technical problems

Extract 9 from T2's interview

Both tutors insisted on the importance of engaging students in oral interactions using the audio tool. They believed that students meet online to practise the language and develop the speaking and listening skill rather than the writing and reading skills. This indicated that tutors did not perceive the affordances the use of the written mode offered to develop the speaking and the listening skill as shown by the analysis of tutorials. The use of the written mode was not meant to develop the writing skills, as online discussions were a hybrid event supported by both modes of communication. They asserted that students were invited to use the chat tool just to overcome breaks in the oral conversation because of technical problems.

Finally, T2 talked about an important aspect which was inviting students to use the different tools according to the type of tasks and topics. Results of the analysis showed that students and tutors attributed different interactive and negotiation functions to the different tools. For topics that invited students to simply share ideas and opinions, students used the audio tool only. For topics that were appealing for negotiation and debate of ideas, students

used the different tools of communication as exemplified by the two last extracts in Chapter Four as well as students' reflections in the first section of the present chapter.

Based on their answers, which at first sight indicated that tutors believed that the writing tools were not important, I explicitly asked them to reflect on the way they perceived the importance of each tool of communication.

5.3.4. Tutors' perceptions about the extent to which modal density of online interactions was important and helpful

I think you need more than one tool you need different tools not just one discussion would be very limited otherwise. But the way they are used makes a big difference as well as the system itself. The whiteboard is essential I should have used them more and particularly the whiteboard I should have invited students to use it more looking back at it at the end of the course I realize how important it is however students have not learnt to do that or use it. It is important because it works as a stimuli what is difficult in language learning is to find something to say about tasks and prepare them a little bit but when having something written a demonstration like pictures they can have ideas and initiate sometimes by asking questions about something written on the board or make a comment. When you jump in the air you need a parachute, they are just like a parachute, all are important even advanced students use all of them with intermediate learners we do not use the WB very much but with advanced

<div align="right">Extract 10 from T1's interview</div>

I cannot see how can the use of different tools hinder interaction actually again it depends on the type of

task and what you want them to do, but the use of different modes for discussion can only be helpful.

<div align="right">Extract 11 from T1's interview</div>

Elluminate allows learners to contribute and collaborate and obviously when they use all these different

tools they can use the tools on their own to collaborate, share ideas and work collaboratively I think the fact they

are active and allowed to make mistakes and they are allowed to express their views opinions and feeling using

the yes and no button and the chat it is all part of making progress and a part of learning effectively a language.

<div align="right">Extract 12 from T2's interview</div>

I think yes the combination is the ideal recipe for effective learning online but it requires a lot of preparation and planning for it works well and lot of monitoring for the whole to work together we tend to go for the easiest option which is focus on one tool because it might be confusing for the tutor and the student to use all of the tools at the same time because you have to bear in mind that some students are not very ICT literate and asking them to use all the tools perhaps at the end of the year when they are more confident with the software we could go for that but I do agree that a combination is the ideal because it is more challenging and adults learners like this kind of challenge it is not bring you are active doing a lot of things and you forget about the stress of making mistakes generally I think that Elluminate is good it enables the tutor to remain in contact with students and it enables or it gives a different experience form the face to face tutorial the tools are important but have to be used appropriately

<div align="right">Extract 13 from T2's interview</div>

I think they are all important it depend on how to use it and when to use it and the right combination would lead to a collaborative learning

<div align="right">Extract 14 from T2's interview</div>

Contrary to the impression conveyed when answering question 3, tutors asserted the importance of the affordances offered by the different tools of communication to enhance collaboration and constructive discussions. T1 described tools as a parachute and T2 described them as an effective recipe for effective online language learning.

Tutors believed that tools were beneficial if they were used in the appropriate way with the appropriate tasks. Their replies correlated with the results of the analysis of students' questionnaires. Students believed that task type and tutors' styles had a direct impact on the way they used tools and engaged in collaborative discussions. This is to say that participants needed to have a full understanding of the affordances of the individual and the simultaneous use of the different tools of communication in order to get the most benefits from the synchronous medium. In addition, tutors needed to choose the right tasks for the appropriate right tools' cluster.

Furthermore, T2 pointed to an important issue which was the level of development of multimodal competencies of students. She believed that it was sometimes difficult for some students to use different tools and at the same time absorb information. She stated that it was difficult for students and for her to manage all that was going on on the screen. This indicated that tutors and students needed to have a more developed understanding of the affordances of use of the different tools of communication. They needed to know when and for what purpose they could use the different clusters of tools:

5.3.5. Reasons attributed by tutors for student avoidance of some tools

Though tutors and students believed that tools were important, some students avoided using the chat and the WB tools. I invited tutors to reflect on this point.

I am sorry this is my first year teaching second level and learning to use the whiteboard and I am still

learning how to use the whiteboard and the course book but I invite them sometimes to make notes on the

whiteboard which is an important part of their course they need to know how to take notes to write something or

to report something. I probably did not insist enough on them to take notes using the whiteboard but some of

them actually did. Some students know how to use it others do not.

<div align="right">Extract 15 from T1's interview</div>

Concerning chat, even the less good ones avoid using the chat they need to practice otherwise they do

not come online

<div align="right">Extract 16 from T1's interview</div>

I think students love the synchronous system, according to their age as well, some people feel a bit

anxious and others think of them just like toys. The main complaint of students is that sometimes they spend

more time doing IET than doing French

<div align="right">Extract 17 from T2's interview</div>

Tutors believed that students avoided using the chat and the WB tools because they did

not know how to use them, particularly the WB tool. T2 said that students spent more time

doing IT than doing French. Lack of training and use of technology were a handicap for the

effective use of technology to engage in constructive multimodal discussions. On the other

hand, T2 believed that students avoided using the chat tool because they needed to develop

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their speaking and listening skills, whilst they had many opportunities to develop the writing and reading skills. Their replies agree with those of less active students who stated they needed to meet online to practise the spoken language.

5.3.6. Tutors' perceptions about the importance of the simultaneous use of tools and the usefulness of the different clusters

Results of the analysis of tutorials and students' questionnaires showed that the simultaneous use of tools had different effects on the progression of discussions to high levels of meaning construction. I invited tutors to give their opinions about this particular point.

I have tried to use different modes at the same time but generally speaking I think that the best collaboration you can get is when the tutor is not present

Extract 18 from T1's interview

I believe that any combination of the audio and writing is very helpful and essential for online students. However, I think that the chat is easier to use than the white board so I believe that the best combination is the audio and chat followed by the audio, chat and WB.

Extract 19 from T1's interview

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I said earlier it can be confusing and if it is done at the beginning of the year you are asking for a disaster because they are not expected to be good at using the tools but if the tool is well monitored by the tutor it will work and the tutorial would be exciting if for example the students are using the chat and the whiteboard at the same time if they are working together one speaking and the other using the whiteboard this is ok but again it requires a lot of monitoring from the tutor in order to help and support I would say the yes and no and the audio together it promotes collaboration because you speak, listen and participate at the same time so I would say that the whiteboard and the chat would work together I would say because it requires writing and speaking at the same time and lot of thinking if they work together they have to be very organised but if it is done really well the result is very well but this has to be very organised and explained lot of suggestions by the tutor and especially at the beginning of the year

Extract 20 from T2' interview

I think that the audio is the most important and I realized that we need all these tools to make sure we communicate effectively I would say a combination is important like the audio and the yes no, the audio and the chat are very important the problem is to avoid confusion and make students right from the beginning to be confident using them

Extract 21 from T2' interview

I do not think for tutors is very difficult you have to pay attention to every thing on one hand it is important because it is not boring because there is a lot going on so students are active all the time but sometimes you think it too much so the answer is we need to use the effective combination for students this might be confusing it might be quite demanding for them to use different tools and absorb information from different tools at the same time specially if they are beginners. I think they are adult they like challenge it is up to the tutor to give them the right support and time so if they have to do a task using the different tools you have to give them time and I think that they tend to help each other a lot so it is not that much difficult

Extract 22 from T2's interview

T1's extracts showed the importance of the simultaneous use of the chat tool and the audio tool to adopt different tutorial roles as it was shown by the analysis. T1 asserted the importance of the use of this cluster to retrieve from oral interactions to give the opportunity to students to take responsibility of their learning and throw them in the pool of collaborative meaning construction. The use of the written mode with the oral mode was meant to enhance autonomous learning by engaging them in I-R-RC-F and IC-R-RC-F discussions (see page 172).

T2 believed that the simultaneous use of the audio and YN cluster was very important and served to enhance students' collaborative meaning construction. However, T2 believed that the simultaneous use of the different tools and clusters of tools was very difficult and demanding for tutors and students. The same idea emerged again which was the level of development of multimodal competencies of the different participants. Participants did not need to know how to use the technology of the individual tools only. Rather, they needed to know how to use clusters of tools. Multimodal competence is not limited to the use of tools,

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but to clusters of tools with the appropriate interactive and communicative functions. Multimodal competence should be defined as the need for participants to understand the particular structure of online discourse, the specificity and the hybrid nature of online discourse, and the use the writing tools and written mode to develop their speaking skills.

5.3.7. Tutors' perceptions about the reasons behind students' spontaneous and simultaneous use of the different tools

As exemplified in the first section of the present chapter, the understanding of the interactive and negotiation functions that students ascribed to the use of the different tools of communication was important. Hence, I thought of inviting tutors to reflect on their students' multimodal choices with particular focus on the spontaneous use of the different tools.

There are several situations if they have a problem if they have a question and also if they have an idea and want to share it with others. The audio is the most used but when discussions are very interactive they tend to use the chat as well

Extract 23 from T1's interview

It depends on the task you are setting if you are asking them to discuss something you are asking them to think without having back up (use more modes) they need to speak and the use of other modes would be very useful.

Extract 24 from T2's interview

Both tutors believed that students used different tools of communication to participate in multimodal discussions depending on the tasks and topics being discussed. Their replies thus confirmed students' belief that the extent to which they engaged in collaborative discussions was affected by the nature of tasks and topics proposed for discussions. Tutors asserted that students tended to simultaneously and spontaneously use the written and oral modes when engaged in discussions that appealed for negotiation and debate of ideas. Students managed to take advantage of all opportunities to participate and get involved in ZPD for collaborative meaning construction, switching between the written and the oral modes of communication.

5.3.8. Tutors' perceptions about the importance of the simultaneous use of tools

Tutors indicated they were hesitant to invite students to simultaneously use the different tools of communication. The analysis of the online tutorials showed that the simultaneous use of the different tools of communication facilitated high levels of collaborative meaning construction.

This is true up to a point I think it is difficult for language learners though because they need to concentrate on what they are doing it can be very confusing to use different modes at the same time particularly for students who are not used to use technology but younger students do not have this problem and are the ones who generally engage in multimodal discussions using different modes and are happy with this, students new to this kind of platforms find it difficult and confusing they forget where are the tools and how to use them but more experienced students get used to it and use it quite naturally

Extract 25 from T1's interview

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The tutor needs to use different tools at the same time we need to keep an eye on the chat line there might be questions for us we need to keep an eye on the board to see if somebody is coming if we cannot afford to use one

There is a lot happening and a lot to be done and I am not sure it works if students are not confident with the use of tools they do not use them. I think I have to be honest it might help but then we hesitate we are not sure if students will do well with tools so we tend to avoid asking them to use the different tools to collaborate but then it depends on the task it depends on the students you have

If the students are confident as well as which combination of students and on the task as well and the way it is presented for example I have tried asking them in groups to work out a story and this task is meant to develop their imagination and thinking skills but it did not work though they were on their own and they had the audio, the chat and the whiteboard I think it is not challenging however if you give them the vocabulary if you go through it if you explain the grammar to use in the task then it works when working together, so it has to do with the explanation f the task it has to be clearly explained the choice of students who work together

Tutors pointed to the same aspect which was familiarity with technology. Both tutors found it very difficult to manage interactions when students simultaneously used the different tools of communication. It became confusing for them as well as for their students. They stated that some students were not very competent in using technology which made it very difficult for such students to use technology or absorb information when different tools were simultaneously used.

In sum, both tutors believed that underdeveloped multimodal competencies were a major handicap towards the effective use of a synchronous environment like Elluminate.

Furthermore, like students, tutors believed that the use of the synchronous medium, the tutors' styles and their teaching strategies, the kind of tasks and the way these were implemented by tutors and realized by students were important factors that affected students' engagement in constructive discussions. The affordances of use of the medium were changeable and were very much related to the way the learning environment was organized.

The learning environment is a system where all its elements (types of tasks, synchronous medium, tutors' teaching styles and strategies, level of development of students' and tutors' multimodal competencies) are interrelated and influence each other. The way each participant attributed or perceived the affordances of the synchronous medium was shaped by his/her multimodal competencies and ability to use technology.

Chapter Six

Discussion and Conclusion

6.1. Introduction

Guided by the literature, to understand how online language students construct meaning together, this thesis brought together two lines of research. The first was concerned with developing a methodological framework for the presentation and analysis of multimodal online interactions. The second was concerned with the analysis of online multimodal discussions and the affordances offered by the use of the different communication tools offered by SAGC to support the collaborative meaning construction process. The primary aim of this thesis was to increase understanding of the way and extent to which communication tools help in constructing meaning in audio-graphic conferencing setting. To do so, this study examined the interrelationship between the different mediational tools of communication and the different affordances of their use that may hinder or promote the creation of zones of proximal development for collaborative meaning construction. This research drew on the socio-constructivist understanding that the process of creation of new meaning is individual and social, and meaning is developed, carried forward and constructed through collaboration.

In this chapter, conclusions are examined in the light of the different research questions and assumptions described in the preceding chapters.

6.2. Patterns of online multimodal interactions

The data analysis provided answers to the following first research question   ,

- What are the patterns of online multimodal interactions?

This question aimed to find out patterns of engagement by participants with each other's contributions and interaction. The coding scheme adopted by this research addressed the types of interaction between participants and how tools were used for different interactive communicative roles and purposes.

Reflecting on this study's conceptualization of the hierarchical educational online exchanges system, turns in exchanges were first coded according to five interactive categories: Initiate (I), Initiate continuity (IC), Response (R), Response continuity (RC) and Feedback (F). This analysis revealed the structural organization of online exchanges. The interactive categories were further classified according to their associated communicative functions which were reflected in the negotiation functions of their associated moves. The application of this coding revealed different points:

First it should be noted that results showed evidence of opportunities for participation and interaction.

6.2.1. Tutors

Results showed that different teaching styles and multimodal choices led to different patterns of interactions. The two tutors produced high percentages of I turns that were relatively balanced between initiating to give information, provide explanations, ask questions

to elicit more information, as well as invite students to build on each other's ideas during discussions.

T1 tended to extend topics more than T2 by producing more IC interactions. T1 made more attempts to ascertain the meaning of previous turns through closed questions that specified the information to be confirmed. Although there was a big difference in the percentage of both tutors' IC interactions, the analysis showed that they reinitiated to perform the same negotiation functions, hence attributing the same communicative functions to their IC interactions. The greater proportion of IC associated negotiation functions comprised exploratory requests, application requests, clarifications, arguments, and assertions as well as low rates of challenges. Both tutors reinitiated by asking open ended questions which were primarily meant to seek more clarifications on previous turns. Both tutors extended previous topics, performing elaborate negotiation functions which translated their attempts towards engaging their students in constructive discussions that facilitated collaborative meaning construction.

Both tutors produced low percentages of responses which were mainly replies that stated information rather than responses that defended or disputed stated positions or presented constructed beliefs and reasoning. Both tutors produced low percentages of RC. RC interactions associated with assertions, clarifications and challenges were mainly replies that defended stated positions and presented constructed beliefs and reasoning building on their students' ideas.

Thus, I, IC and RC interactions suggested great efforts by tutors to support the meaning construction process by using negotiation functions that served to provide information, convey meaning, prompt, probe, and guide and facilitate learning. Hence, the first conclusion is that the particular presence of IC and RC interactions conveyed attempts to extend previous topics engaging students in constructive discussions that conveyed substantial

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information and depth of negotiation and debate. Both tutors maintained a visible tutor presence by engaging in IC interactions. Thence, the presence of IC interactions indicated a deeper involvement in both the provision and exchange of information for scaffolding and supporting the learning process.

To engage in I and IC interactions, tutors used primarily the audio tool. In addition, they used the A+C and the A+WB clusters to post pictures or comments and highlight new words, concepts and ideas while explaining them using the audio tool. Concerning R and RC interactions, results showed that tutors withdrew from direct oral interactions using the writing tools. The analysis of extracts showed that the switch to the written mode using the WB and/or the chat tools created opportunities for students to build on each other's ideas while at the same time being supported by tutors' written contributions.

Moreover, results showed the predominance of the writing tools over the audio tool to engage in R, RC and F contributions. Tutors showed the same multimodal preference towards the use of the written mode along with the oral mode when performing elaborate negotiation functions to sustain negotiations and debates. Results indicated that tutors used the A+WB cluster using the whiteboard alongside the audio tool to write their contributions as well as their students' contributions instead of simply posting pictures and their pre-prepared texts or instructions.

It is concluded then that tutors switched between the written and the oral modes using the writing tools to withdraw from oral participation to create opportunities for students to engage in collaborative constructive discussions. This was further confirmed by tutors' interviews. Tutors provided the appropriate scaffolding and support for autonomous collaborative learning using writing tools. The main conclusions are then: tutors ascribed a particular use to each tool. They adopted different tutor roles, switching between the written and the oral mode thanks to the availability of different tools that are in complementary

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relationship. To play the role of virtual classroom controller, they used the audio, and A+C and A+WB clusters. To play the role of observers, guides and facilitators, they mainly used the chat and the WB tools.

6.2.2. Students

The examination of patterns and quantity of students' interactions showed instances where interaction was at high levels.

The very low rate of G1's I and IC interactions was meant to invite tutors to provide more explanations and information. However, both groups of students produced high percentages of R and RC interactions. Students responded and engaged in successive responses to defend and/or dispute challenges with information and evidence before they finally reached agreement and built consensus. These negotiation functions reflected the rhetorical tactics used by participants to achieve certain communicative purposes. For the present collaborative learning context, the use of a wide range of IC and RC indicated more efforts by students to extend discussions building on each other's ideas and suggested attempts to offer alternative perspectives and engagement in the process of argumentation. The presence of RC clarification and RC exploratory requests indicated attempts to progress further in the understanding of the topic by questioning rather than merely accepting the shared information. The presence of RC challenge/counter-argument suggested efforts at critical appraisal of what was said in previous turns, resulting in the proposal of alternatives for further discussion.

R and RC interactions associated with elaborate negotiation functions were hence a necessary element in the social constructivist learning process because such interactions are sources of cognitive conflict (von Glaserfeld, 1989) that prompt debate and reconsideration of

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ideas, which signals effort at collaborative meaning construction. In addition, this type of R and RC interactions suggests an awareness of knowledge gaps and attempts towards collaborative negotiation and argumentation. Thus, the prevalence of R and RC interactions associated with elaborate negotiation functions indicated that the interactional patterns of both groups reflect more closely the characteristics of constructive discussions as participants collaborate to share information yet contribute critical responses that prompt efforts from others to justify or explain their views. Students tended to explain and elaborate at greater length in RC interactions more than in R interactions, hence providing more depth of negotiations and debates. The same conclusion was reached that RC interactions indicated students' efforts to support the meaning construction process by building on each other's ideas. Hence, we concluded that such efforts reflected the extent of learning support available from peers and tutors in the collaborative group learning process.

The meaning construction process was thus described as sets of I and IC interactions followed by successive RC interactions that indicated the presence of exchanges where the shared information was questioned, checked, or challenged, which reflected meaning negotiation that built new understandings. Thus, the extent of participation was shown by the frequency of types of interactional roles adopted by participants. The more students engaged in RC interactions, the more they were actively involved in the process of collaborative meaning construction.

Therefore, I conclude that online interactions were tailored to the requirements of learning in the context of SAGC. Participants engaged in IC and RC interactions as attempts to extend discussions, thus creating zones of proximal development for collaborative negotiations and debates.

As far as the use of the different tools of communication was concerned, students behaved like their tutors by ascribing interactive as well as communicative functions to each tool as well as clusters of tools of communication. Despite the overwhelming use of the audio tool to engage in all types of interactions performing all kinds of negotiation functions, students particularly used the oral and the written modes of communication to perform elaborate negotiation functions when engaged in RC interactions to build on each other's contributions.

Results showed that the difference in terms of Groups' multimodal choices was insignificant when responding to their tutors. Students showed the same preferences as each other towards the use of the audio, the chat, the WB and the YN tools. Students predominantly used the audio tool to exchange information, express opinions and provide explanations and clarifications. Few attempts were made to use the chat tool when they faced technical problems. Few attempts were made to use the WB as a response to their tutors' invitations. Few attempts were made to use the YN to respond to their tutors' comprehension checks and to show rapid agreement or disagreement. In addition, they used the YN tool for phatic functions i.e., to establish social contact or acknowledge the hearing of previous turns.

However, to engage in RC interactions, active students and less active students made very different multimodal choices. Less active students predominantly used the audio tool to perform all kinds of negotiation functions. They did not make any attempts to use the chat or the WB tools.

In contrast, active students made more diversified multimodal choices. They used the different tools at more or less the same frequency to build on each other's ideas. They simultaneously used the written and the oral modes to engage in collaborative negotiations and debates with the aim of reaching consensus and collaboratively building a new agreed upon meaning.

It was concluded that the extent to which students got involved in constructive discussion was indicated by the frequencies of engagement in RC interactions. Engagement in RC interactions was facilitated by the switch between the different tools of communication. The availability and the use of the different tools of communication offered different affordances that enhanced students' participation in the learning process. This confirmed other researchers' findings that synchronous conferencing systems offer better opportunities for students' participation (Hampel & Hauck, 2010; Mirza & Lamy, 2010; Guichon, 2010; Fergusson, 2009).

6.3. Patterns of multimodal online exchanges

The previous section explained the conclusions reached from the analysis of individual turns. To examine the social process of meaning construction, we need to examine the way turns build on each other to govern how the different patterns of online exchanges shaped out. Hence the following question was raised:

- What is the effect of the affordances of the individual and the simultaneous use of communication tools on patterns of online multimodal exchanges?

Students participated in different types of exchanges that displayed different patterns as well as different levels of modal density. Patterns of online exchanges were shaped out by the different associations between I, IC, R, RC and F interactions as well as the mediational multimodal choices of participants. The analysis identified four types of online synchronous exchanges: I-R-F, IC-R-F, I-R-RC-F and IC-R-RC-F online exchanges. This research further classified them into cumulative and exploratory exchanges according to the extent to which

they reached high levels of meaning construction and extent of participation of the different participants.

Tutors provided structured support in involving students in different types of exchanges to construct meaning together. I and IC interactions associated with close ended information, exploratory and application requests involved students in I-R-F and IC-R-F that were described as cumulative but not collaborative exchanges; where there was one way flow of information between a particular student and his/her tutor. Participants focused on their individual contributions using elaborate negotiation functions without engaging in collaborative meaning construction. These were immediate and not extended exchanges. Results showed that I-R-F and IC-R-F reached high levels of meaning construction (Ph3). However, students performed elaborate negotiation functions but failed to launch collaboration due to the high level of control exercised by tutors over the distribution of turns. The control exercised by the tutor on the organization of interaction and distribution of turns limited students' opportunities towards collaboration and collaborative construction of meaning. Consequently, despite the fact these exchanges reached Ph3 of meaning construction, they were described as low level cumulative non collaborative exchanges. As such, in I-R-F and IC-R-F students were recipients of a transmissive pedagogy. The focus of students on their own contributions had a potential problem of missing the benefits of socio-cognitive conflicts, in which ideas were challenged, defended or defeated (Golay Schilter et al., 1999; Hinde, et al., 1985; Mercer & Littleton, 2007). The exchanges were predominantly cumulative. Evidence from tutorials showed students adding to each other's ideas without criticizing or challenging them. Collaboration between students involved the use of meaning making tools which included engagement in forms of collaborative exchanges that support social meaning construction. Collaboration requires negotiation with other group members. In other words, collaboration involves partners carrying out work together (Dillenbourg, 1999;

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Mangenot & Nissen, 2006; Fergusson, 2009). It is the result of a continued attempt to construct and maintain a shared conception of a problem (Lipponen, 2002); an interaction in which participants are focused on co-ordinating shared meaning (Crook, 1999). Participants must negotiate mutually shared or common knowledge in order to work together or to perform a task together (Littleton & Hakkinen, 1999). Collaborative negotiation is held to trigger collaborative construction of meaning and hence learning.

I-R-F and IC-RF exchanges engaged in by students resulted in an accumulation of information and exchange of ideas, but avoided the challenges, counter-challenges and explanations that are important features of collaborative meaning construction.

On the other hand, I and IC interactions associated to open ended information requests and exploratory requests involved students in I-R-RC-F and IC-R-RC-F exchanges. I and IC interactions were used to begin subsequent successive responses (RC) to extend discussions which took the form of IC-R-RC-F or I-R-RC-F exchanges. Contributions built on each other and the process was extended rather than immediate. This added weight to ideas from previous discussions. These types of exchanges functioned as sites for the extensive consideration of questions and propositions. I and IC turns associated with open exploratory requests involved students in R followed by successive RC interactions that were dedicated to perform elaborate negotiation functions. Successive responses engaged students in active collaborations for negotiation and debate of ideas.

The analysis showed that the higher frequencies of RC interactions that formed I-R-RC-F and IC-R-RC-F were associated with elaborate negotiation functions, which indicated participants' tendencies to extend speaking time for the purpose of negotiating and debating ideas.

Some exchanges did not progress beyond the negotiation level. I-R-RC-F and IC-R-RC-F exchanges that were characterized by active engagement in the negotiation process were described as cumulative but collaborative exchanges. Students were able to create their ZPD where they built positively but uncritically on each other's ideas. However they did not attempt to sort out conflicts, such as those that might be necessary to create new meanings and a change in understandings. Hence, these exchanges were described as moderate cumulative collaborative online exchanges.

Some exchanges progressed beyond the negotiation level where students engaged in an argumentation process, challenging each other's ideas. Exchanges that reached the argumentation level were exchanges were students succeeded in reaching consensus, creating new understandings and meanings, and finally applying them. Hence, these exchanges were described as exploratory exchanges where students pointed to conflicts and tried to resolve them by challenging each other's ideas till they reached negotiated agreement, changing their understanding and creating new agreed meanings. Conflicting views were presented but the intention was to reach a resolution and a consensus. RC interactions then helped students to extend their understanding. They were implicated in the shared construction of meaning, not only to understanding related to the task in hand, but also to the construction of shared understandings and contexts that allowed learners to work effectively as a group. Exploratory exchanges were thus characterized by active participation of different students, justifications, alternative views, visible reasoning and the joint consideration of opinions, challenges, statements and suggestions to be interwoven in I-R-RC-F and IC-R-RC-F exchanges.

These patterns allowed tutors to present options to the group and then to step back, leaving ideas to be reworked and combined with related ideas by students which then triggered negotiation and discussion. This is a well-established method of constructing meaning together successfully (Rojas-Drummond, Mazon, Vega & Velez, 2007). These exchanges allowed

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students to pool their experience and build positively and critically on previous contributions in the discussion, constructing shared meaning by a process of negotiation and argumentation rather than simple accumulation. There was a socio-cognitive conflict in which the presentation of challenges and variant perspectives had the potential to move the discussion on (Hinde, Perret-Clermont & Stevenson-Hinde, 1985). Argumentation and negotiation are prerequisites for collaborative knowledge construction.

Thus, I-R-RC-F and IC-R-RC-F were extended discussions that were elaborate and constructive. They were elaborate because participants performed elaborate negotiation functions. They were constructive because they reached high phases of meaning construction (Ph3, Ph4 and Ph5). These may be compared to exploratory dialogues proposed by Littleton and Whitelock (2005) who defined exploratory dialogue as "The social form of thinking that is essential for successful participation in educated communities of discourse (Littleton & Whitelock, 2005, p 152).

I conclude then that in the field of synchronous audio-graphic conferencing, online discussions offered students the possibilities to engage in exploratory exchanges (I-R-RC-F and IC-R-RC-F) that supported extensive negotiations and debates. Thus, I reached the conclusion that results suggested different extents of engagement in the learning process for both groups. The high frequencies of I-R-F and IC-R-F suggested a greater tendency to start competing new exchanges rather than the follow up on previous turns. I-R-RC-F and IC-R-RC-F suggested collaborative efforts to actively attend to the meaning and implications of others' contributions and further develop the topic of discussion through reinitiating turns as opposed to only focusing on own contributions.

6.5. Modal density of online exchanges

The aim of this section is to understand how the affordances of the different tools of communication to engage in different types of exchanges can most effectively support online language teaching and learning. It answers the following question:

- Do multimodal online synchronous interactions in audio-graphic conferencing support the meaning construction process and if so to what extent?

Affordances of use of tools of communication were shown to have positive and negative implications. Accessibility offered learners relatively easy access to large amounts of information and increased opportunities for collaborative work, although it can lead to information overload, as argued by Kear and Heap (2007).

Results showed that online discussions reached high levels of meaning construction where new understandings and meanings were collaboratively created and applied. Students engaged in related short as well as long exchanges that were mediated by multimodal tools. Both information sharing and topic development phases in online exchanges were found. They indicated participants' involvement in the comparison of individual understandings of concepts, meaning negotiation, and debate of shared information which are characteristics of the collaborative constructivist learning process. The availability of different tools of communication offered different affordances that helped to a high extent in the creation of the different online exchanges that displayed different levels of collaboration and opportunities for collaborative meaning construction.

Students and tutors seemed to believe in an inherent hierarchy among tools and behaved accordingly. They gave priority to the audio tool over other tools. In this regard, Mangenot and Nissen (2006) stated that "Regarding mediated communication and tool choice: an implicit hierarchy seems to exist" (p. 5-6). According to Norris (2009), modal density can

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be achieved by intensity, which means that focus is on a mode of communication which is believed to be best suited to deliver a message under present circumstances. Norris (2009) explained that the importance of specific modes in interaction was determined by the different circumstances of the situation of the communication such as the social actors and environmental factors. Results of the current study showed that modal density was achieved by intensity that I redefined as the use of one particular tool of communication which was believed to be best suited for a particular communication situation, hence favoured over other tools to engage in online discussions. Alternatively, Norris (2009) explained that modal density could be achieved by complexity when several tools are simultaneously used to deliver the same message and no single tool was given priority over the others. Based on the results of the present analysis, and as regards the nature of the synchronous audio-graphic conferencing medium under study, I suggested a similar concept that I called modal complexity to cope with the nature of synchronous multimodal online interactions. By modal complexity I refer to the simultaneous use of tools by learners to build on each other's ideas rather than conveying the same message, where some tools might still be given priority over the others.

As regards the nature of the data of this research, modal density was created through intensity as well as modal complexity. Intensity was the characteristic of all types of audio-only exchanges and multimodal I-R-F and IC-R-F discussions where the audio tool was prominently used. For I-R-F and IC-R-F discussions, there was a unidirectional exchange of ideas and attempts to limited negotiations between tutors and individual students. Circumstances in this situation necessitated the use of the audio tool. The use of a second tool was not essential and represented an insignificant support to audio contributions. The chat tool for instance was used because of audio technical problems, the YN tool was used to show quick agreement and comprehension, and the WB tool was used to post pictures, texts and

summary of discussions by tutors. Less active students, who showed low levels of multimodal competencies, engaged in exchanges with intensive modal density.

On the other hand, only on a few occasions was modal density achieved through modal complexity which boosted up discussions to high levels of meaning construction. Effective modal complexity was achieved when all tools were simultaneously used when engaged in multimodal I-R-RC-F and IC-R-RC-F discussions. Participants were involved in collaborative negotiations and debates trying to make use of all participation opportunities offered by the synchronous medium shifting focus from oral mode to use the writing mode as well. However, priority might still be given to the audio tool. Results showed that meaning construction was enriched by the simultaneous use of the different tools that offered affordances that were not available when using the audio tool only. Groups of students were prompted to share knowledge, challenge ideas, justify opinions, evaluate evidence and consider options in a reasoned way. The affordances of modal complexity (i.e. the simultaneous use of tools of communication) can be described as supporting collaborative efforts.

Modal complexity was characterized by a gradual withdrawal of tutors' control over time with the use of fewer I-R-F and IC-R-F exchanges. Tutors exercised minimal control over discussions through IC and RC extended turn sequences. Tutors retreated from oral participation leaving the floor to students to build on each other's ideas. Compton (2009) stated that online tutors should ensure that there are ample interaction opportunities and provided sufficient guidance and support for learners in the selection of learning options. In the current study, tutors provided more learning support and scaffolding when using the written mode via the use of the chat and WB tools. Students engaged in IC-R-RC-F and I-R-RC-F exchanges where control moved from tutors to students providing thus both the means and the opportunity for learners to engage in exploratory online exchanges. The shift from a

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tutor-led discussion to a more student-led discussion via the simultaneous use of the written mode by tutors corresponded with heightened levels of interactions for the co-construction of meaning. This was very important for the development of autonomous learning. In this regard, White (2003) stated that the learner autonomy approach emphasized negotiation of meaning and "Includes the capacity to negotiate and develop control of learning experiences while interacting with others in the learning community" (p. 161). Furthermore, Hampel (2009) carried out a study to identify a range of skills that tutors require for collaborative learning to be successful. She stated that tutors were faced with the challenge of finding a balance between encouraging learner autonomy and learner control. This analysis showed that the shift between modes using the chat, the WB and the audio tools helped tutors to create this balance.

Results showed that the more intense the collaboration was, the more the students simultaneously used the different tools of communication to refer and build on each other's contributions without having to wait for their audio turn. Writing tools provided participation opportunities for active students to engage in exploratory exchanges that reached Ph5 of meaning construction. In this case, the WB tool was not used to post pictures or pre-prepared texts by tutors; the chat tool was not used as a substitute to the audio tool but rather to constructively contribute to online discussions. When engaged in I-R-F and IC-R-F exchanges, the use of the WB tool and the chat tool along the audio tool offered technical affordances as was explained by T1, who described them as parachutes that saved online discussions in case of technical breakdown. However, the simultaneous use of the different tools of communication when engaged in multimodal I-R-RC-F and IC-R-RC-F exchanges offered positive affordances providing a cognitive support to collaborative meaning construction. Students shifted to collaborative work taking responsibility for their learning by shifting responsibility from the tutor to the group. Students managed interactions and engaged in the collaborative process of meaning construction where they referred to each other's

contributions made in the different tools. Hence, results revealed facets of engagement by participants in each other's contributions, which indicated the underlying interactional and negotiation purposes of use of the chat, the WB and the audio tools.

It is concluded then that the gradual reduction of tutors' control from interactions was made possible thanks to modal complexity through the availability of writing tools. The use of different tools facilitated students' engagement in productive interactions that built into exploratory exchanges where students collaborated to negotiate and debate ideas before they reached agreement, built consensus and created new understandings. The shift of responsibility from the individual to the group promoted constructive discussions that enhanced collaborative meaning construction. In the field of asynchronous communication, researchers (Littleton and Whitelock, 2005; Littleton, 2007; Mercer and Littleton, 2007; Ferguson, 2009; Littleton and Mercer, 2009) found that students worked avoiding cumulative exchanges in order to collaboratively construct new knowledge. Similarly, results showed that synchronous students engaged in exploratory exchanges to progress beyond simple accumulation of information to engage in negotiation and argumentation processes using all tools of communication. The availability and use of the different tools of communication offered affordances that facilitated the smooth shift between the different types of online exchanges. Students managed to create ZPD when engaged in multimodal I-R-RC-F and IC-R-RC-F exchanges using all tools of communication.

Modal complexity thus offered opportunities for the creation of ZPD for collaborative negotiations and argumentation. Moreover, modal complexity through the switch between tools supported the move from low phases towards high phases of meaning construction. IC-R-RC-F and I-R-RC-F exchanges where participants used the different available communication tools reached the highest levels of meaning construction (Ph3, Ph4 and Ph5).

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In other words, the interplay between the oral and written modes provided by online communication offered different ways of collaborative meaning construction, where online discussions were not linear but rather circular; information was refined before a new understanding was co-created.

The patterns found in the tutors' use of extended turn sequences using the chat and the WB tools over time presented certain implications for availability of learning support as teaching and cognitive presences. Therefore, the affordances of use of tools (technology) and tutors' scaffolding were key features of online multimodal communication. Each group of affordances offered advantages to learners but were also associated with constraints that had the potential to limit learning. Constraints were associated with the way participants perceived and understood the affordances of use of the different tools and their tutors' scaffolding. This is explained in the next section.

6.5. Actual and perceived affordances of use of the different tools of communication (Participants' perceptions of their online experience)

This section deals with the results with regard to the last research question:

• How do students and tutors perceive their experiences of online multimodal interactions in SAGC in terms of participation opportunities and adequacy of online learning?

Örnberg Berglund (2005) stated the way technological mediation affected interaction and communication was relevant in the context of online environments. Örnberg Berglund's results showed that the individual use of tools resulted in the generation of affordances

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different from the affordances that emerged out of the simultaneous use of tools of communication.

6.5.1. Individual use of tools

The results showed that the audio tool was predominantly used to engage in all phases of meaning construction. The chat and the WB tools were used by tutors to post comments and corrections. The chat tool provided an archive that could easily be reviewed during or after the lesson. The chat tool was also used as a substitute to the audio tool in case of sound problems by all participants. It is "a welcome backup when problems with the audio connection occur" (Hauck and Youngs: 2008, p. 12). Students used the chat tool to write short answers when invited to by their tutors. Both tutors used the chat tool to evaluate and build on students' ideas by highlighting new and important ideas, without interrupting students. The results were confirmed by the analysis of students' and tutors' reflections when responding to the questionnaires and when interviewed.

The audio tool was better suited to exchanges where tutors were controlling the flow of communication and dominating the collaborative space.

6.5.2. The simultaneous use of tools

The affordances of the different tools when individually or simultaneously used are presented by the following Figure (Figure 6.1).
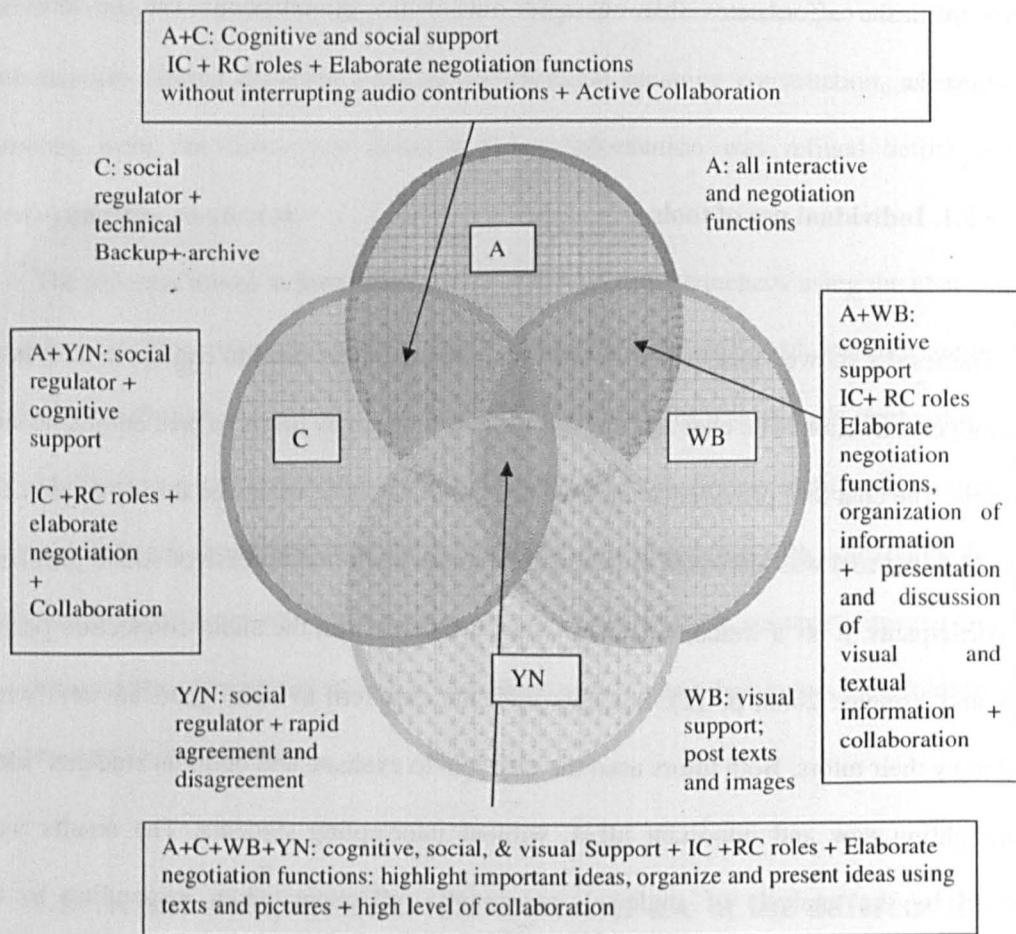
A+C: Cognitive and social support
IC + RC roles + Elaborate negotiation functions
without interrupting audio contributions + Active Collaboration

C: social regulator + technical Backup+ archive

A: all interactive and negotiation functions

A+Y/N: social regulator + cognitive support

IC +RC roles + elaborate negotiation + Collaboration

A+WB: cognitive support IC+ RC roles Elaborate negotiation functions, organization of information + presentation and discussion of visual and textual information + collaboration

A

C

WB

YN

Y/N: social regulator + rapid agreement and disagreement

WB: visual support; post texts and images

A+C+WB+YN: cognitive, social, & visual Support + IC +RC roles + Elaborate negotiation functions: highlight important ideas, organize and present ideas using texts and pictures + high level of collaboration

Figure 6.1. The affordances of the individual as well as the simultaneous use of the different tools of communication

Figure 6.1 shows that four important clusters of tools are identified, which are: A+C, A+WB, A+Y/N, and A+C+WB+YN tool clusters. Results showed that the use of the different clusters mainly provided the cognitive support that students need to contribute to the creation of ZPD for collaborative meaning construction.

However, these affordances were perceived differently by active students, less active students, and their tutors.

6.5.2.1. Active students

Active students used the different tools of communication when engaged in all types of online exchanges. They made an informed rather than a random use of technology. They were aware of the positive and facilitative affordances of the WB, the chat and the YN tools not just the audio tool. Like all participants, they favoured the audio tool over others as they believed they were meeting online to develop their aural and oral competencies. Two functions were ascribed to the use of the simultaneous use of the chat and the WB tools with the audio tool. First, the tools were simultaneously used to provide each other with the cognitive support when engaged in the process of negotiation and debate. Students believed that these tools provided opportunities for free participation, contrary to the audio tool which was under the control of tutors. Students used the chat, the WB and the YN tools along with the audio tool to sustain collaboration, taking advantage of the written and oral modes of communication. Second, the tools were used as social regulators since they gave students the opportunity to contribute without having to interrupt each other.

The chat and the WB tools allowed students' contributions to be compared, negotiated and challenged. This makes the use of writing tools helpful in large group discussions so that students do not have to wait for everyone else to contribute before making a contribution. The A+C cluster allowed students to ask questions and make comments without interfering with the audio of the speaker. The use of the A+WB cluster allowed several items of information to be organized and interrelated where both visual and textual information were presented. It allowed pieces of information to be highlighted as well as offering the potential to compare and contrast information. The use of A+C+WB+YN allowed multiple understanding to be shared by virtue of students contributing multiple pieces of information relating to the concepts. The use of the WB made it possible for students to dynamically organize and

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represent their ideas building on each other's ideas, which in turn allowed the tutors to assess the level of understanding they had achieved. The visual representation afforded by the WB and the chat tools allowed shared understanding to be negotiated in a more efficient way than if the audio tool alone was used.

6.5.2.2. Less active students

These students expressed their beliefs in the importance of the different tools. However, it was apparent from the analysis of videos and students' questionnaires that they did not understand the affordances of the individual use of the chat, the WB and the YN nor the affordances of their simultaneous use. They believed that the chat was to be used in case of oral communication breakdown. Moreover, they did not believe in the relevance of the WB and the chat tools for students' use for collaborative meaning construction. They rather believed they were more relevant for tutors.

Furthermore, they stated they could grasp information from different tools, but they found it distracting to absorb and at the same time contribute to multimodal discussions. Students have to divide their attention between different information tools. They expressed they felt cognitively overloaded because they were not familiar with technology. Unlike active students, they found the simultaneous use of the audio and writing tools a demanding task. They could not manage using them at the same time as concentrating on tutor's and students' contributions. The lack of understanding of the affordances of the simultaneous use of tools was due to the lack of understanding of their functionalities. Less active students did not know how to use the different tools, which confirms our conclusion that they showed less developed multimodal competences than active students.

It is concluded then that the quantitative as well as the qualitative analysis showed that the different levels of modal density of online exchanges did not have an equalizing effect in this context, contrary to previous research on multimodal online interactions (Hampel and Hauck, 2006), due to the different levels of advancement and development of multimodal or technological competences of the different participants.

6.5.2.3. Tutors

Both tutors insisted on the importance of inviting students to use the audio tool more than the other tools. They believed that the chat tool was best suited to monitor students' interactions as well as their own interactions. The chat tool was used to correct students' mistakes and provide feedback. They viewed the WB tool as a visual support on which to write ideas and post pictures that helped engaging students in intensive interactions and collaboration. Furthermore, they believed in the importance of using the written mode alongside the oral mode to adopt different tutorial roles. They used the audio tool to adopt a controlling role. They used the writing tools to adopt a more facilitative role by withdrawing from direct oral interactions. Tutors believed that the simultaneous use of the different tools of communication enhanced students' collaborative meaning constructions and acknowledged the importance of the use of writing tools to support oral contributions.

Despite the fact that the chat and the WB tools were viewed as good means to control the quantity of their discourse and the creation of participation opportunities, tutors stated they did not encourage students to use them because they believed the aim of online tutorials was to develop students' oral and aural skills rather than the writing skill. They invited students to use the chat tool just to overcome breaks in the oral conversation in case of technical problems. Furthermore, they believed that the simultaneous use of the different tools was very difficult

and demanding for them and their students. They stated that successful individual and simultaneous use of tools was related to students' level of familiarity with technology and the extent to which they understood the affordances of use of the different tools. The findings corroborate Hauck and Youngs' findings who concluded that

> [T]he extent to which telecollaboration partners can benefit from an exchange partly depends on their current level of multimodal communicative competence that is their ability to make efficient use of the modes for meaning making available to them online in order to engage in interculturally rich interaction. (2008, p. 20)

Both tutors then acknowledged they did not make enough use of the WB tool because they did not know how to use it for the implementation of collaborative tasks. However, both stated that collaborative tasks worked better when students used the writing tools to build on audio contributions. Consequently, they expressed their willingness to design tasks where students have to use the writing mode using the WB in particular to build on each other's ideas.

Hence the results of the analysis of synchronous conferences and the reflections of tutors and students confirmed that participants displayed different levels of development of their multimodal competencies. In this regard, Bower (2011) insisted on the importance of the development of students' multimodal technological competences. He further suggested that "A range of synchronous collaboration competencies are required for effective learning and teaching in web-conferencing environments" (2011, p.79). One of these competencies was the interactive competence which stands for multimodal competence which includes "How to use the tools not only to receive and transmit information, but also to collaborate and co-create"

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(Ibid: 77). In this regard, the results of this research supported Bower's result concerning the educational imperative for developing students' technological capabilities. Student centred approaches to learning require more advanced multimodal competencies in order to lead collaborations and control tool use. The results of this research corroborate Clarke, Ayres, and Sweller's findings (2005) that understanding how to operate the mediating technology could significantly increase students' ability to acquire the to-be-learnt subject matter concepts. Students with greater levels of comfort with technology who had participated in technology mediated courses reported significantly greater levels of satisfaction with the course.

In this study, active students used the different tools to aid discussion. Bower (2011) stated that:

> [A]s multimodal synchronous communication systems become more prevalent and the functionalities they afford become more sophisticated, the ability to effectively collaborate using such systems will become increasingly important. (2011, p. 80)

He stressed the need to give students the opportunity to develop their interactional competence which he qualified as a prerequisite for efficient online collaboration. Coburn (2010) stated that "The chances for students, with different personal backgrounds, of having successful conversations will be improved if they develop their computer skills and take advantage of online affordances" (2010, p.17). The results of the present study corroborate their findings. However, in the context of this research, the definition of students' multimodal competence was rather stretched to include the ability to understand the potentials and affordances of the individual as well as the simultaneous use of tools to receive and transmit in addition to collaborating to construct new understandings. Active students showed developed

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multimodal competencies as they could take advantage of the different affordances of the individual and the simultaneous use of tools. As was pointed out by tutors and students themselves, less active students neither knew how nor when to simultaneously use the different tools, which made it difficult for them to understand the different affordances of the different tools. Less active students missed the opportunity to engage in collaborative multimodal exchanges. Students' successful simultaneous use of the different tools and participation in multimodal exchanges characterized by high levels of modal density indicated advanced levels of multimodal competencies. I conclude by saying that the way each participant perceived the affordances of the synchronous medium was shaped by her or his multimodal competencies and ability to use technology.

In general, active students and less active students had different perceptions of the affordances of use of the different tools of communication. Hence, the lack of modal complexity between tools was explained by tutors' as well as less active students' unwillingness to simultaneously use the different tools. Modal complexity was believed to be demanding for tutors and cognitively overloading for less active students. Less active students seemed unable to perceive the affordances offered by the different tools because of their less developed multimodal competencies.

It was concluded then that tutors refrained from inviting all students to use the different tools, despite their belief in the importance of the cognitive support they offered to enhance the learning process, because they were aware of the difficulties less active students were facing because of their limited multimodal competences.

Moreover, besides the use of tools, modal complexity was related to levels of interactivity that depended on the circumstances of the learning situation: tutors' roles and styles and task types. Students' online interactions were oriented and affected by the complete ecology in which it was situated, as shown by Ferguson (2009) and Örnberg Berglund (2009).

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It could not therefore be assumed that the learning process was supported by the audio-graphic system itself only. In this direction, Stickler et al. (2005) pointed out that "The tuition medium is by no means the only aspect defining interaction patterns: task design and tutor style play an important role". Similarly, results of the present study showed there were several possible reasons that accounted for the results obtained in this study.

6.6. Affordances of tasks and tutors' scaffolding

Garrison and Cleverland-Innes (2005) argued that task design and tutor's facilitation and direction were believed to promote a deeper approach to knowledge building and learning. In corroboration, results of the present study showed that there was a range of factors that impacted upon collaborative meaning construction: the multimodal competencies of students, the tutors' styles and tutorial roles, and task design.

6.6.1. Affordances of use of tools to realize different types of tasks

In this particular research context, the typical tasks were debates that focused explicitly on interaction and collaborative negotiations and argumentation. The analysis showed that instances of sharing and comparing of information were concentrated in the first activity (debriefing) where students were invited to reflect on their answers. Discussions reached high levels of meaning construction (Ph3, Ph4, Ph5) during the main activities where tutors introduced topics of discussion inviting students to discuss and negotiate with them and/or together in small groups. The shift of topic and task engaged students in different patterns of interaction where they focused either on information sharing or negotiation debate of ideas using the different tools.

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The results of the analysis of the three sources of data (online tutorials, questionnaires and interviews) showed that the more the topics were appealing, the more students simultaneously used the different tools of communication to participate in constructive discussions. In addition, the type of task and the way it was implemented by tutors oriented students' use of tools that offered different pedagogical affordances that affected students' engagement in collaborative multimodal exchanges. Furthermore, students formed and applied multimodal clusters depending on the type of tasks that governed how the patterns of multimodal exchanges shaped out. The more the tasks were appealing the more students engaged in I-R-RC-F and IC-R-RC-F multimodal exchanges for collaborative meaning construction. However, results showed that not all students could participate in I-R-RC-F and IC-R-RC-F multimodal exchanges as they avoided exchanges that displayed a high level of modal complexity.

Kress (2003) believed that by designing tasks where students are increasingly versed in multimodality, this would make students able to "choose, not merely with full competence within one mode [...] but with full awareness of the affordances of many modes and of the media and their sites of appearance" (Kress 2003: 49). In the same realm of thought, Hauck and Young (2008) talked about the adaptation of task design depending on the different modalities offered by telecollaboration.

> [T]utors will need to be trained in the design of tasks that systematically develop the learners' electronic literacy skills. Such tasks will make efficient use of multiple modalities so that there was a need for the learners to stretch, change, adapt and modify the means of representation, communication and interaction available to them. (2008, p. 101)

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However, Hauck and Young (2008) did not refer to the particular tools offered by each individual modality. Concerning the use of audio-graphic conferencing systems, the results of the present study showed that each individual tool offered by the same technological medium needed to be taken into account when designing tasks. This result was echoed by many online researchers who stressed the importance of designing tasks that cope with the nature of online environments taking into account the affordances offered by the different tools of communication these environments make available. Coburn (2010: 2) suggested that "[Audio-graphic conferencing systems] has implications for functionality, task design and practice". Kenning (2010) insisted on the importance of carefully designing tasks appropriate to the specific socio-cultural context and in relation to the technical affordances of SAGC. Hampel (2006) reached the same conclusion and suggested task adaptation depending on the affordances and constraints of the tool employed. Hampel and Hauck (2006) investigated the demands made on tutors and learners in CMC environments and of ways in which arising pedagogical challenges can be met through task design. Hampel (2006, p. 111) stressed that tasks needed to be appropriate to the medium and that therefore "An easy (and cheap) transposition of face to face tasks to virtual environments is not possible".

The aforementioned studies insisted on taking into account the affordance of use of each tool of communication which is confirmed by our study. However, their studies did not mention the importance of the affordances of the combined use of tools. The results of this study suggested the adaptation does not only depend on the affordances and constraints of tools employed, but on the affordances and constraints of the simultaneous use of the different tools as the use of clusters of tools offered different affordances in terms of opportunities and difficulties. There was a need to increase the students' multimodal communicative competence by developing their awareness of the communicative potential of each tool as well as clusters

of tools, to enable them to make informed choice of a certain tool or certain clusters for specific interactive roles and negotiation functions.

Results thus showed that awareness of the learning environment was important and essential when learning a language online.

6.6.2. Tutors' styles and roles

Tutors' styles and roles were other important factors affecting students' involvement in I-R-RC-F and IC-R-RC-F multimodal exchanges and the way they experienced and perceived the affordances of use of the different tools. Tutors engaged in IC and RC interactions switching between the written and oral modes using the different tools to adopt different teaching roles which created different opportunities for students to assume their responsibility for their own learning creating their ZPD for collaborative meaning construction. Vygotsky explained that teaching "is good only when it awakens and rouses to life those functions which are in a stage of maturing, which lie in the ZPD" (Vygotsky, 1956, p. 278). The types of interactions identified indicated that tutors' styles did indeed have an influence on the quality of interaction. Although tutors monopolized speech turns, IC and RC interactive tutors' roles promoted students' interactions by involving them in the process of negotiation inviting them to explain, clarify, elaborate and challenge rather than simply sharing information. Tharp and Galimore (1988) suggested that teaching occurs when assistance was offered at points in the ZPD at which performance required assistance. The results of the analysis suggested efforts in tutor scaffolding which resulted in students testing evidence against experience and statement of the relevance as well as the application of new understandings.

However, tutors stated that online teaching was a very demanding task because of the availability of different tools of communication. They clearly stated that it was difficult for

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them to manage multimodal interactions when the different tools were simultaneously used. In the field of video conferencing, Guichon (2010) reached the same conclusion and stated that:

> [T]he main difficulty for teachers is that they have to manage these complex operations of production and interpretation in real time and in an environment that concentrates several communication tools into the limited space of a computer screen [...] managing different tools almost simultaneously to carry out various sub-tasks proved to be a great source of difficulty for the teachers. (2010, p. 173)

In the field of audio-graphic conferencing, I reached the same conclusion. Results showed that tutors avoided inviting students to use the WB and the chat tools despite their awareness of the cognitive and interactive support they provided for better collaboration opportunities. Results showed that this avoidance had to do with the level of development of tutors' and students' multimodal competencies as was shown by Compton (2009) who stated that:

> [W]hile online language learning has become more possible with the increase in communication tools and the number of online language courses increasing, teacher training at its present state has not focused on preparing language teachers for the challenges of teaching in an online environment [....] After all, online language teachers cannot be expected to become effective based on training meant for face-to face classrooms when these two environments involve different skills and responsibilities....a teacher who is good at teaching in a face to face class can easily jump in and teach in this medium is a common myth. (2009, pp. 96-97)

The results of the present study showed that the context of online language learning has prompted the need for new teaching skills that are different from those used in teaching face to face language courses. In this line of thought, Hampel and Stickler (2005) noted that online language tutors not only needed different skills from those of traditional language teachers in face to face classrooms but also different skills from online teachers of other subjects. Coleman, Hauck, Stickler and Hampel (2010) stated that online tutors needed to be "technically literate" and need to be able to choose the right tools best suited for the tasks. They further argued that tutors need training in "the distinctive pedagogy" of distance language learning. Lamy and Goodfellow (1998) addressed the issue of mediation which resulted in the re-conceptualization of the tutor's role in online environments. Hampel and Stickler (2005) proposed a pyramid of online tutors' skills in an attempt to identify the key competences for online tutors. The two first levels of skills related to technological skills and specific technological competence for the software and the third level relates to dealing with constraints and possibilities of the medium; to understand the affordances of the specific applications for collaborative tasks. In this regard, Compton (2009) suggested a modified version of Hampel and Stickler's model and added another dimension to describe the technological competence as the ability to understand the different constraints and possibilities of different software as well as the ability to choose suitable technology to match online language learning tasks and the ability to deal with constraints and possibilities of different software. He suggested the dimension of creativity, which refers to the ability of tutors to adopt technology for online language tasks. Guichon (2009) identified three types of skills pertaining to online language teaching: socio-affective skills, pedagogical skills and multimedia skills. He defined multimedia skills as the capacity to adequately operate the

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software and to use the most appropriate modes for a given task based on knowledge of constraints and possibilities of the learning online medium." He stated that online teachers:

> [h]ave to be able to orchestrate the different multimodal resources that are available and use them according to pedagogical objectives. Because teachers are required to deploy psychological and communication skills in addition to the usual pedagogical skills in real time, it seems that synchronous online teaching is a very demanding task. (2009, p. 172)

The results of the present research confirm the different researchers' conclusions about the importance of developing multimodal competences of both online students and tutors. Results showed that online tutors have to have specific technical and software competence and be aware of the affordances of use of tools in terms of constraints and possibilities for a better implementation of tasks. The development of multimodal competencies is prerequisite for the success of online learning experiences. In this line of thought, Hauck and Dooly (2012) stated:

> [T]oday the key role played by teachers in mediating online language learning based on the ability to assess the affordances of any given tool – the possibilities and constraints for making meaning and communication offered by the available modes (Hampel, 2006) – and the ability to use these according to the learners' needs, task demands, and desired learning outcomes, is widely acknowledged. Indeed, if technologies are integrated into pedagogical practices in an arbitrary fashion, or, if used inadequately, their true additional value to language learning could be quite limited, if not highly questionable. Hence, the importance of adequate training programmes for CALL and CMC-based

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language teaching informed by pedagogical considerations and suitable theoretical frameworks. (2012, p. 188)

However, results of this research showed that tutors' multimodal competence or technological literacy does not imply the knowledge of the affordances of the different tools only, as is stated by the different researchers. It was rather defined as the capacity to adjust the potential of any tool as well as the potential of any cluster of tools to their pedagogical objectives, the interactive relations they need to establish with their students (interactive role), and the hybrid nature of online multimodal exchanges (the patterns of multimodal exchanges). This is to say that tutors needed to have the ability to deal with constraints and possibilities of use of tool, have the ability to choose the right tool or clusters of tools to match online language learning tasks, and have the ability to orchestrate the different tools according to the whole ecology of the online learning situations.

Hence, despite the fact that the UK Open University provides intensive training to its online tutors (Hauck & Hampel, 2005; Hauck & Guichon, 2011; Beaven et al., 2010), the analysis of participants' questionnaires and interviews showed that OU online tutors and students need more training. Results showed that tutors need to understand the affordances of the different tools and pedagogical online multimodal exchanges to know how to provide opportunities for various forms of mediated interactions with different students. Online tutors need to be trained about how to manage interactions when students engage in multimodal I-R-RC-F and IC-R-RC-F multimodal exchanges. There is a need to raise tutors' awareness to the particular hybrid nature of online discourse. The analysis of interviews showed that tutors became more aware of the need to develop their multimodal competencies to design tasks that invite students to use the different tools and the WB tool in particular. Both tutors could develop a better understanding of the affordances of use of the different tools and the way they

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adopt different roles by adjusting the potential of audio and writing tools to their interactive and communicative needs. They clearly stated that at the end of online sessions they could understand that some tool clusters were very important for collaborative learning.

It was argued then that online tutors needed more preparation for online conferencing environments. Results of this study indicated that in the field of audio-graphic conferencing, there is a need to raise tutors' awareness about the different structures of online exchanges and the way to deal with their different levels of modal intensity and modal complexity for a better implementation of tasks. Thence, tutors and students did not just need to know how to use buttons but for what interactive and communicative functions could they use each tool or cluster of tools.

Figure 6.1 showed that tools of communication offered different individual possibilities for enhancing collaborative meaning construction, but offered even better opportunities in combination as multimodal clusters. Thus, tutors needed to be aware of the affordances the identified clusters offer for the implementation of tasks and successful engagement of students in multimodal I-R-RC-F and IC-R-RC-F exchanges. The results showed that discussions were more constructive and interactions more productive when participants simultaneously used all of the different tools of communication. Discussions reached high phases of meaning construction when using A+C, A+WB, and A+YN clusters but were less constructive than when using A+WB+C+YN cluster. As a result, to increase students' multimodal competencies, tutors need to start by designing and implementing tasks where students are invited to use the two-tools clusters and then gradually move to tasks where they are asked to use all of the available tools. Tutors need to progressively introduce tasks with increased levels of modal density; focus should be first put on modal intensity where students are to be gradually introduced to the simultaneous use of the different tools before they can realize tasks where modal complexity is required.

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Finally, tutors need to be aware of the different patterns of online exchanges in relation to the mediational choices of their students and the affordances they offer for the implementation of the different tasks, which highlight socio-constructivist principles of learning.

It can be concluded that an online learning environment is a comprehensive system where all its elements (types of tasks, synchronous medium, tutors' teaching styles and strategies, level of development of students as well as tutors' multimodal competences) influence each other.

6.7. Summary of findings

- The application of the proposed coding categories and model of analysis showed the existence of different patterns of online discussions that were characterized by different levels of modal density. Some were characterized by modal intensity where only the audio tool was used, others showed an intermediate level of modal complexity where two modes were used, and others were at a high level of modal complexity where all the different tools of communication were used.

- Two cumulative exchanges I-R-F and IC-R-F were identified. They were characterized by modal intensity; they offered cumulative but not collaborative discussions that did not reach high levels of meaning construction.

- Two exploratory exchanges I-R-RC-F and IC-R-RC-F are identified. They were characterized by modal complexity; they offered collaborative multimodal discussions that reached high levels of meaning construction.

- Modal complexity was important whenever there was an appeal for collaborative negotiation and argumentation. Modal complexity was relevant to launch and engage students in collaborative argumentation process.

- The switch between the oral and written modes of communication using the audio, the chat and the WB tools provided better opportunities for students to build their ZPD to engage in collaborative process of negotiation and argumentation that reached high levels of meaning construction.

- Students perceive differently the affordances of the individual and the simultaneous use of tools of communication depending on the level of interactions, collaboration and engagement in the different types of online discussions. The use of different tools offered facilitating affordances for engagement in high levels of meaning construction process.

- The use of the different tools of communication offered different affordances depending on the way they were used; if engaged in cumulative exchanges, the focus was on audio tools and other tools were used to complement it. The chat tool was used by tutors to correct mistakes and provide feedback. The WB tool was used by tutors to post texts and pictures. The chat tool was used by students as a substitute to the audio tool in case of technical sound problems. They were ascribed social as well as technical affordances.

- The simultaneous use of different tools offered affordances for engagement in exploratory exchanges. The chat, the WB, the YN and the audio tools were used to cognitively support each other for the creation of ZPD. Students progressed in their understanding using the different tools to engage in high levels of collaborative meaning and cognitive presence.

- Active students were able to make an increasingly informed use of the tools available in Elluminate. Less active students were not able to manage to fully act upon the communicative affordances of use of the different tools. The level of development of tutors' and students'

multimodal competencies has a great effect on the way they perceive and take advantage of the different affordances of use tools of communication.

- The switch between the oral and written modes using the different tools of communication provided excellent opportunities for tutors to adopt different tutorial roles depending on their needs and their students' needs.

- Results of this research suggested a redefinition of multimodal competence as the capacity to adjust the potential of any tool as well as the potential of any cluster of tools to their pedagogical objectives, the interactive relations they needed to establish with their students (interactive role), and the hybrid nature of online multimodal exchanges (the patterns of multimodal exchanges). This is to say that participants needed to have the ability to deal with constraints and possibilities of use of tool, have the ability to choose the right tool or clusters of tools to match online language learning tasks, and have the ability to orchestrate the different tools according to the whole ecology of the online learning situations.

The results made me draw some theoretical as well methodological implications

6.8. Methodological framework and implications

This research was concerned with the examination of the way students co-construct meaning taking advantage of the different affordances offered by the synchronous audio-graphic medium under study. To analyze multimodal interactions, a model of analysis was developed. First and foremost, it was necessary for the method of analysis to be aligned with the socio-constructivist focus of the study, which views learning as a social as well as individual process.

The coding scheme for the transcription and representation of multimodal data proposed and adopted by the present study was original and helped to determine the way the multimodal choices of participants governed the way online interactions and online exchanges shape out.

Second, the implementation of the proposed model for the description of the meaning construction process was successful and offered an original model that would help future online research in the analysis of multimodal online data with particular reference to the meaning making process. Hence, the present work shows the value of adopting complementary theoretical and analytical approaches which draws on cognitive and socio-constructivist theories of learning.

Results showed the existence of all phases with different proportions. Despite the fact that most discussions were for sharing and comparing information, there was also evidence of collaborative meaning construction. The socio-constructivist learning perspective assumed that meaning construction occurred during interaction which involved the sharing of multiple perspectives on experiences and concepts, and negotiation of individual interpretations (Vygotsky, 1978; Wertsch, 1985). The application of this model of analysis provided evidence that students shared information and critically analyzed their own views and revised concepts in the light of conflicting ideas, as such creating ZPD where the process of meaning construction was supported by the availability of oral and writing tools, tutors' scaffolding and a variety of tasks.

Hence, there were instances of interaction that involve inconsistencies or contradictions in ideas and opinions. Students tried to build an understanding of the contradictory information and engaged in the process of negotiation where they followed a pattern that included exploratory requests, clarifications, assertions, challenges and concessions of the inconsistent information. These elaborate negotiation functions formed the

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larger part of the set of negotiation functions performed by the different participants to assert, or propose other views for consideration question and challenge the proposed information and justify through extended reasoning.

The model of analysis adopted by this research drew on Gunawardena et al.'s model (1997) which described the process of knowledge construction as a linear process. Hopkins et al. (2008) pointed out that the three upper phases of knowledge construction correspond to the use of higher forms of thinking which corresponded to the performance by participants of elaborate negotiation functions. However, the analysis showed that the process was rather cyclical and that communication moved from Ph1 up through higher phases as well as from higher phases down to lower phases performing elaborate negotiation functions. The use of elaborate negotiation functions engaged students in a deep processing of information where they analyzed, re-analyzed, synthesized, re-synthesized, evaluated and re-evaluated information before internalization took place. Students engaged in a process of revising and refining information, requiring a switch of communication between the different phases of meaning construction with the aim of validating or rejecting new information. According to the socio-constructivist view, meaning construction involves learners in negotiation of meaning, reasoning and reflection on authentic tasks and engagement in conversation where knowledge is revised (Laurillard, 1995). This process of continual revision and refinements of new understandings and meaning was facilitated by the availability of the different tools of communication where students switched between the written and oral modes to engage in constructive discussions as exemplified above.

It is hence concluded that the more students performed elaborate negotiation skills using the different tools of communication, the more they engaged in a cyclical process of knowledge construction at a deep level of processing. Communication moved up and down between the different phases of meaning construction before new knowledge was co-

constructed and finally validated. This confirms the results obtained in another research study (Mirza, 2010). In sum, there seemed to be a relationship between the nonlinearity in the progression of meaning construction, the type of negotiation functions performed by students and the affordances of the simultaneous use of the different tools of communication. The more students performed elaborate negotiation skills simultaneously using the different tools of communication, the more the process of meaning construction moved to upper levels in a cyclical/spiral way and vice versa.

However, the application of this model showed the necessity of further refinements to cope with the nature of multimodal data generated in the context of synchronous audio-graphic conferencing. Negotiation in communication took on different forms, depending on both the level of negotiation and the strategies employed. Hence, the analysis identified three types of synchronous online exchanges: cumulative non-collaborative, cumulative collaborative and exploratory collaborative exchanges. When engaged in cumulative non collaborative exchanges, the focus was on individual contributions where high negotiation functions were used. However, there was no follow up on these elaborate contributions; individual contributions were elaborate but the exchange as a whole barely reached the negotiation level. Exchanges never progressed beyond Ph3 of meaning construction. When engaged in cumulative collaborative exchanges, focus was on negotiation where students built positively and critically on each other's ideas. However, there was neither a change in understanding nor a creation of new meanings. Communication did not progress beyond negotiation and did not reach upper levels of meaning construction (Ph4 and Ph5). Finally, exploratory exchanges were characterized by active engagement of students in collaborative negotiation as well as argumentation processes challenging each other's ideas that resulted in a change of understanding and the creation of new meanings. Exploratory exchanges reached the highest phase of meaning construction where new meanings were tested and applied.

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Based on these three levels of collaboration and creation of ZPD for meaning negotiation and construction, refinement of the third phase of my model of analysis is necessary. Hence, Ph3 was divided into three sub-phases as negotiation was launched at this level.

6.8.1. Phase 1: Sharing and comparing information

The first phase did not need refinement because discussion was at a very basic level, i.e. one where participants perform the following low level negotiation functions: information requests, provide information, acceptance, corroboration and comprehension checks.

6.8.2. Phase 2: Inconsistency and dissonance (Quick consensus building)

The second phase also did not need refinement because students performed the same low level negotiation functions: explanation requests, explanations, quick disagreement, and quick agreement.

6.8.3. Phase 3: Negotiation and co-construction of meaning (Deep conflict and consensus building)

Refinement concerns this level of meaning construction. Results showed that this phase needed to be split into three levels depending on the level of collaboration and engagement in conflict and consensus building:

6.8.3.1. Low level of negotiation (cumulative not collaborative exchanges)

Students use the following negotiation skill: exploratory requests, rejections, and arguments. However, students did not collaborate and tended to focus on their own contributions. Negotiation remains at a low level.

6.8.3.2. High level of negotiation (cumulative collaborative exchanges)

Meaning was made more publicly accountable and reasoning was more visible in talk. Students performed the following negotiation functions: exploratory requests, clarifications and reasoning. However, students did not challenge each other's ideas. They rather built collaboratively and positively on each other's contributions using the following negotiation skills: exploratory requests, clarifications, rejections, arguments, and assertions. Students engaged in the process of negotiation and did not engage in the process of argumentation.

6.8.3.3. High level of argumentation (exploratory collaborative exchanges)

Students tried to build a deep consensus by elaborate meanings, clarifying views, and modifying or adjusting their degrees of commitment towards their assertions, when they were faced with the requirement to defend their assertions and to critically evaluate those of their peers. According to Galloti (1989) and Shaw (1996), there were close connections between the concept of argumentation and the concepts of high forms of thinking. Learners had to consider each other's assertions and evidences for those assertions during argumentation and consensus building process, and in this way they engaged in high forms of thinking. At this point, students engaged in an argumentation process, which resulted in achievement of deep consensus and the creation of new understandings and meaning. Participants used negotiation and argumentation functions that were: assertions, challenges and counter-argumentation,

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justifications, concessions (negotiated agreements) and consensus building. From a socio-constructivist viewpoint, this sub-phase was necessary because it prompted debate and reconsideration of ideas presented which signaled efforts at meaning construction and cognitive development (Pena-Shaff & Nicholls, 2004).

6.8.4. Phase 4: Testing tentative constructions (judgment of the relevance of the newly constructed knowledge

This phase did not change. In this phase, students reflected on their newly constructed meaning by testing it against their previous knowledge, their existing cognitive schema, and their personal experience and interpretations.

6.8.5. Phase 5: Agreement statement/applications of newly constructed meaning

This final phase did not change. It was devoted to meta-cognitive statements where learners restate all the points discussed, make conclusions and illustrating their understanding that their knowledge or ways of thinking have changed as a result of online discussions. They end up using the agreed upon new meanings.

6.9. Pedagogical implications

Based on these conclusions, the following recommendations are suggested:

- Collaborative meaning construction requires sustained negotiation and argumentation. Negotiation and argumentation processes are held to trigger collaborative

construction of meaning and hence learning. Results showed that successful collaboration is a complex process that involved the organization of tools. For the present context of synchronous learning, individual as well as the combined use of tools, task types and tutors' scaffolding are important factors that need to be managed for successful collaboration and the way students engaged in multimodal online exchanges, in particular exploratory exchanges. They influence the way students engage in the different online exchanges, the way they use the different tools of communication, and therefore influence how they experience their affordances.

- Collaboration between learners involves the use of tools of communication and involvement in I-R-RC-F and IC-R-RC-F multimodal exchanges that support the meaning construction process. Thus, it is important for them to understand the conditions for collaboration (Hakkinen, 2004) and involvement in exploratory exchanges using the different tools of communications. If learners are to collaborate online, they need to be able to use multimodal online exchanges as well as the different tools of communication as sources for collaborative meaning construction negotiation.

- All participants need to be able to make sense of their learning environment with its associated affordances: affordances of multimodal exchanges, pedagogical affordances of the use of the different tools of communication as well as the affordances of tutors' scaffolding. Similarly, Hampel (2006) argued that it could not simply be assumed that learners were familiar with the new media, aware of the affordances and able to use them constructively.

- Tutors and students need developed and elaborate multimodal competencies in order to take advantage of the different affordances of use of multimodal online exchanges. Lack of training and use of technology were a handicap for the effective use of technology to engage in constructive multimodal discussions. Results showed that training did not provide high

level support for understanding the inter-relations of multiple tools used synchronously and pedagogical purposes.

- There is a need to raise tutors' and students' awareness and understanding that chat and WB tools can be used as a cognitive support rather than simply as social or technical supports.

- Tutors and students need to understand the intricate relationship between the different learning skills. The written mode serves to develop the oral as well as the aural skills and vice versa. There is a need to raise tutors' awareness that they are not totally different and independent skills. Use of writing tools does not necessarily mean focus on the writing skill. Results of the present study show how writing tools like chat and WB tools endorsed and enriched oral constructive discussions. Participants should be trained on how to get the greatest advantage from the hybrid nature of online conversation.

- The cognitive support provided by the simultaneous use of tools was shown to offer negative affordances and constraints to online communication by less active students. Therefore, as synchronous audio-graphic conferencing is a different learning context from face to face contexts, students need to be trained on how to engage in extended multimodal exchanges using the different tools.

- Results showed that the type of tasks and the way they are implemented by tutors orient students' use of tools that offer different pedagogical affordances that affect students' engagement in constructive discussions. The design of tasks where students are versed in multimodality would offer students good learning opportunities. Tutors and course designers should adapt the task design depending on the affordances of different tools of communication offered by conferencing tools. Tutors need to be trained in the design of tasks that would develop students' multimodal competencies and electronic literacy skills. Furthermore, tutors need to be trained in the design of tasks that cope with the nature of online environments to

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take into accont the modal intensity and modal complexity offered by the different tools of communication. Tutors need to take into account the affordances of the simultaneous use of tools in terms of possibilities and constraints in the design of tasks.

- Because results showed that awareness of the learning environment is essential and important, tutors need to be trained to increase the students' multimodal communicative competence by developing their awareness of the communicative potential of each tool as well as clusters of tools to enable them to make informed choice of a certain tool or certain clusters to fulfill different interactive and communicative roles.

- Finally, this research showed that synchronous audio-graphic conferencing environments are a good venue for the implementation of socio-constructivism as a learning theory for successful online language teaching. The availability of different tools of communication provided students and tutors with excellent opportunities to engage in collaborative work for the negotiation and debate of ideas. Results showed that the modal density (in terms of complexity and intensity) of SAGC have good impacts on students' engagement in the collaborative process of meaning construction. Participants could use the affordances of the different tools of communication to collaborate and create zones of proximal development where they could share and create new understandings.

6.10. Limitations and Future perspectives

One of the limitations of this thesis is that the sample was only a small subset of online learning sessions by two tutors, and as such cannot be considered representative of synchronous audio-graphic conferencing tutorial management by the tutor cohort. Hence, there is a need to widen the scope of research to include more sessions with different tutors.

The second limitation of this thesis is that in the particular context of this thesis, the typical tasks were debates that focused explicitly on interaction and collaborative negotiations and argumentation. Tutors did not provide other types of tasks like role play and filling the gaps. Hence, this thesis did not show whether the use of the different tools of communication offered by SAGC would offer the same affordances when implementing other types of tasks different from debates and discussions.

Besides, online tutorials were carried out through the SAGC Elluminate which is only one of a range of online tools that may be used for online language courses. As the results of the present study apply to a particular context, further studies in different contexts using different SAGC environments are required to show generalisability.

This research suffered from a serious technical limitation. One of the initial aims of the present research was to observe how students used the tools of communication when sent into breakout rooms. However, the analysis of students' online interactions when sent to breakout rooms was problematic. Elluminate records whatever room the observer is in. Hence if the researcher was recording breakout rooms, the only way of obtaining a recording for breakout room 2 would have been to ask one of the participants to record it on his/her computer, an approach which raised ethical issues and was therefore not adopted Additionally, even the use of external cameras offered a limited data with only a limited number of students, which could not be considered representative. Consequently, I decided to not include them in the analysis. Hence, student-student online multimodal interactions that are very important were not analyzed.

On the other hand, the questionnaires were not sent at the right time students. I could not send the questionnaires to students while I was still observing them. It was only shortly before the end of the course that the questionnaires were sent. This is a limitation to this research as the questionnaire contained a number of questions which appealed to participants'

micro-memories of the tutorials. In future research, I will send the questionnaires to students well before the end of the course.

The present work shows the value of adopting complementary theoretical and analytical approaches and urges the need to develop models of online multimodal data analysis in the context of SAGC which draws on cognitive and socio-constructivist theories of learning. However, the model of analysis implemented in this study was again applied to a limited set of online learning sessions. Ideally, the model of multimodal presentation and analysis would have been applied to other levels on language courses. Hence, the reliability of the extrapolation of these results to other educational contexts needs to be carefully considered. Hence, the findings highlight the need for workable methods, tools and models of analysis to research and analyse multimodal online communication.

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Appendix 1

Consent form

Name of Project:

Impact of Multimodal Online Interactions Generated in Audio-graphic Conferencing Systems

on The Knowledge Construction Process

You are invited to participate in a study of the implementation of synchronous audio-graphic conferencing systems. I aim at checking the extent to which these contexts create constructive opportunities for collaboration, interaction and participation among students. We do not aim at criticizing the currently used programs. In addition, the present study does not aim at judging the participant's (the students and the tutor) performances. Rather, we aim at ameliorating the design and implementation of such contexts.

The study is being conducted by:
- Mirza Chahrazed (PhD student)
- Marie Noelle Lamy and Jim Coleman (my supervisors)

If you agree to take part in this research, you will not be asked to do anything other than participate in your tutorial in the normal way, but I will record your voice and retain a copy of your text chat. I will use this data for research purposes only, and I will not share it with anyone other than my supervisors and the examiner of my dissertation.

Information or personal details gathered in the course of the study are confidential. If my dissertation contains screen shots for illustration, I will blank out your name (which appears on the screen in the Elluminate connected participants' window). If I reproduce examples of text chat, I will anonymise the contributions so that your name does not appear. I may use some quotations in my future publications. Again, I will anonymise the quotations.

I undertake to keep the data securely to avoid any accidental disclosure. I will use my personal laptop to store, process and analyze the data. I am the only one who uses the laptop. Also, my laptop is password protected which means that we have to log on to have access to my data. No one knows my password. So in case of theft or loss of the laptop, no one can have access to the collected data. Also, I will use short time out password controlled screen saver, and I will log off correctly at the end of a

session. Furthermore, any CD-ROMs or driver, used to back up the collected data, will be locked away in a drawer and will not be left on a desk.

If you decide to participate, you are free to withdraw from further participation in the research at any time without having to give a reason and without consequence.

In case you need to talk with someone else about my research project, you can contact my lead supervisor:

Marie Noëlle Lamy: m.n.lamy@open.ac.uk

Faculty of Education and Language Department of Education and Language Studies

Walton Hall

Milton Keynes MK7 6AA

Thank you for completing this form.

I, _____ *(participant's name)* have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Signature: _____Date:

Investigator's Name: ___Chahrazed Mirza
(block letters)

Investigator's Signature: M.C Date: 20-04-2008

The ethical aspects of this study have been approved by the Open University If you have any complaints or reservations about any ethical aspect of your participation in this research, please contact me initially (c.mirza@open.ac.uk) and my lead supervisor (m.n.lamy@open.ac.uk). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

Appendix 2

Information Sheet for Questionnaires

Prof. Marie Noëlle Lamy
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Dear Student,

I am supervisor for PhD student Chahrazed Mirza. Her PhD research study explores students' experiences in online environments. It aims at checking the extent to which these contexts create opportunities for interaction and collaboration among students. A few weeks ago you kindly agreed to allow Chahrazed to observe some of your online tutorials, and to participate in a brief survey about your perceptions of your online learning experiences using Elluminate.

To arrive at a better understanding of the learning-teaching phenomena, these perceptions are very important in her research. Your contribution will help us to improve the design and implementation of such learning contexts.

We would be very grateful if you could fill in the attached questionnaire.

Some sections ask you to tick a box, but please answer open questions as fully as your time allows. Your responses provide valuable insights.

There is no reward for taking part, but any resulting publication will be made available.

Thank you in advance for taking part in this study, which will help us understand the impact of online environments like Elluminate on learning experience. Your contributions will be anonymous so that your names do not appear. Some quotations may be used in future publications. Again, they will be anonymous.
If you decide to participate, you retain the right to withdraw from further participation in the research at any time without having to give a reason and without consequence. In this case, your responses will be destroyed.
No personal data is to be collected which means that there is no risk of revealing personal data. We undertake to keep the data securely to avoid any accidental disclosure. No data will be passed to a third party. All the data collected will be destroyed once the study is complete.
In case you need to talk with someone about the research project, you can contact me by email: m.n.lamy@open.ac.uk

The ethical aspects of this study have been approved by the Open University. If you have any queries about any ethical aspect of your participation in this research, please contact me. Any query you make will be treated in confidence and investigated, and you will be informed of the outcome.

Please email the completed questionnaire as an attachment to c.mirza@open.ac.uk.
Thank you very much indeed for your help!
Marie-Noëlle Lamy

Appendix 3

The questionnaire

Online language learning experiences using Elluminate.

Click to put an X in the appropriate box:

You are studying:

L211: ☐

L310: ☐

Please indicate your responses to the following statements from strongly agree to strongly disagree:

1. Apart from the audio channel, my tutor regularly invites me to use communication tools such as:

	Yes	No
1.1. Text chat	☐	☐
1.2. White board	☐	☐
1.3. Yes/no button	☐	☐

2. In addition to the audio channel, I spontaneously use other tools such as:

	Yes	No
2.1. Text chat	☐	☐
2.2. White board	☐	☐
2.3. Yes/no button	☐	☐

3. The following statements accurately reflect my contributions to **the different online discussions that I attended during the year**

	Strongly Agree	Agree	Disagree	Strongly Disagree
3.1. I have plenty of opportunities to participate in the discussion	☐	☐	☐	☐
3.2. I am able to take advantage of the opportunities for participation offered	☐	☐	☐	☐
3.3. I usually prefer to build on others' ideas	☐	☐	☐	☐
3.4. I usually prefer to contribute my personal ideas	☐	☐	☐	☐
3.5. I usually respond to others' contributions	☐	☐	☐	☐

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3.6. Others usually respond to my contributions	☐	☐	☐	☐
3.7. I have learnt from other students' contributions	☐	☐	☐	☐

4. To carry out the intentions listed in 5.1 to 5.8, I prefer to use specific tools (put an X in the appropriate box or boxes):

	Audio	Text chat	White board	Yes/No	Others
4.1. Share ideas	☐	☐	☐	☐	☐
4.2. Express my disagreement	☐	☐	☐	☐	☐
4.3. Ask for explanations and clarifications	☐	☐	☐	☐	☐
4.4. Explain and clarify my ideas	☐	☐	☐	☐	☐
4.5. Reject others' ideas	☐	☐	☐	☐	☐
4.6. Defend my ideas	☐	☐	☐	☐	☐
4.7. Justify my ideas	☐	☐	☐	☐	☐
4.8. Accept and build on others' ideas and express consensus	☐	☐	☐	☐	☐
4.9. Restating the agreed position and use new knowledge	☐	☐	☐	☐	☐

5. I can remember occasions when it was helpful to simultaneously use more than one tool to make constructive contributions:

	Yes	No
5.1. Audio and text chat	☐	☐
5.2. Audio and yes/no button	☐	☐
5.3. Audio and white board	☐	☐
5.4. Audio, text chat and yes/no button	☐	☐
5.5. Audio, text chat, white board, yes/no button	☐	☐
5.6. Text chat and white board	☐	☐
5.7. Text chat and yes/no button	☐	☐
5.8. Text chat, yes/no button and white board	☐	☐
5.9. White board and yes/no button	☐	☐

6. I believe that:

	Strongly Agree	Agree	Disagree	Strongly Disagree
6.1. Constructive discussions are enhanced by the use of the audio channel	☐	☐	☐	☐
6.2. Constructive discussions are enhanced by the use of the chat text	☐	☐	☐	☐
6.3. Constructive discussions are enhanced by the use of the white board	☐	☐	☐	☐
6.4. Constructive discussions are enhanced by the	☐	☐	☐	☐

use of the yes/no button				
6.5. Constructive discussions are enhanced by the simultaneous use of more than one communication tool	☐	☐	☐	☐

7. I find that I am encouraged to participate because:

	Strongly Agree	Agree	Disagree	Strongly Disagree
7.1. The tutor invites me to do so	☐	☐	☐	☐
7.2. There is collaboration with other students	☐	☐	☐	☐
7.3. The task or topic appeals to me				
7.4. Apart from the audio, I can use different communication tools to express my ideas	☐	☐	☐	☐

8. I find it easier to contribute constructively in online discussions when:

	Strongly Agree	Agree	Disagree	Strongly Disagree
8.1. The tutor clarifies issues raised during the discussion	☐	☐	☐	☐
8.2. The tutor builds on students' contributions.	☐	☐	☐	☐
8.3. The other students clarify issues raised during the discussion.				
8.4. students build on each others' ideas	☐	☐	☐	☐

9. I find it easy:

	Strongly Agree	Agree	Disagree	Strongly Disagree
9.1. To absorb information conveyed via two or more communication tools simultaneously	☐	☐	☐	☐
9.2. To contribute to a discussion while absorbing information conveyed via two or more communication tools simultaneously	☐	☐	☐	☐

10. Could you give examples to illustrate your answers on question 9? Note that, in this and following questions, the box will expand to allow you to answer as fully as you wish

11. Do you have a preference to use one communication tool over another? If possible, say why and provide an example. Please cover all four tools – audio, text chat, white board and yes/no button.

12. You may be aware of a reason why you chose to avoid using a specific tool when contributing to the discussion. If so can you provide an example?