

Synchronous Communication in a Web-Based Senior High School Course: Maximizing Affordances and Minimizing Constraints of the Tool

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Researchers studied the use of a suite of synchronous communication tools in support of a Web-based, senior high school French course whose students were dispersed over the vast, sparsely populated province of Newfoundland and Labrador, Canada. The objective was to describe interaction according to four types: student-teacher, student-student, student-content, and student/teacher-tools. The interactions were considered in relation to the tools' affordances and constraints. The study revealed that teachers' decisions related to the choice of pedagogical activities and the assignment of privileges play an important role in effective use of the tools.

Foreign-language instruction poses challenges in Web-based learning because of a lack of two-way interaction (Bruce and Shade, 1994; Clifford 1990) and limited opportunities for oral communication. Limitations can be overcome partially by providing students with oral practice and feedback and by using instructional strategies that encourage frequent student-student and teacher-student dialogue. Such interaction can be supported through reliance on synchronous communication tools.

In this article we report on the simultaneous, combined use of a suite of synchronous communication tools in support of a Web-based senior high school French course. The course is designed to be delivered with 60% synchronous communication supported by vClass™ and an asynchronous component supported by WebCT™. The specific objective was to describe the types of interaction, taking into account the affordances and constraints of the tools.

Background and Context

The population dispersion of Newfoundland and Labrador, the mostly easterly province of Canada, presents challenges to providing educational opportunities in small schools in the province's many remote and rural communities. The challenges are particularly noteworthy at the senior high school level, where schools must provide clientele with the same standard and advanced programming as is offered to students in urban centres.

These challenges have been addressed partially through use of information and communication technologies to support course delivery. In 1988, the province's Ministry of Education initiated delivery of an advanced mathematics course using audioteleconferencing. The addition of other courses and steadily increasing enrollments led to a recommendation to increase distance education course offerings using a Web-based system administered by the Center for Distance Learning and Innovation (CDLI) (Government of Newfoundland and Labrador 2000). In 2002-03, the CDLI offered eighteen Web-based senior high school courses designed according to provincial curriculum guidelines in seventy-four sites across Newfoundland and Labrador (Government of Newfoundland and Labrador 2002).

The choice of vClass™ for synchronous communication related to the software's low bandwidth requirements (Elluminate 2002), with connections as low as 28.8 kbps being supported (Elluminate n.d.). The virtual classroom can be described as a real-time collaboration environment offering a suite of tools accessed through a graphical interface. Tools include audio with two-way voice, shared whiteboard (WB), public and private text-based direct messaging (DM), hand raising with sequencing, private and public polling, and application sharing (Elluminate 2003).

When students first enter the virtual classroom, they have access to DM and hand raising. Access to other tools, such as the microphone or the WB, must be assigned by the moderator. The teacher can assign moderator privileges to students at any time to allow them to lead a class or make a presentation. The DM tool affords many-to-many communication or multiple private and public text-based simultaneous conversation. Whereas DM supports an exchange of messages between two participants, among multiple selected participants, or among all in the class, two-way audio supports only one conversation at a time in public, one-to-many communication. The affordance of an oral conversation between a teacher and a subset of the class is not supported in vClass™.

The WB is analogous to a traditional classroom's chalkboard or overhead transparency on which the teacher normally writes and invites the students to write. The WB affords an added feature: A student can be assigned a screen to work on individually, or with other students. The "Screen Image Palette" feature enables the teacher and students to take a snapshot from the desktop, save it as a JPEG file, and place it directly on the WB. The WB supports the import of PowerPoint™ presentations and GIF/JPG images. The WB screens can be printed or saved to a file for subsequent review.

vClass™ supports the goals of designing a Web-based course for French and other foreign languages, which require a greater provision of

opportunities for synchronous communication than most other subjects. The primary focus and essential purpose of the Core French Program, as described in the ministry's curriculum guide, is communication in French in order to "establish and maintain personal relationships, to share ideas and opinions, and to get things done" (Government of Newfoundland and Labrador n.d., 8). Some of the outcomes that students are expected to attain by the end of high school include the ability to interact in a classroom where French is the language spoken participate spontaneously in conversation, express and justify opinions and points of view, and ask a variety of questions (Atlantic Provinces Education Foundation n.d.).

Conceptual Framework

The effectiveness of synchronous tools depends on the skill level of the users and on individual learner characteristics (Sherry 2000). Such characteristics might include computer experience, peer and teacher influence, parental education, gender, and communication apprehension (Fishman 1996). This study is premised on the assumption that the effectiveness of the tools will also depend on the interaction that takes place. McIsaac and Gunawardena (1996) argued that the concept of interaction is fundamental to the effectiveness of distance education. Interactions can be categorized according to various typologies. Moore (1989) distinguished between three different types of interaction in distance education: learner-instructor, learner-content, and learner-learner. For this study, we employ the terms "teacher" and "student" instead of "instructor" and "learner," respectively. No directionality is implied in the order of these pairs – for example, student-teacher interaction includes student-to-teacher and teacher-to-student interaction. Also the singular form includes the plural, unless the context requires the plural form.

The effectiveness of the tools could be described in terms of their ability to help users meet their goals for action in a given context. In this case, the goals relate to communication. The inherent capabilities of the tools, such as what they allow a user to do or not do, determine their effectiveness. Yet these capabilities on their own cannot support the users' achievement of goals. To draw on an analogy, a power drill in the hands of a small child will have limited effect in spite of its inherent capabilities. It is how the individual makes use of or interacts with the tool in pursuit of a goal that determines its effectiveness (Murphy 2002). In this regard, we can add a fourth type of interaction to those previously mentioned: user-tool interaction. This type is similar to learner-interface interaction as described by Hillman, Willis, and Gunawardena (1994). In this article, this type is referred to as *student/teacher-tool interaction*.

A user interacts with a tool in an effective way when he/she is able to maximize its affordances and minimize its constraints. Affordances are a potential or perceived capacity of an object to enable the assertive will of the actor (Ryder and Wilson 1996). Gibson's (1979) perspective on affordances is that they are ecological properties of the relationship between an agent and its surrounding environment. Gibson intended an affordance to mean an action available to an individual in the environ-

ment, independent of the individual's ability to perceive this possibility. This study of synchronous communication in a Web-based course is premised on a concept of affordances as the capacity of a tool or tools to enable the communicative, assertive will of the students and teacher. The absence of or diminished capacity to enable the assertive will represents a constraint of the tool. Sherry (2002) argued that there exists a delicate balance between the affordances and constraints of any forms of computer-mediated communication. This balance is related to the user's interaction with the tools and the ways in which this interaction allows him or her to maximize the affordances, while simultaneously minimizing the constraints.

Method

Specific data-collection techniques included six class observations using vClass™. Three small-group interviews were held with students using DM and two-way audio. The teacher was interviewed twice: once at the beginning of the observation period to orient the researchers, and again at the end. All interviews and observations were conducted using vClass™. The tools were used by the researchers for communicating with the users in order to develop firsthand experience with the ways in which the affordances and constraints manifested themselves.

The approach to the inquiry recognized that data are context-related and dependent (Lincoln and Guba 1985). The purpose of the observations was to learn about and describe qualitatively the types of interactions taking place and to determine how these interactions related to the affordances and constraints. The observations of teaching and learning provided insight into how the users were interacting with each other as they used the tools and how they were interacting with the tools themselves. The observations were semistructured in that they were guided by a specific focus on the on the concepts of interaction, affordances, and constraints and by a holistic perspective on the use of synchronous tools in Web-based learning in general. Observations were recorded in field notes, and DM and WB records related to each session were saved as printable files.

The interviews were also semistructured and focused on participants' perceptions of the types of interaction and on the constraints and affordances. The purpose of the interviews was to seek clarification or further insight into the interactions identified in the course of the observations. For example, students were asked what tools they preferred to use and why; and what types of activities they typically engaged in using vClass™. Participants included one teacher and twenty students in a Level 1 or Grade 10 senior high school French course. The instructor was situated in St. John's, the capital city, and students were dispersed hundred of miles away, over seven schools under the jurisdiction of two school districts in Labrador and northern Newfoundland. These schools were chosen for the study because (1) the students were studying the same French course; (2) these students were grouped as a class for scheduling and instructional purposes; and (3) the schools were in small,

remotely located communities dependent on distance education opportunities for their programming.

Description of the Findings

The goal of the observations and the interviews was to describe the types of interaction and the relation between the types of interaction and the user's experiences in maximizing affordances and minimizing constraints. Four types of interactions were noted from the literature and described in the conceptual framework. These were student-teacher, student-student, student-content, and student/teacher-tools. The description of the findings presents an overview of the four types of interaction that were observed and/or referenced in the interviews. Students' and teachers' interactions with the tools are described in relation to affordances and constraints.

Student-Teacher Interaction

Instances of student-teacher interaction were observed in the context of teacher-initiated and teacher-directed activities and questions. An illustrative example of this type of interaction is the teacher asking a question using two-way audio and the students responding to the question and to follow-up related questions. The "warm up" exercise using two-way audio observed at the beginning of each class represents a case in point. In this exercise, students were expected to respond in French to a question such as, "Quel temps fait-il chez toi?" or "What's the weather like where you are?" These types of questions were directed to a student chosen by the teacher using students' log-in order. The dialogue was intended for all to hear as a part of language instruction and aural development. Student-teacher interaction was initiated by a student to seek clarification of instructions, ask general questions, or alert the teacher to technical problems. The teacher used DM to respond to students' questions and to make administrative inquiries.

Student-teacher interaction occurred as well through use of the polling feature. This tool was designed to be teacher controlled. Thus, students could not initiate communication by polling; they could only respond. When the teacher needed to verify that all students could see the screen, he asked them to indicate with a checkmark. In addition, the polling feature was used by the teacher to evaluate student comprehension by asking them to indicate their level of understanding on an A, B, C, D scale. The teacher polled these answers privately. He also made use of the polling feature using the "Class pace indicator," by which students indicated whether the pace of the lesson was too slow or too fast. Students used the hand-raising feature when the teacher directed a question to the entire class and a particular student indicated his/her interest in responding. During the six observations, students used this feature twice to ask a question or to seek clarification, and relied on DM for all other occasions.

Student-Student Interaction

Student-student interaction was observed primarily during one activity in which the teacher paired students and assigned each group to one screen of the WB and requested a sentence in French using a word supplied by the teacher. Interaction between the students in the group required using the WB or DM, as the microphone allowed for public communication only. Students did not make use of DM for this activity, even though they could have sent private messages to each other in support of their collaboration. When student-student interaction using DM was observed, the interaction was social rather than learning related.

Student-Content Interaction

Student-content interaction was noted during each of the observations. The content was presented using either the WB or prerecorded material on audiotapes. The WB content took the form of PowerPoint™ slides of activities created by the teacher. In other cases, the content was selected by the teacher from the same instructional materials (texts, workbooks, audiotapes) that teachers and students used in the classroom-based teaching of the same course. The activities involved completing exercises presented on the WB as they might appear in a traditional classroom on a chalkboard or on an overhead projector. Students were asked to supply the answer orally or by writing directly on the WB.

Students were allotted five to ten minutes to prepare their answers. In one case, they were invited to consult their textbook, which was not online – that is, to read an article and then respond to questions addressed to them orally by the teacher. Another activity involved viewing a list of countries presented on the WB and matching countries with their language. The teacher assigned control of the WB to a designated student in order to display a response. Students also interacted with content in the form of audio files of short prerecorded segments and then completed a related exercise during the WB.

Student/Teacher-Tool Interaction

Students made spontaneous use of DM, relying on it for one-to-one communication with their instructor or with another student. It was their preferred tool for asking questions and seeking clarification. During the group interviews, one student indicated that she preferred to write comments in English using DM rather than speak in French using two-way audio: "I like messaging because I don't like talking French." Another student indicated, "It's more private. I can talk to only one student"; and another, "I prefer direct messaging because of the privacy. I don't have to be so shy. You can talk one-to-one without the class knowing about it." The teacher noted that for administrative questions, "Students prefer to use direct messaging but it takes time to write their questions or responses."

Whereas the preferred tool for students was DM, the teacher preferred the WB, with two-way audio as his second choice. Students commented, "We don't usually write on the whiteboard. The teacher usually does all the stuff on the whiteboard." The WB served two purposes. In most instances, it was the central point of contact for interaction with content. In other cases, the teacher made use of this tool to provide linguistic support or scaffolds for oral/aural interaction using the two-way audio.

One student referred to the advantage of the WB: "The teacher writes things on the whiteboard while he's talking so we don't have to write. He writes examples. It's easier to understand." However, as the teacher commented, the WB presented technical constraints: "After I send students to a screen, I don't know if and when they have arrived there." In one instance, students indicated that they could not see the screens that the teacher had put on the WB. The teacher also commented regarding the WB that uploading graphically complex images containing color, sound, and animation is so slow that any educational advantage is compromised by the loss of class time.

In addition to the WB, the teacher made regular use of the microphone. The instructional value of this tool was described by one student, who noted, "It makes things easier to understand when the teacher is speaking." Another student highlighted the tool's constraints when he noted that "it would be easier if more than one person could talk at a time." Students' interactions with two-way audio were hampered by constraints of unknown origin. Problems with this tool were common during all six observations. At least one student per class indicated that he/she was unable to get the microphone to work and that he/she needed to use DM instead. The same problem was encountered during interviews conducted by the researchers using vClass™.

The most common problem with two-way audio was a delay in student response, usually of about five to fifteen seconds. This problem is partially caused by constraints inherent in the tool in that speaking requires clicking on the "Talk" button. This action consumes a few seconds and cannot be completed until the previous speaker has deactivated the feature. Another possible cause is that students may be engaged in some other activity, such as chatting either online or offline. The teacher concluded that "the main frustration with vClass™ is the timing, the fact that it takes students a while to respond. It is not as spontaneous as live communication." The teacher also noted that, although the audio feature works well, "With French there are body gestures and facial expressions that are impossible to communicate because there is no opportunity to see each other."

Student interaction with the vClass™ tools is moderated by the teacher, who can assign or revoke privileges. On start-up, the hand-raising and DM tools are available to students. The teacher commented that he would like to facilitate more student-student communication with the tools but that vClass™ did not support this type of interaction: "It would be neat to be able to put students in groups and send them off to discussion rooms, to check in on them, but just let them work together. Now they can't do that." Students can be assigned to discussion groups, but their communication is conducted through DM.

Discussion

VClass™ affords opportunities and support for teacher-student interaction and one-to-many communication primarily through the WB and two-way audio. It provides support for student-content interaction through the WB. Student-student interaction and one-to-one interaction, such as between the teacher and an individual student, are afforded only by text-based DM or through use of individual screens on the WB. The two-way audio provides only one channel of communication at a time, whereas DM presents multiple channels and supports multiple dialogues simultaneously. However, DM is text-based only and cannot support the oral/aural, one-to-one interaction that is desirable in learning a second language.

One-to-one communication between individual students or between a teacher and a student could provide support for more student-centered forms of learning frequently advocated in the literature. Effective use of synchronous tools might aim to maximize the affordances that support such interactions. This goal can be accomplished through conscious choice of pedagogical activities that require students to work together and to use the tools that support this interaction. For example, students could be assigned group activities, and then be encouraged to make use of the private messaging in DM to support their collaboration. The teacher can assign privileges to students that allow them to share screens, thereby promoting student-student interaction. Assigning the privilege of moderator to a student would also encourage a more student-student interaction.

The way in which the WB is used can also determine the types of interaction possible and feasible in the context of a given activity. Rather than using the WB to drive the lesson and to serve as a focal point for delivery of content, student-directed and student-initiated communication could be promoted by using the WB as a scaffold or support to communication, as was seen in the warm-up exercises. Using the tools in conjunction with each other in this way – for example, using the DM and/or WB in support of two-way audio – might encourage more frequent student-student interaction with the tools, and, possibly, more student oral/aural communication.

Conclusion

The types of interaction identified in this study provide insight into some of the ways in which tools can be used for synchronous communication in Web-based learning. To promote most effective use of the tools, the teacher and students must aim to maximize affordances and minimize constraints. Where we have relatively young learners, the onus may fall more on the teacher to promote effective use rather than on students. The teacher's decisions related to the choice of pedagogical activities and the assignment of privileges will play an important role in effective use of the tools so as to promote the types of interaction that will help achieve goals related to communication. As well, affordances and

constraints can be managed through simultaneous use of a number of tools in combination, such as when the teacher in this study supported oral communication using two-way audio by providing visual supports with the WB.

In spite of a teacher's or the students' best efforts to make effective use of the tools, the inherent constraints can only be minimized and compensated for in limited ways. If the goal is to engage in oral/aural communication, the teacher can adopt pedagogical strategies that will maximize opportunities for students to speak and hear. However, given the incapacity of a tool to allow for private, oral discussion or for more than one discussion to take place at a time, the students' and teacher's goal of communication may still not be easily met. As well, the lack of visual contact and supports that would allow the interlocutors to see gestures and other linguistic cues is not a constraint that can be easily compensated for and may require very creative and highly effective use of the tools. Teachers using synchronous tools for communication in Web-based learning may benefit from professional development opportunities that focus on maximizing affordances and minimize constraints of the synchronous tools through managing privileges, choice of pedagogical activities, and combined use of tools. Such opportunities might provide teachers with strategies, techniques, and resources designed to compensate for the constraints of the tools and to promote the types of interactions that will best support the achievement of communication goals.

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