

*Sociocultural theory and its application to
CALL: A study of the computer and its relevance
as a mediational tool in the process of
collaborative activity*

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Abstract

This study in the field of Second Language Acquisition (SLA) was conducted in a Spanish as a foreign language classroom. The study investigates dyadic face-to-face collaborative dialogue at the computer from a sociocultural perspective. Protocols for analysis were obtained by the transcription of audio recordings of twelve dyads/triads completing three tasks in two mediums of implementation, computer and non-computer-based. By comparing learners' activity in the two mediums through microgenetic analysis (i.e., developmental analysis), we were able to study some specific ways in which the computer influenced the course of interaction. Specifically, the aim of the study was to investigate the value of the tasks as pedagogical instruments to support collaborative activity in the foreign language classroom; the value of collaborative activity as a source for possible restructuring of interlanguage (i.e., microgenesis); and the impact of the computer as a mediational tool in the processes of collaborative activity. Results confirm: (1) the three tasks support high degrees of collaborative activity – albeit qualitatively different; (2) language can – sometimes simultaneously – be deployed by learners both as a means of communication and as a cognitive tool to achieve linguistic development; (3) the presence of the computer seems to change the nature of collaborative activity.

Keywords: Spanish, collaborative activity, sociocultural, microgenesis, Vygotsky, computer

1 Introduction

A fundamental premise of a sociocultural approach to language learning is the notion of knowledge being social and created in interaction. According to Vygotsky (1978), cognitive development appears first in the inter-psychological plane and it is then appropriated by the individual. The processes undergone in inter-psychological activity¹

1 The term activity is used throughout this paper in its Vygotskian sense, in other words, as the unique event defined by the processes that develop as a result of the learners' interaction with a task in combination with the learners' own goals and perceptions of that task (Coughlan & Duff, 1994).

are mediated by tools, either physical and/or symbolic, language being the most pervasive of these. Social interaction is a means to achieve development that enables appropriation/internalisation “through a dynamic transformative process called microgenesis” (Wertsch, 1985 in Ohta, 2000:54). The learning process I am referring to as microgenesis can sometimes be observed while learners engage in dialogue, and can thus be studied within the situated activity in which it occurs.

Framed within this approach to language learning, the main objective of the investigation reported in this article was to study collaborative activity across three tasks in two modes of implementation (computer versus paper) in order to address the following questions:

1. To what degree do the three different tasks in the two mediums of implementation – computer and non-computer based – support collaborative activity in the classroom?
2. To what degree do participants engage in High Quality Collaboration (HQC)?²
3. What is the effect of the computer as a mediational tool in the processes of collaborative activity?

After establishing the theoretical underpinnings of the study in section 2 entitled “Sociocultural Theory”, I provide an overview of the context and research methods deployed (see section 3 below). The comparative nature of the methodology employed aims to identify specific patterns and characteristics of interaction influenced by the medium. In other words, the comparison between computer and paper modes moves away from general questions about the supremacy of one mode over another.³ The aim is to explore specific tasks implemented in a particular context to identify possible strengths and weaknesses brought about by the mediational tool. A second aspect to bear in mind is the need in the field to find, test, and refine the methodological constructs required to adequately investigate collaborative activity in the classroom. In an effort to contribute to the fulfilment of this need, I introduce the concept of High Quality Collaboration (HQC) (see section 3.3 below), a methodological construct grounded in the data that facilitates both qualitative and quantitative data analyses. This paper forms part of a wider study of the processes of collaborative activity in computer-mediated tasks (see Ganem, 2004).

2 Sociocultural theory

Sociocultural theory is rooted in the “Vygotskian argument that knowledge is social and is created in interaction” (Daniels, 1993). The sociocultural approach to learning differs

2 For the purposes of the present study I have defined *High Quality Collaboration* as collaboration where learners, working within a zone of proximal development (ZPD), are able to co-construct language related knowledge. For further information see the ‘Analytical Procedures’ section of this paper.

3 Comparative research between CALL and other modes of instruction has repeatedly been criticised among the academic community (see Doughty, 1992; Chapelle, 2001; Levy, 2001; Dunkel, 1991)

from other cognitive approaches in that it does not accept that knowledge originates and develops exclusively inside the individual mind by means of biological mechanisms and internal processes. Vygotsky accorded learning a fundamentally social nature. Thus learning is a mediated process that originates in societal activity. The learning process "...can sometimes be traced visibly in the course of talk between expert and novice. This local, contextualized learning process is labelled microgenesis" (Mitchell & Myles, 2004:198). From a sociocultural perspective there are three important issues to be considered in relation to learning, specifically in the classroom: instruction, agency, and situatedness. The role of instruction is at the core of this approach. Instruction is essentially a collaborative act where zones of proximal development⁴ are created by the participants, that is agents with their own social perspectives and histories, goals, attitudes, etc. The situated quality of learning highlights that circumstance is a pervasive aspect that has to be carefully considered since "learning unfolds in different ways under different circumstances" (Donato, 2000: 47).

Due to the complexity of agency during activity and the pervasive influence of circumstance upon it, it is possible that activities change and evolve even in the span of a few moments. Furthermore, although a group of participants might be involved in performing a particular task, this does not mean that they are all engaged in the same activities which, in turn, has major implications in the language classroom since it is students that shape both the goals and outcomes of tasks (see Lantolf & Appel, 1994; Donato, 2000; Roebuck, 2000). These theoretical insights have been corroborated by investigations into SLA tasks carried out by researchers such as Coughlan and Duff who suggest that tasks are no more than "behavioural blueprints" (1994: 175) for learners to engage in their own particular activity. Not only do their protocols show how five different learners conceptualise the same task differently, but also how the same learner re-interprets the same task in a different way when asked to perform it again over a period of time. Their work leads them to conclude that on the one hand "a linguistic event never duplicates a past one, and can never be truly replicated in the future" and on the other hand, although "the task or blueprint may be the same, the activity it generates will be unique" (Coughlan & Duff, 1994:190).

2.1 Collaborative dialogue

From a sociocultural perspective, the cognitive processes involved in the production of output that might lead to language development – e.g. through focusing on form; by "pushing" learners to get involved in more mental efforts and thus process language at a deeper level; by moving from semantic to strategic levels in order to achieve accurate production, etc. (Swain, 1995) – are first realised in the inter-mental plane and then internalised. It is through and by means of dialogue that noticing, hypothesis testing,

⁴ In Vygotsky's words, the ZPD is "the discrepancy between a child's actual mental age and the level he reaches in solving problems with assistance indicates the zone of proximal development" (Vygotsky, 1986: 187). Lantolf (2000) has interpreted the zone of proximal development (ZPD) as a metaphor for the "site where social forms of mediation develop...for observing and understanding how mediational means are appropriated and internalized" (2000: 16–17)

and reflective metalinguistic talk can occur (Swain, 1997). However, not all dialogue is equally conducive to cognitive and linguistic development. Researchers like Donato (1994), Swain (1997), Swain and Lapkin (2001), and Roschelle and Teasley (1995) have identified collaborative dialogue that emerges from learners' interactions when engaged in problem-solving activity as the kind of interaction that can potentially lead to the co-construction of linguistic development through the process of internalisation.⁵ In Swain's words, collaborative dialogue "is where language use and language learning can co-occur. It is language use mediating language learning. It is cognitive activity and social activity" (Swain, 2000: 97). Crucially, engagement in collaborative dialogue does not necessarily take place because learners misunderstand each other and have to "negotiate for meaning" (cf. Long, 1983; Pica, 1994), but because they notice a linguistic problem and try to find out solutions to solve it. Central to this perspective is the issue of agency; to be able to understand collaborative activity we also need to understand "how the learner relates himself to the learning task and how this relationship is based on the learner's self-constructed goals" (Donato, 1988: 5).

2.2 The computer as a mediational tool in the processes of collaboration

Collaborative work at (learners interacting with each other in front of/ by means of the computer) and with (learner-computer interaction) the computer is not equal to the sum of its parts and this is one of the reasons why much of the research work carried out to compare the effectiveness of computer versus teacher or computer-based tasks versus paper-based tasks in terms of products rather than processes has been criticised (see Doughty, 1992; Oxford, Rivera-Castillo, Feyten & Nutten, 1998) as trying to compare incommensurable activity. Questions such as "does CALL work?, is CALL good for second language learning?" confuse tools with methods, ignore the effects of agency discussed above, and ultimately, just reflect what Papert calls "technocentric" thinking, a simplistic view of the value and role of technology (1987 in Dunkel, 1991:20). Studying the role of the computer from a sociocultural perspective takes into account the material and cognitive potential, and consequences that this instrument might bring into classroom activity, an under-researched area (Mercer & Scrimshaw, 1993). However, there is a real lack of research on interaction with or at the computer in the second language classroom from this perspective; in relation to interaction through the computer, e.g. computer-mediated communication CMC, refer to the work of Warschauer and his colleagues, for instance Warschauer (1996, 1998); and Warschauer and Kern (2000).

What learners talk about when working in pairs or groups, and whether or not they do so in the target language, has been a constant preoccupation for classroom researchers (see for instance Piper, 1986; Abraham & Liou, 1991). These studies show the importance of observing, comparing, and analysing specific tasks and their characteristics to evaluate the kind of linguistic activity they are conducive to. However, progress – or lack of it – is measured in terms of outcomes, overlooking the need to

⁵ The process of transition from inter-mental activity to intra-mental activity is called appropriation or internalisation (Frawley, 1997).

study interaction as a social process where learning might be taking place outside the parameters of what the researcher thinks should be learned through a certain task.

Mediation, a fundamental concept of sociocultural theory, “is the process through which humans deploy culturally constructed artefacts, concepts, and activities to regulate (i.e. gain voluntary control over and transform) the material world or their own and each other’s social and mental activity” (Lantolf & Thorne, 2006: 79). A strength of sociocultural theory is precisely that it allows us to investigate to what extent and in which ways different components, and the relationships they generate, influence activity. The processes of collaborative activity in the classroom cannot be effectively studied by isolating the different elements, i.e. computer, task, language, the learner, etc., and then trying to explain interaction by adding up the results. In other words, what the different constituents offer the learner is partially intrinsic to the constituent, and partially created through situated activity. By exploring face-to-face collaboration at the computer in the language classroom we will be contributing to an area of CALL that is seriously under-researched despite the potential that providing the learners with two powerful mediational tools in combination, computer and language-in-collaboration, might bring.

3 The study

3.1 Context, learners, and research design

The study was conducted in a Spanish as a foreign language classroom for undergraduate students throughout an academic semester; the class was conducted largely in the target language, although English was sporadically used. The participants were 11 females and 7 males in their late teens/early twenties. Their level of Spanish was Intermediate, which corresponds to a grade C in ‘A’ level Spanish, the national qualification within the British Education context taken at the end of secondary schooling. The study focused upon the following grammatical structures as part of the course programme being taught by the author: personal pronouns to include subject, direct and indirect object, prepositional and reflexive pronouns; infinitive verbs; radical changing verbs; and ‘ser’ versus ‘estar’ (the two Spanish verbs for ‘to be’). None of these structures were expected to be new for the students although, as the pre-test showed, they did indeed have problems with their use.

The main instrument for data collection was the task. Learners agreed to be audio-recorded while performing language tasks in pairs/trios for the purposes of research. Data were collected by the teacher-researcher during weeks 5, 8, and 11 out of a 12-week programme. Due to the fact that data collection was implemented as part of the students’ Spanish class, participants were free to decide whom they wanted to work with since this is what normally happens in all the Spanish sessions at the university and it was not in conflict with the study design. The recorded data (5 hrs 20 min of learners’ interaction) were transcribed to produce protocols for data analysis. The three tasks, described below, were implemented in two modes: computer-based and paper-based. The main purpose of comparing the two modes of implementation was to facilitate the study of the computer pervasiveness in activity (see Gánem Gutiérrez, 2003; 2004). For each of the tasks, participants were divided into two groups. Half of the dyads/trios

accomplished a Computer-Assisted Language Learning (CALL) task and half a Paper task. Students were given the opportunity to work alternately between the two modes throughout the three tasks. In other words, participants who worked on CALL mode in task 1 were then asked to work on Paper mode in task 2 and so on. The study corpus comprised of 12 protocols (2 paper-based and 2 computer-based for each of the three research tasks), and were managed and analysed with the assistance of two software packages: N5 and Excel. Students also took a grammar test at the beginning and at the end of the study (pre- and post-tests respectively) in order to evaluate progress in relation to the grammatical structures mentioned above (for a full report refer to Gánem Gutiérrez, 2004).

3.2 The tasks

Three problem-solving tasks were specifically designed as the main data collection instrument to elicit and record the processes of collaboration undergone by participants while accomplishing them either at the computer (CALL tasks) or in a paper version (Paper tasks). The main methodological purpose of the tasks as instruments for data collection was to provide the participants with an opportunity to engage in inter-psychological activity by collaborating to complete them. Using the capabilities of HotPotatoes, feedback and help from the computer were provided in various degrees and in three different ways: clues, hints, and a correction button. Clues were selectively provided by means of a question mark button next to a blank; when clicking this button students would obtain clues in the top frame of the screen. Hints were available in selected frames; this button was always positioned at the bottom of the screen and students would get letters for the words required just by putting the cursor in the desired blank and clicking the hints button. The correction button, always located at the bottom of the page and provided in every frame, would integrate correct answers into the text, but marking them by means of bold type; incorrect gaps would be cleared out for students to continue working on them. The teacher-researcher was always available to everyone whether they were working at the computer or on the paper versions of the tasks. In general, there was more help available as the task progressed to encourage the participants to collaborate and get help from each other before resorting to the machine. Learners working on the paper tasks received feedback and help from the teacher-researcher when requested.

Task 1: Professionals Today

The first task (see appendix 1) consisted of three parts: (1) a discussion about the world of work, implemented through a hierarchical exercise where participants had to organise concepts such as 'power' and 'money' according to what they considered more or less important in the world of work; (2) an interview reconstruction of a Spanish professional talking about his views of the world of work; and (3) creation of a document to express participants' own views about the topic, but in the context of the UK. The goals of this task were on the one hand, to provide a space for discussion and collaboration to reach common agreement and express their own thoughts and, on the other hand, to practise personal pronouns in a contextualised way.

Task	Procedure	Main Goals	Expected intermental activity	Programme type for CALL version
1. Professionals Today.	<p>1. Discussion – aided by computer – about the world of work and relationships</p> <p>2. Cloze exercise to complete interview with a Spanish professional about perceptions of work and relationships.</p> <p>3. Creation of a document to express students' own views towards either professional life in Spain, taking into account the views in the interview, or work life in the UK.</p>	<p>To practise personal pronouns.</p> <p>To discuss and express their views on the task topics.</p> <p>To create a document in order to synthesise their discussion.</p>	<p>Communication for meaning.</p> <p>Metalinguistic talk.</p> <p>Metacognitive activity (e.g. planning)</p>	<p>Drag-drop programme implemented with HotPotatoes</p> <p>Partial-deletion programme.</p> <p>Webpage generator GoLive.</p>
2. Gifted Daughters: Problem-solving task: variation on a trail quiz.	<p>Students have to solve a problem by collecting the necessary information (5 pieces). Each piece of information is provided to them by the computer when they successfully complete a grammar task.</p>	<p>To solve a problem.</p> <p>To practise personal pronouns, and the infinitive.</p>	<p>Metacognitive talk leading to the solution of the problem (e.g. planning, and negotiation)</p> <p>Metalinguistic talk.</p>	<p>HotPotatoes to produce cloze, translation, matching and jumbled sentence exercises.</p> <p>GoLive.</p>
3. Mexico City: Text reconstruction, a variation on Dictogloss	<p>1. Students read a short text on the screen that will disappear after 60 seconds. (They have two opportunities to read the text.)</p> <p>2. Students collaborate on reconstruction of the text, following a cloze format .</p> <p>3. Students write together a similar text, but this time about London, using a word processor.</p>	<p>To work on “Ser” y “Estar” by reconstructing a text in which these verbs are essential.</p> <p>To create a document that will reflect their personal perceptions about London. To negotiate the kind of information to be included in their text.</p>	<p>Metacognitive talk: planning how to tackle the task.</p> <p>Metalinguistic talk.</p> <p>Communication for meaning.</p>	<p>HotPotatoes.</p> <p>GoLive.</p>

Fig. 1. Summary of the tasks as a tool for data collection.

Task 2: Gifted Daughters

Task two (see appendix 2) was a traditional problem-solving task (trail quiz) where participants are given clues that will help them solve the problem posited. This task

consisted of a macro-task: finding out which language and which musical instrument belonged to which of five sisters; and five embedded micro-tasks that focused on grammar (personal pronouns and infinitive verbs). The micro-tasks were implemented as gap-filling, translation, jumbled sentences, and caption writing. In other words, the dyads had to solve a problem by collecting the necessary five pieces of information, the object of this being the encouragement of metacognitive talk which is believed to stimulate individuals, provide them with an infrastructure to negotiate development, take and manage control of their activity and learning, and guide them through the tasks (see Hoven 1999; Swain 2000; Ohta 2001). Each piece of information was provided to them by the computer – or teacher – after completing a micro-task based on grammar. This task was also intended to bring about metalinguistic talk in relation to personal pronouns and use of infinitive verbs in Spanish.

Task 3: Mexico City

Finally, the third task (see appendix 3) was an adaptation of ‘dictogloss’ (Kowal & Swain, 1997: 295; Swain & Lapkin, 2001: 101) which is described as ‘...a procedure that encourages students to reflect on their own output. In this procedure, a short, dense text is read to the learners at normal speed; while it is being read, students jot down familiar words and phrases; the learners work together in small groups to reconstruct the text from their shared resources...’ (Kowal & Swain, 1997: 295). The purpose of implementing this type of task in the study was twofold: (a) to promote the production of metalinguistic talk while providing learners with practice on ‘ser’ and ‘estar’ since these verbs were necessary for the successful reconstruction of the text; (b) to compare the effects of the computer (as opposed to the Paper version) in terms of creativity and accuracy.

In the CALL version of this task, participants read the text provided on the right hand side of the computer screen instead of listening to it (as done in ‘dictogloss’); they were not allowed to typewrite while the text was on the screen. The Paper version of this task consisted of three pages: one with the instructions, another one with the text, and a third one with the title of the text and blanks for learners to reconstruct it; as in the CALL version, punctuation marks were provided. The text was designed for learners to focus on the verbs ‘ser’ and ‘estar’. Intermental activity was expected to produce metacognitive and metalinguistic talk.

To summarise, the three tasks designed for collection of data in this study provided the students with a twofold general objective. On the one hand, students had the specific aim of completing the problem solving phase of the tasks, and on the other hand, they were able to focus on form by working on the grammatical structures that were part of the exercises embedded in the tasks.

3.3 Analytical procedures: interaction foci and collaborative episodes

Analysis focused on the study of patterns emerging from the data on the one hand, but also on the study of behaviour that might be unique to certain dyads/trios on the other. The aim was to better understand the degree to which certain tasks and task features might be considered as blueprints in terms of being pedagogical tools, and what the specificity of the computer might be throughout the processes of collaborative activity.

3.3.1 *First level of analysis: foci of interaction*

The degree of collaboration in the study refers to a dual dimension during interaction, (a) the social relationships developed among the participants, i.e., did they collaborate, compete, argue, etc. and (b) what the focus of those social relationships was, e.g. the task, the target language, social conversation. In order to assess and compare the degree of collaboration and foci of interaction among tasks and between mediums, the data were coded for language related talk (following Swain & Lapkin, 1995, language related talk is defined as any talk where students discuss the language they are producing, where they question the language they are producing, or where they correct each other or themselves); task related talk (talk specifically related to task implementation, i.e. about content, problem-solving activity, or simply carrying out the task without focusing on the target language); and off-task talk. Subsequently, percentages of the foci of talk across the data were calculated in order to gain a quantitative perspective of the relationships between type of task and medium of implementation, and the foci of talk supported. These percentages were calculated taking the text unit⁶ as the unit for analysis. The text unit was adopted for this kind of quantification rather than the speech turn, because that is the unit utilised by N5, the software package through which data were managed. It must be emphasised at this point that the role of numerical data is purely descriptive, numerical data provide a perspective of the phenomena in question in relation to the overall picture being presented, which is accurate for our sample. However, the relatively small data set makes it unwise for generalizations to be made.

3.3.2 *Second level of analysis: High Quality Collaboration (HQC)*

Once all the language related talk was identified throughout the data, it was further segmented and coded into episodes following Swain (1998: 70) who defines a language related episode (LRE) as “any part of a dialogue in which students talk about the language they are producing, question their language use, or other -or self-correct”, and which focuses on one “language item only” (Fortune & Thorp, 2001: 146).

A further construct for data analysis was High Quality Collaboration (HQC). For the purposes of the present study I have defined High Quality Collaboration as collaboration where learners, working within a zone of proximal development (ZPD), are able to co-construct language related knowledge. This can be achieved through what Donato (1994) has called “collective scaffolding”, which is collaboration where several “novices” are able to empower each other by achieving as a dyad/group what they could not achieve individually; or by an individual “expert” providing the necessary assistance required by a “novice” to achieve any kind of language related development. In my view, and as the definition of HQC implies, microgenesis episodes (MGEs), i.e. episodes where the learning process towards internalisation can be perceptible to the researcher’s eye, are not the exclusive manifestation of learners working within their ZPDs. This metaphoric socio-cognitive space is also “inhabited” by other LREs where learners achieve, through collaboration, language constructions which appeared to be

⁶ In N5 a line is a text unit “of at most 74 characters in length (including spaces)” QSR International Pty Ltd[©] 1980–2000. A text unit, therefore does NOT necessarily correspond to a speech turn.

microgenetic LRE (excerpt from computer-based task 2)	non-microgenetic LRE (excerpt from computer-based task 1)
129 H: pero continuo (.) es el= (<i>but carried on (.) it's the=</i>)	65 E: ehhe "qué piensan ustedes acerca de lo que es importante" ((fading voice while reading instructions)) ehhe " <i>hat do you think is important</i> " ((fading voice while reading instructions))
130 h: =no s no estoy seguro (.) continuo= (= <i>I'm no I'm not sure (.) carried on</i>)	66 M: um (.) ah (.) LE parece? ((pause)) o la A <i>um (.) ah (.) to her ((in Spanish indirect personal pronoun "le")) it seems? ((pause)) or the a</i>
131 H: =[gerundio (= <i>gerund</i>)	67 E: a a mi (.) compañera ((pause)) LE si <i>to to my (.) classmate ((pause)) le yes</i>
132 h: [a leer? ([<i>to read?</i>])	68 M: le parece? [si le parece <i>to her it seems? [yes to her it seems ((using correct personal pronoun "le"))</i>
133 H: después de [continuar (<i>after to [continue]</i>)	69 E: [le parece porque es (.) indirecto ((pause)) que la inteligencia gencia es [más? <i>[to her it seems because it's (.) indirect ((pause)) that intelligence is [more?</i>
134 h: [continuar leyendo leer leyendo (.) leyendo?= ([<i>to continue reading to read reading (.) reading?</i>])	
135 H: =si es leyendo porque es el gerun gerundio average(.) después de seguir y continuar ((she recalls? a grammar point studied in class)) =(<i>yes it's reading because it's the gerund average gerund (.) after to carry on and to continue</i>)	

Fig. 2. High quality collaboration.

beyond their individual capabilities as evident at the beginning of the LRE in question, but where the process of change as such is not overt. Figure 2 provides examples of the two kinds of LREs I have categorised as HQC.

In the microgenetic episode we are able to witness how Henry (h) (all names are

pseudonyms) progresses from being unable to produce the correct form in turns 130 and 132 to gaining control of the form and producing it correctly in turn 134 as a result of Hena's intervention (H) and the collective experience, which enables them to engage in a pedagogic routine. In the non-microgenetic example, on the other hand, the correct form is produced by Mina in turn 66, but she shows uncertainty (turns 66 and 68). Ellen takes Mina's suggestion and hesitation (t66) as a point of departure for reflective consideration (t67) that culminates in metalinguistic consolidation for both participants (t69). Although change is not "visible" in the episode, knowledge construction and consolidation are, as learners empower each other within a ZPD.

Methodologically therefore, the process of categorisation of HQC is simultaneously intertwined with qualitative analysis. The method was rooted in the work and notions conceptualised in fields such as psychology, education, and SLA, but was developed as analysis became more grounded in the data. For validity and reliability purposes, the process for developing the coding scheme entailed various stages where categories were defined, checked, and refined until we (supervisor and researcher) were confident the system worked and could be applied to the data reliably, e.g. two protocols were independently coded and results compared. The relevance of the computer was assessed throughout all the stages of analysis as an integral aspect of the phenomena being investigated. However, the computer's impact was specifically studied through comparisons across the data in relation to its effect on talk foci, i.e. language related talk, task related talk, and off-task conversation, as well as to the use of semiotic mechanisms (such as repetition, use of L1, reading aloud) mediating CALL activity (for the latter see Gánem Gutiérrez, 2004). These analyses were carried out to inform us on possible advantages or drawbacks of using the computer to implement specific types of tasks.

4 Results and discussion

All the participants in the study showed willingness to work as part of a pair/trio, no disputational talk or un-collaborative behaviour was identified in any of the transcribed protocols. Across the three tasks, there were no striking differences between the percentage amounts of talk for language related matters, task related activity, and off-task activity. Learners working on paper engaged in 4% more language related talk than people working at the computer, with virtually no difference (1% more on paper) in terms of task related talk. Students at the computer engaged in 7% off-task conversation whereas paper-based learners in only 2%. The medium influenced off-task conversation in that some of the computer off-task talk was caused by distractions directly related to the computer (for example one dyad had technical problems with a text that was not meant to be visible on the screen), and paper-based learners normally engaged in off-task conversation while having to wait for the teacher to check their work. As Table 1 and Table 2 show there are more important medium related differences across individual tasks both in relation to talk foci and HQC collaboration. These tables and figures are discussed in the following sections.

Task 1: Professionals Today

In task 1, an interview reconstruction primarily based on gap filling, learners working on paper engaged in a higher percentage (67%) of language related talk than learners

Table 1 *Percentages of talk foci between mediums*

% of text units	CT1	PT1	CT2	PT2	CT3	PT3
Language Related Talk	59.5	67	66.5	55.5	17.5	34
Task Related Talk	31	33	29.5	41.5	75	64.5
Off-Task Talk	9.5	0	4	3	7.5	1.5

Table 2 *HQC comparison*

	CT1	PT1	CT2	PT2	CT3	PT3
Total No	57	64	26	24	17	33
LREs						
HQC Episodes	16	21	11	5	1	11
MG Episodes	3	5	5	2	0	7

working at the computer (59.5%) whereas for task 2 the results were the opposite, there was a higher percentage of language related talk at the computer (66.5%) than on paper (55.5%). There is a sharp difference in task 3 where learners working on paper showed a much higher degree of language related talk (34%) than learners at the computer (17.5%). In task 1 the difference observed in relation to language related talk is more related to the amount of off-task conversation learners engaged in than to the medium itself. One of the computer dyads spent some of the task time socialising because they had never worked together before, and they obviously needed to establish a socio-affective rapport before they embarked on the task. The other computer-based dyad who also spent some time off-task also needed to do so, as they got slightly diverted from the task to talk about how to type in orthographic accents on the computer, and although this was not particularly important for one of the participants, the other one made recurrent efforts to find out throughout the session.

Consistently with the amount of language related talk, more LREs were identified in the dialogue of paper-based learners (64) than in computer-based ones (57, see Table 1 and Table 2). Of particular importance, however, is the amount of HQC and microgenetic episodes (MGEs) identified in task 1. Learners working on paper co-constructed 21 HQC episodes (HQCEs) of which 5 were considered microgenesis, and these figures were 16 and 3 respectively for learners working at the computer. The computer played a limited role in the learners' collaborative achievement of HQC. In the case of HQC constructed around targeted items, i.e. pronouns, infinitive verbs, radical changing verbs, and 'ser' versus 'estar', learners had access to immediate feedback from the machine, which could be potentially valuable to reinforce the recently constructed knowledge. Furthermore, in a minority of targeted HQC items, negative feedback from the computer made the learners continue working on those items. However, the teacher actually scaffolded 4 out of the 16 HQC episodes at the computer and 7 out of 21 in the paper-based version. There were no considerable differences in relation to task-related talk in this task between the two mediums.

Task 2: Gifted Daughters

Learners' talk in Task 2, the macro problem-solving task based on micro problem-solving linguistic exercises such as translation, gap filling, caption writing, and jumbled sentences, shows interesting differences between the mediums. The percentage of language related talk (see Table 1) was higher at the computer (66.5%) than on paper (55.5%). In spite of this, the number of LREs is very similar in the two mediums (see Table 2: HQC comparison), 26 at the computer versus 24 on paper). There is, however, a clear difference in relation to HQC with computer-based learners able to co-construct 11 HQC episodes out of which 5 were identified as MGEs. In the case of learners working on paper, they only constructed 5 HQC which included 2 MGEs. The machine played an important role in this kind of task; first of all, the availability of immediate feedback on demand meant that learners did not have to wait for the teacher to check their work and provide subsequent clues and exercises, which was the case for paper-based learners. Secondly, the specific kind of computer feedback provided, combined with the nature of the sub-tasks, encouraged learners to stretch their interlanguage and continue working on erroneous items, which in time led to a considerable amount of reflective talk and also contributed to 3 out of 5 MGEs. Precisely because of the importance of computer feedback hereby highlighted, special care needs to be accorded to the kind of feedback programmed in the task since there were also occasions where feedback created some confusion, e.g. the non-acceptance of a sentence because it was lacking a full stop. Finally, this particular task design gave computer-based learners more control and freedom as to how and when they wanted to tackle the macro problem-solving task. Paper-based learners did not have this choice, pace and range of "working tools", e.g. further exercises provided by the teacher were dependent on the teacher's availability.

In terms of task-related talk, the higher percentage identified in the paper-based protocols (41.5% versus 29.5% for computer learners) was related to the following two main reasons: first of all, learners spent more time trying to figure out what they had to do to carry out the task, in spite of having exactly the same instructions as their computer counterparts. Secondly, as outlined above, they spent longer working on the macro problem-solving task than learners at the computer. The indexes of off-task talk were very low in both mediums; the only dyad at the computer that engaged in off-task conversation did so at the beginning of the task because they had not worked together before. Off-task talk in the paper version was caused by learners having to wait for the teacher to provide feedback.

Task 3: Mexico City

For this task learners had to read a short text about Mexico City, and then reconstruct it. They also had a subsequent sub-task where they had to write a similar text about London. This task was the least successful of the three research tasks, with only one group out of four benefiting from it linguistically. Furthermore, its implementation on the computer fundamentally influenced the nature of activity away from language learning. The percentage of language related talk for the learners working at the computer was low, only 17.5% versus 34% for learners working on the paper version, and there was only one computer-based HQC episode (see Table 1 and Table 2: HQC comparison). The direct effect of the computer on the way learners interpreted and implemented the tasks was caused by the use of boxes to hold each word. The rationale

for the design was to promote the use of key content words, such as the name of city symbols, as the basis for language discussion about grammar words to make sense of the content and recreate the text. However, the appearance of boxes on the monitor encouraged a mnemonic approach throughout the whole session because learners knew they needed to “remember” the text exactly as they had read it for the computer to accept it. Piper reports similar behaviour when referring to the talk of learners working on a COPYWRITE task: “[learners] are seeking to call up the words mainly from their memory” (Piper, 1986: 192). This software is based exactly on the same principle as our task 3, learners read a text on screen and then try to reconstruct it with no help, but with dashes representing words. I believe that the fact that learners read the text instead of listening to it, as it is normally implemented in traditional dictogloss, also appealed to a reproduction of a seen “object” from memory rather than a reconstruction of a heard “text” which would be more difficult to reproduce exactly.

The dyad working on the paper version also followed a memory approach – even when they did not worry much about the spaces provided for words on their sheet – and these learners also kept very close to the original text when they wrote their own text about London. Neither of the two dyads at the computer finished the reconstruction task. The triad working on paper approached the task from a more creative perspective which produced the best results, 45% of language related talk, and 9 HQC episodes that included 7 MGEs, more – as a group – than any of the other dyads/groups across the three tasks. The results from this successful triad bear resemblance to the kind of activity reported by Swain and Lapkin (2001), whose dictogloss students focused on form while discussing their language problems, “brought to conscious attention gaps in their own knowledge”, engaged in hypothesis testing and built on each other’s resources (2001:110).

The fact that language related work at the computer (17 LREs in total, which included one HQC episode) did not provide learners with opportunities to stretch their interlanguage and co-create zones of proximal development also reflects the nature of learners’ activity. They were working from the memory of a recently read text, and the language they focused on was either within their memory grasp where they were making spelling corrections, for instance, or simply involved self-corrections. Even the limited amount of LREs (3) where learners engaged in some reflective activity and could have potentially led to some creative use of vocabulary, for instance, was cut short by the sudden recollection of a word in the text, ending thus the creative exploration they had initially embarked on. The delivery of this task via the computer meant a task transformation from “open” – as the paper version was – into “closed” where the gaps of the computer required discrete, precise information (Loschky & Bley-Vroman, 1993).

Task-related talk, which represented a large percentage in both modes of implementation, 75% for computer-based and 64.5% for paper-based interaction, was – as language related talk – qualitatively different. Learners at the computer engaged in more meta-task commentary, as well as planning how to tackle the exercise, whereas learners on the paper version engaged in more task-implementation talk. Text reconstruction was supported by cumulative repetition, for instance, without necessarily focusing on form while doing so. Off-task conversation, 7.5% at the computer, was related to keyboard combinations to type orthographic accents, and some socialisation. The minimal off-task percentage among learners working on paper (1.5%) was an

interesting mini-discussion brought up by the general topic of cities that was the basis for their activity.

5 Conclusions

Sociocultural theory has provided theoretical and methodological foundations in this study to investigate pair/group interaction at the computer and the impact of the machine upon collaborative activity. A core premise underlying the investigation is that interaction has the potential to support cognitive and linguistic development (Swain, 1997; Swain & Lapkin, 2001). However, not all dialogue is collaborative dialogue, i.e. “where language use and language learning can co-occur” (Swain, 2000: 97), and we need to gather more information to understand the inter-psychological basis for the adequate promotion of the latter. The type of task learners engage in and the influence of the medium (computer or paper) on interaction also need addressing if we are going to provide better opportunities for learners in classrooms where computers are increasingly being used. Variability across the dyads/groups in terms of performance highlights the need to evaluate and discuss tasks as blueprints for activity (see Coughlan & Duff, 1994). The results of this study therefore reflect the activity that took place among specific learners under specific circumstances.

Keeping the above observations in mind, and to summarise the findings in relation to the research questions posed at the beginning of the study, I believe the dictogloss version – as implemented for this particular study – was the least successful of the three tasks, and when carried out at the computer, it was a very limited source for language related activity. In its paper version, the motivation and creative approach of a group of participants made a meaning-making experience out of the task. It has to be emphasised that one cannot attribute the success – or lack of it – of a task solely to the medium of implementation; but also to the suitability of the particular task design to that medium. Therefore, caution needs to be exercised when equating CALL task ‘design’ to simply transferring paper-based tasks to a computer. Task 1 supported the highest number of HQC episodes and proved to have certain useful features, such as the opportunity for learners to explore their own ideas and stretch their interlanguage in order to express them; the main gap-filling format provided opportunities for form focused discussions even when this type of exercise could have led to its individual resolution. A downside of this task was the requirement for learners to work on gap-filling for too long; this, I believe, undermined learners’ efforts to make a better use of the semantic and syntactic context surrounding the gaps. The integration of macro and micro problem-solving endeavours in task 2 showed mixed results. Most learners did not find the macro problem-solving task relevant to their language class and therefore relegated it as an exercise to do after the “proper” work on language. Based on this study and other reports on the use of problem-solving tasks that are not obviously language oriented (see comments about “Lemonade Stand” in Abraham & Liou, 1991) I also believe caution needs to be observed not to cognitively overload learners to a degree where the concern for linguistic activity is overshadowed. In relation to the micro problem-solving tasks based on language, the translation and caption writing exercises were the most successful in task 2, with jumbled sentences being the least linguistically motivating. Even when learners are expected to work at syntactic level

in order to create meaningful sentences, there is very little evidence that they do so, and the drag and drop facility (very popular in commercial CALL programmes) when this task is implemented via the computer invites, in my view, a trial-and-error approach.

A limitation of the study was its relatively small scale which has repercussions for its scope for generalisation. Furthermore, in an effort to investigate the impact of the computer in the classroom in conditions as fair as possible for the two mediums being compared (computer and paper), and based on a research design which would allow for replicability, some powerful features of CALL such as hypertext and multimedia were avoided. Further research is needed to assess, in more precise ways, and varied conditions, the degree to which the computer, as another participant in interaction, and some of its potentially powerful features, add to the co-construction of meaning, and impact on learners cognitively, for instance.

Drawing on sociocultural theory to study interaction and collaboration in the language classroom is a concept still in its infancy. The kind of developmental analysis promoted by Vygotsky as a means to explore cognitive development needs to be cautiously explored and refined when applied to the study of second language development. In this article, I have advanced an analytical unit, High Quality Collaboration (HQC) to investigate the co-construction of language related knowledge among learners working on paper and computer-based tasks. This unit has allowed qualitative analysis of interaction as well as quantification for comparative purposes. More specifically, HQC episodes have enabled the study of knowledge co-construction between learners even when some episodes cannot be strictly classified as microgenetic ones. Undoubtedly, this unit of analysis will have to be further tested to assess its value as a methodological tool in other studies.

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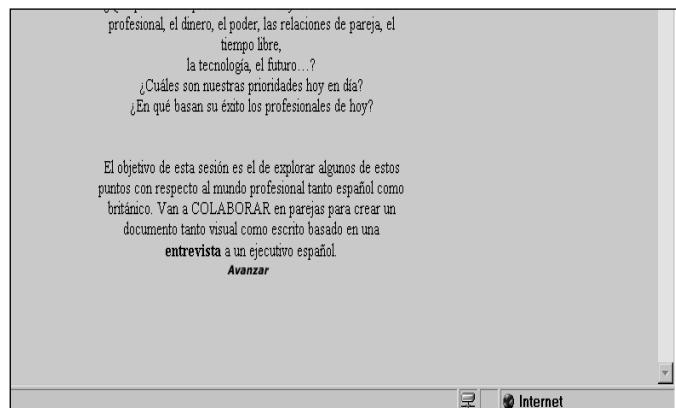
References

- Abraham, R.G. and Liou, H. (1991) Interaction Generated by Three Computer Programs: Analysis of Functions of Spoken Language. In: Dunkel, P. *Computer-Assisted Language Learning and Testing: Research issues and Practice*. New York: Harper Collins, 85–109.
- Adobe GoLive: Web authoring package – see Products / Web publishing: <http://www.adobe.com>
- Arneill, S., Holmes, M. and Street, H. (1998) *Hot Potatoes*, Victoria, Canada: University of Victoria: <http://web.uvic.ca/hrd/halfbaked>
- Chapelle, C.A. (2001) *Computer Applications in Second Language Acquisition: Foundations for teaching, testing and research*. Cambridge: Cambridge University Press.
- Coughlan, P. and Duff, P.A. (1994) Same Task, Different Activities: Analysis of SLA Task from and Activity Theory Perspective. In Lantolf, P. and Appel, G. (eds.), *Vygotskian Approaches to Second Language Research*. Norwood, NJ: Ablex.
- Daniels, H. (1993) *Charting the Agenda: Educational Activity after Vygotsky*. London: Routledge.

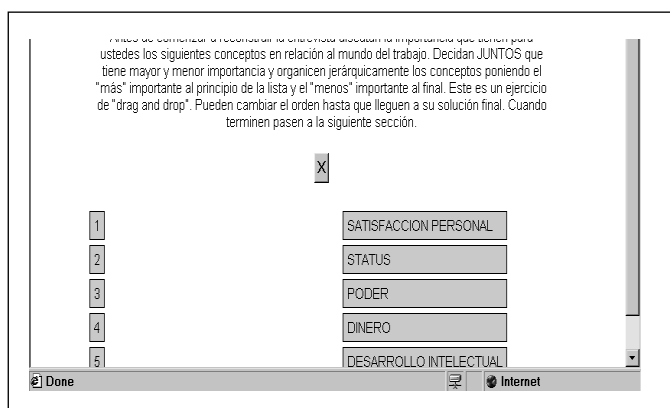
- Donato, R. (1988) Beyond group: A psycholinguistic rationale for collectivity in second language learning. *Unpublished doctoral dissertation*, University of Delaware.
- Donato, R. (2000) Sociocultural contributions to understanding the foreign and second language classroom. In: Lantolf, J.P. (ed.) *Sociocultural Theory and Second Language Learning*. Oxford: Oxford University Press, 27–50.
- Doughty, C. (1992) *Computer applications in second language acquisition research: design, description, and discovery*. In: Pennington, M. and Stevens, V. (eds.) *Computers in Applied Linguistics: An International Perspective*. Clevedon, England: Multilingual Matters, 127–154.
- Dunkel, P. (1991) (ed.) *Computer-assisted language learning and testing: Research issues and practice*. New York, NY: Newbury House.
- Fortune, A. and Thorp, D. (2001) Knotted and Entangled: New Light on the Identification, Classification and Value of Language Related Episodes in Collaborative Output Tasks. *Language Awareness*, **10**(2/3): 143–160.
- Gánem Gutiérrez, G.A. (2003) Beyond interaction: the study of collaborative activity in computer-mediated tasks. *ReCALL*, **15**(1): 94–112.
- Gánem Gutiérrez, G.A. (2004) The Processes of Collaborative Activity in Computer-Mediated tasks: in Search of Microgenesis. *Unpublished doctoral dissertation*, University of Southampton.
- Hoven, D. (1999) CALL-ing the learner into focus: towards a learner-centred model. In: Debski, R. and Levy, M. (eds.), *WorldCALL: Global perspectives on computer-assisted language learning*. Lisse: Swets & Zeitlinger, 149–167.
- Kowal, M. and Swain, M. (1997) From semantic to syntactic processing. How can we promote it in the immersion classroom? In: Johnson, R. K. and Swain, M. (eds.), *Immersion Education: International Perspectives*. Cambridge: Cambridge University Press, 284–309.
- Lantolf, J.P. and Appel, G. (1994) (eds.) *Vygotskian Approaches to Second Language Research*. Norwood, NJ: Ablex.
- Lantolf, J.P. and Thorne, S.L. (2006) *Sociocultural Theory and the Genesis of Second Language Development*. Oxford: Oxford University Press.
- Levy, M. (2001) Coherence and direction in CALL research: comparative designs. In: Cameron, K. (ed) *C.A.L.L. The Challenge of Change*. Exeter: Elm Publications, 5–13.
- Long, M.H. (1983a). Native speaker/non-native speaker conversation and the negotiation of comprehensible input. *Applied Linguistics*, **4**(2): 126–141.
- Long, M.H. (1983b). Linguistic and conversational adjustments of non-native speakers. *Studies in Second Language Acquisition*, **5**: 177–193.
- Loschky, L. and Bley-Vroman, R. (1993) Grammar and task-based methodology. In: Crookes, G. and Gass, S. (eds) *Tasks and Language Learning: Integrating Theory and Practice*. Clevedon, England: Multilingual Matters Ltd, 123–167.
- Mercer, N. and Scrimshaw, P. (1993) Researching the electronic classroom. In: Scrimshaw, P. (ed.) *Language, classrooms & computers*. London: Routledge, 184–91.
- Mitchell, R. and Myles, F. (2004) *Second Language Learning Theories*. London: Arnold.
- Ohta, A.S. (2000) Rethinking interaction in SLA: Developmentally appropriate assistance in the zone of proximal development and the acquisition of L2 grammar. In: Lantolf, J. P. (ed.), *Sociocultural Theory and Second Language Learning*. Oxford: Oxford University Press, 51–78.
- Ohta, A.S. (2001) *Second language acquisition processes in the classroom: Learning Japanese*. Mahwah, NJ: Lawrence Erlbaum.
- Oxford, R.L., Rivera-Castillo, Y., Feyten, C. and Nutten, J. (1998) Computers and more: Creative uses of technology for learning a second or foreign language. In: Darlequay, V., Ding, A. and Svensson, M. (eds), *Les Nouvelles Technologies Educatives dans l'apprentissage des langues vivantes: réflexion théorique et applications pratiques*. Lyon, INSA (<http://www.insa-lyon.fr/Departements/CDRL/index.html>).

- Pennington, M. and Stevens, V. (1992) (eds.) *Computers in Applied Linguistics: An International Perspective*. Clevedon, England: Multilingual Matters.
- Pica, T. (1994) Research on negotiation: what does it reveal about second language learning conditions, processes and outcomes? *Language Learning*, **44**: 493–527.
- Piper, A. (1986) Conversation and the computer: a study of the conversational spin-off generated among learners of English as a second language working in groups. *System*, **14**: 187–198.
- Richards, T. and Richards, L. *N5 Package for Qualitative Data Analysis from QSR*. University of Western Sydney.
- Roschelle, J. and Teasley, S.D. (1995) The Construction of Shared Knowledge in Collaborative Problem Solving. In: O'Malley, C. (ed.) *Computer Supported Collaborative Learning*. Berlin: Springer-Verlag, 69–97.
- Roebuck, R. (2000) Subjects speak out: How learners position themselves in a psycholinguistic task. In: Lantolf, J. P. (ed.) *op. cit.*, 79–95.
- Swain, M. (1995) Three functions of output in second language learning. In: Cook, G. and Seidlhofer, B. (eds.) *Principle and Practice in Applied Linguistics*. Oxford: Oxford University Press, 245–256.
- Swain, M. (1997) Collaborative dialogue: Its contribution to second language learning. *Revista Canaria de Estudios Ingleses*, **34**: 115–132.
- Swain, M. (1998) Focus on form through conscious reflection. In: Doughty, C. and Williams, J. (eds.), *Focus on Form in Classroom Second Language Acquisition*. Cambridge: Cambridge University Press, 64–81.
- Swain, M. (2000) The output hypothesis and beyond. In: Lantolf, J. P. (ed.) *op. cit.*, 97–114.
- Swain, M. and Lapkin, S. (1995). Problems in output and the cognitive processes they generate: a step towards second language learning. *Applied Linguistics* **16** (3): 371–391.
- Swain, M. and Lapkin, S. (2001) Focus on form through collaborative dialogue: Exploring task effects. In: Bygate, M., Skehan, P., and Swain, M. (eds.) *Researching Pedagogic Tasks: Second Language Learning, Teaching and Testing*. London: Longman, 99–18.
- Vygotsky, L.S. (1978) *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Warschauer, M. (1996) Motivational aspects of using computers for writing and communication. In: Warschauer, M. (ed.), *Telecollaboration in foreign language learning*. Honolulu, HI: Second Language Teaching & Curriculum Center (University of Hawai'i Press), 29–46. <http://www.nflrc.hawaii.edu/NetWorks/NW01/>
- Warschauer, M. (1998) Researching technology in TESOL: Determinist, instrumental, and critical approaches. *TESOL Quarterly*, **32** (4): 757–761.
- Warschauer, M. and Kern, R. (2000)(eds.) *Network-Based Language Teaching: Concepts and Practice*. Cambridge: Cambridge University Press.
- Wertsch, J.V. (1985) *Vygotsky and the Social Formation of Mind*. Cambridge, MA: Harvard University Press.

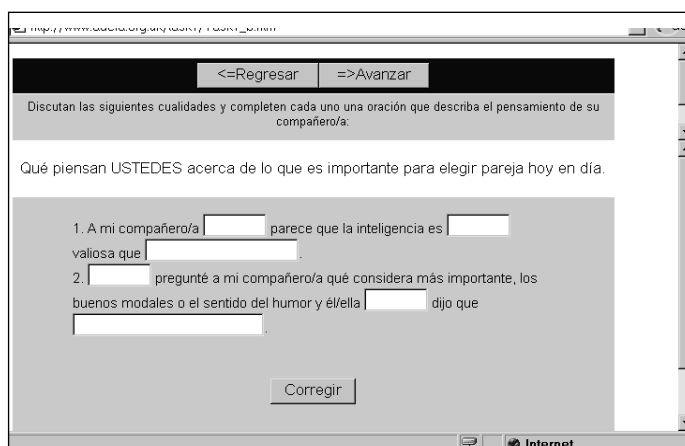
Appendix 1: Task 1 Professionals today



Frame 1



Frame 2



Frame 3

¡Ahora, a la entrevista!

JUNTOS y COLABORANDO SIEMPRE como pareja, reconstruyan la entrevista hecha a un ejecutivo español. La entrevista consiste de ocho preguntas y sus respectivas respuestas. Cada vez que terminen una pregunta y respuesta, pueden hacer "click" en el botón "revisar", las respuestas incorrectas desaparecerán de sus casillas para que puedan trabajar en ellas otra vez hasta que acierten. Como ÚLTIMA opción pueden acceder a las "pistas" en algunas preguntas pero traten de encontrar las respuestas entre ustedes **dos ANTES** de pedir ayuda. Ojo: NO todos los blancos tienen "pistas".

¿Listos?...

Avanzar

Frame 4

Appendix 2: Task 2 Gifted daughters

Cada una toca un instrumento musical diferente (los cuatro instrumentos son el clarinete, la flauta, el piano y el violín) y cada una habla un idioma diferente.

Para resolver el problema y completar el cuadro, necesitan JUNTOS(AS) obtener CINCO oraciones que les darán todas las claves necesarias. ¿Cómo obtener las oraciones? Bueno, pues deben COLABORAR como pareja, y SIEMPRE hablando español, en los ejercicios que tienen en la computadora. Cada vez que completen CORRECTAMENTE los ejercicios, obtendrán una oración.

Avanzar

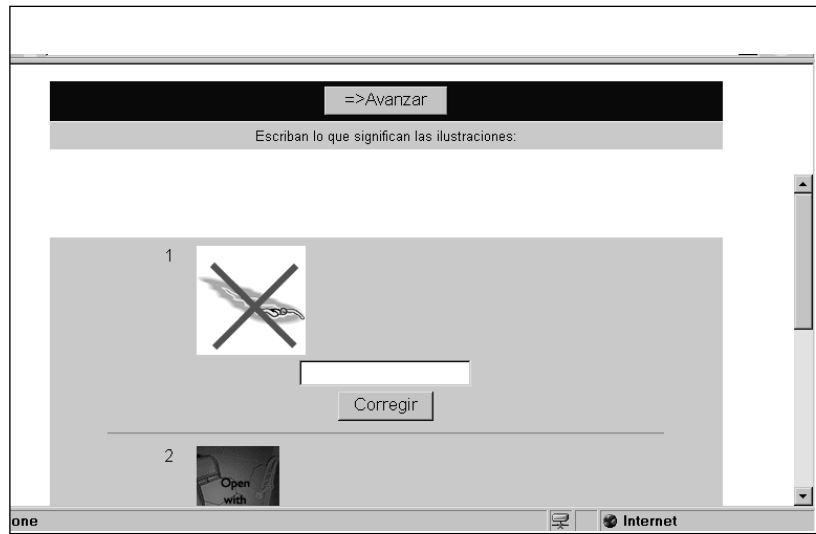
Frame 1

Primera clave:

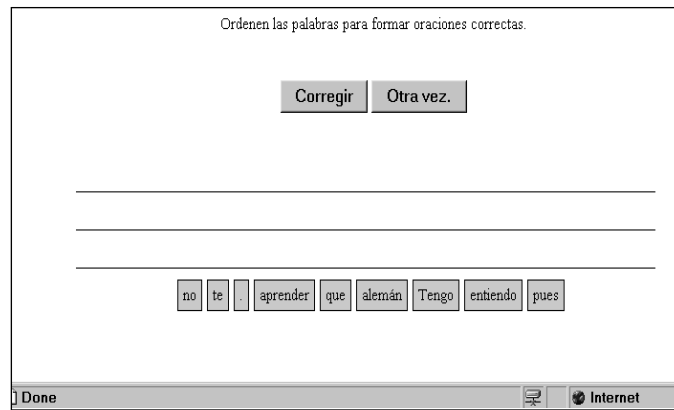
La hermana que toca el clarinete no habla ni francés ni alemán.

Avanzar

Frame 2



Frame 3



Frame 4