

Appropriation of videoconferencing- mediated training in a large French company

□ Résumé

Le but de ce papier est d'étudier l'appropriation de la formation médiée par la visioconférence (VMT) dans une grande entreprise française. Les utilisations de deux systèmes de vidéoconférence (classe virtuelle et à classe distante) ont été comparées. Les dimensions de l'appropriation (modalités d'appropriation, usages instrumentaux, attitudes) et la satisfaction des utilisateurs ont été étudiées, à travers une enquête intégrant questionnaires et observation.

La recherche a révélé que les apprenants préfèrent la classe virtuelle à la classe distante. Leur motivation est associée en particulier à des gains opérationnels et à l'intérêt pour l'innovation. Nous avons souligné également que formateur préfère l'interactivité et le contrôle des interactions alors que les apprenants préfèrent les interactions entre pairs, notamment celles basées sur l'échange de bonnes pratiques.

Mots clefs :

Formation, appropriation, vidéoconférence, usages, TIC.

□ Abstract

The purpose of this paper is to explore the appropriation of the videoconferencing-mediated training (VMT) in a large French company. The uses of two videoconferencing systems (virtual class and remote class) were compared.

Dimensions of appropriation (appropriation moves, instrumental uses, attitudes) and users satisfaction were studied, using a survey and observation of videoconferencing.

The research found that learners preferred virtual class to remote class. Their motivation is associated especially to the operational gains and to interest for innovation. We highlighted also that trainer prefers to control interactivity and interactions whereas learners prefer interactions between peers, notably "best practice" interactions.

Key-words:

Training, appropriation, videoconferencing, ICT, uses.

1. Introduction

Information technologies' (IT) development has introduced new possibilities in the field of training, notably for distant training. In this context, videoconferencing appears to be a promising tool, as it enables us to cross-distances, whilst conserving possibilities of real time interaction between teachers and trainees.

Our study focuses on the appropriation of videoconferencing for training in a large French company.

This particular company counts 170,000 employees, which are situated in several locations. Professional training is provided in different locations and employees have to travel for participating in training sessions on specific topics. Each year, several millions hours are provided.

For company managers, videoconferencing may be considered as a way to reduce travels, time required for the organization of training sessions and to modernize company image for employees, while it provides interactions between the learners and the trainer like in a face-to-face training situation. Nevertheless, managers thought that employees would not agree with the use of videoconferencing or that they would not cope with this new technology. For this reason, they wanted to explore videoconferencing appropriation for the employees. They are interested on the experimentation of two environments of videoconferencing for training: virtual class (desktop videoconferencing) and remote class (where distant learners are gathered together in the same room, like in traditional class, while the trainer is situated at distance).

Consequently, the overall research question guiding this study was: what is the appropriation of the virtual class and of the remote class for professional training? This topic is little developed in the literature. However, the IT effects on the learning on the one hand and the effect of videoconferencing on the interaction on the other hand have been explored. In the following section, studies on these two topics are reviewed.

2. Literature review

2.1. IT and training

Several authors focus on the relationship between IT and learning. Their main question is if an IT is able to improve the learning performance, and how.

In this perspective, some authors showed that technology's capabilities emphasized learning performance (Alavi, 1994).

Others researchers showed that IT have not significant effect on learning performance (Russel, 1999), (Alavi,

1994). For example, Alavi *et al* (2002), found that the learning outcome of an e-mail environment was higher than the learning outcome of a more sophisticated Group Support System environment. Mehlenbacher *et al.* (2002), pointed out that there was no significant difference in student performance in the two learning situation (two web-based sections of a technical writing class and a conventional version of the class).

These last outcomes are in contradiction with the richness media theory (Daft *el. al.*, 1984). For Clark (1994), the learning effectiveness is enhanced by the instructional method and not by the technology itself.

According to Collins (1991), the instructional implementation of technology is the determination factor for learning effectiveness. In this direction, some authors showed the importance of the instructors' characteristics for increasing learning effectiveness: the instructor's positive attitude towards technology, the instructor's interactive teaching style and the instructor's control over the technology [Webster & Hackley, 1997] or the instructor's self-efficacy [Mathieu *et al.*, 1993).

Several authors have explored various factors concerning learners that emphasize the learning effectiveness in technology-mediated learning environments: collaboration among students, motivation and student characteristics like level of academic ability, motivation, degree of effort and maturity (Hiltz, 1993) or learning strategies (Mehlenbacher *et al.*, 2002).

The same mixed outcomes are issued from studies focusing on students' satisfaction, which is another aspect of the learning performance. Piccoli *et al.* (2001) found that students in a virtual learning environment reported significantly higher computer self-efficacy than those in a traditional classroom. In contrast, Alavi *et al.* (2002) noticed no significant difference in the students' satisfaction with the learning process under the two distributed learning environments (a "simple" environment and a more sophisticated environment). Benbunan-Fich and Hiltz (2003) were interested on another type of technology-mediated learning, the online courses. Their results suggested that there were non significant differences in the students' perceived learning associated with the delivery mode (totally online via asynchronous learning networks, traditional face-to-face courses, and sections using a mix of traditional and online activities).

Chiu *et al.* (2007) integrated the Information Systems success model and the fairness theory for highlighting variables that affect learners' satisfaction. They found that information quality, system quality, system use, distributive fairness and interactional fairness have significant positive effects on satisfaction.

Furthermore, other researchers highlighted the limits of virtual learning environments: the feeling of isolation (Brown, 1996), frustration, anxiety and confusion (Hara & Kling, 2000) as well as reduced interest in a subject matter (Maki *et al.*, 2000).

A few recent studies focus not only on the learning performance but also on the intention to continue a technology-mediated learning environment. Employing the Unified Theory of Acceptance and Use of Technology (UTAUT), Chiu and Wang (2008) showed that performance expectancy, effort expectancy, computer self-efficacy, attainment value, utility value and intrinsic value were significant predictors of individuals' intention to continue using Web-based learning, while anxiety exhibited a significant negative effect. These findings suggested the beneficial effect of positive subjective task value on stimulating learners' intention to continue using Web-based learning.

Nevertheless, no study focused on the program and university level of analysis.

2.2. Videoconferencing uses

The studies focusing on the use of IT have not concluded on the efficiency of a particular medium compared to other media. While some studies assert that videoconferencing is as effective as face-to-face interactions or more effective than audioconferencing (e.g. Valacich *et al.*, 1994), others assert that the videoconferencing has not significant effect (e.g. Alavi *et al.*, 1994 ; Dennis *et al.*, 1998). In contradiction to the media richness theory, researchers highlighted other factors than the technology's features that influenced the perception of the richness of the medium. This factors are: the exchange of social information, that became over leaner media as effective as richer media over a period of time (Walther, 1995); the familiarity with communications partners (e.g. Carlson & Zmud, 1999), the established norms and relationships among group members (McGrath, 1993).

Other factors than technology's features are more evident when the same technology is used in the same company. In this direction, Webster & Hackley (1997) found that the desktop videoconferencing system is used less than it would be according to their functions. Although all the employees are hesitant about allowing access to their periodic snapshots, they have different levels of uses. The authors explained this difference by the following factors: social influence, medium experience, job fit, desktop video self-efficacy and lower introversion.

Similar results are found in the field of education and training. For example, some researchers found that learning mediated by videoconferencing lead to a higher degree of interaction with the teacher, linked to a more efficient learning (Goodfellow, 1996) and to a

higher degree of collaboration between learners (Rutter, 1981 ; Sellen, 1995 ; Marquet & Nissen, 2003) than face-to-face learning. Nevertheless, other academics showed mixed results. O'Conaill *et al* (1993) showed that the interaction between the learners and the trainers is closer to the face-to-face one in a leaner videoconferencing system than in a richer videoconferencing system. Alavi *et al.* (1995) found that the three environments (face-to-face collaborative learning, local groups – students on the local campus – and non-proximate distant groups involved in Desktop Videoconferencing (DVC) are equally effective in terms of student knowledge acquisition. However, higher critical-thinking skills were found in the distant DVC environment. The students in the three environments were equally satisfied with their learning process and outcomes. The distant students using DVC were more committed and attracted to their groups compared to local students who worked face-to-face or through DVC. Comparing audioconferencing and desktop videoconferencing, Yoo and Alavi (2001) found that the influence of group cohesion (members' attraction to the group) over social presence is additive, rather than substitutive, to that of media condition.

In the same direction, other authors considered that videoconferencing, like other technical systems, is « neutral » and take part therefore in various uses (Clark, 1994 ; Collins, 1991).

Furthermore, the implementation of the videoconferencing is highly important. Webster and Hackley (1997) and Ologeanu (2005) suggested that the greater number of locations, the greater the process losses and the less involved the remote students appeared.

3. Research framework

Appropriation is one of the main concepts of the Adaptive Structuration Theory (AST), which considers that technologies are manipulated and structured by users in their contexts. Desanctis and Poole (1994) distinguish the spirit and the features of an IT. Spirit is defined like “*the official line that the technology presents to people regarding how to act when using the system, how to interpret its features, and how to fill in gaps in procedure which are not explicitly specified.*” (p. 126). Features are characteristics or technical functions of the technology.

There are four aspects of appropriation [16]:

- Appropriation moves,
- Faithfulness of appropriation (which means that appropriation may be faithful or unfaithful to the IT spirit),
- Instrumental uses, which are intended purposes that groups assign to technology as they use it (for example, task activities, use of the IT by a group member to increase his

power or to maintain social relationship among members, use of the IT by an individual purely for private reasons, use of the IT to play or to explore the technology),

- Attitudes that the group displays as technology structures are appropriated.

The concept of appropriation is focused on users perceptions and attitudes as on users behaviours during the IT implementation. Appropriations are “immediate, visible actions that evidence deeper structurations” (De Sanctis & Poole, 1994, p. 128). Thus, appropriations are synonymous of adaptations (Majchrzak et al., 2000). New technologies represent opportunities to change groups’ structures.

We suggest that in the specific domain of training, the instrumental purposes may be described like “pedagogical genders”. Pedagogical genders are communication genders (Yates & Orlikowski, 1992) or styles of interaction in a training situation. They are characterized by the pedagogical intention (what to teach ?) and by the pedagogical method (how to

teach ?) (Fallery, 2004). There are varies pedagogical genders like Courses, Talks, Examples, Demonstrations, Debates, Simulations, etc.

In the particular domain of training, appropriation moves may be linked to the possible changes of pedagogical and technical distances (Marquet & Nissen, 2003). The pedagogical distance focuses on the interactions and exchanges between peers and between learners and trainer. The technical distance is produced by technical mediation (as breakdowns or transmission cut). We may associate the pedagogical and technical distance to the satisfaction toward the videoconferencing (sound, video and transmission quality).

We decided to not study faithfulness of appropriation because in the experimentation stage of VMT the technology is “opened” and the spirit is not defined by company managers.

3. Methodology

Appropriation dimension	Definition	Method of data collection
Previous ITs’ experience	Previous knowledge and experience of TIC and distance training.	Survey
Appropriation moves	Related to VMT structures, group structures and task structures (technical and pedagogical distances).	Survey Observation of video-training sessions
Instrumental uses	Intended purposes or meaning that learners assign to VMT Pedagogical genders	Survey
Attitudes	Perceived value of IT for the work Comfort	Survey Observation of video-training sessions
Learners satisfaction	The extent to witch videoconferencing is evaluated on several dimensions: Sound Quality, Picture Quality, Quality of Slights legibility, Conditions of speak, Interaction to the trainer, Interaction with peers.	Survey

Table 1. Methodology *Appropriations dimensions and methods of data collection*

4.1. Context

The company that we studied counts around 170,000 employees, spread across the whole country. Managers wanted to explore learners’ and trainer’s perceptions, attitudes and uses about two types of training through videoconferencing: virtual class and distant class.

- In the virtual class, the learners and their teacher were situated in several locations and interacted through their

personal computers and a specific videoconferencing software.

- In the remote class, learners are gathered together in the same room and the trainer only is situated at distance.

4.2. Subjects

60 learners participated in the experiment. 19 one-hour videoconferencing sessions of training (7 sessions in virtual class involving 20 students and 10 session in

remote class involving 40 students) were carried out. The number of participants by session varied. They were 2, 3 or 4 learners for each virtual class session and they were between 3 and 6 participants for each remote class session.

The topic of these sessions was to provide professional skills for operating employees, in the commercial domain. These learners had been chosen by their line managers according to the same criteria as for the «traditional» training in the company. For all the sessions, the same trainer was involved in the experiment.

4.3. Measurement issues

In order to measure all the dimensions, we used two methods:

- Qualitative methods: focus group interview with learners, based on an interview guide, and observation of the video conferencing sessions. The purpose of this method was to measure appropriation moves,
- Quantitative methods, consisting of a survey combining open and closed items. A questionnaire combining 41 open and closed questions was administrated immediately after each session. The closed questions were designed according to the five-point Likert-scales.

Analyses of all measures were conducted using Sphinx software. We combined chi-square test to measure relationships between answers to closed questions and lexical analysis to treat the open answers and the focus group interviews.

Content analysis was employed to study observation accounts. We created a coding frame, based on the pedagogical genders.

Research framework and methodology is reflected in the table 1.

5. Main findings

5.1. The satisfaction toward the virtual class is higher than the satisfaction toward the remote class.

This result is driven from the Chi-square test crosses between types of environments of videoconferencing for training (Virtual/Distant) and on several aspects of the satisfaction variable.

The results of Chi-square test are as follows:

	Relationship
Sound quality x Type of VMT	Significant (X2 = 2.73, 1-p = 90,15%)
Video quality x Type of VMT	Significant (X2 = 2.28, 1-p = 86,90%)
Slight legibility quality x Type of VMT	No significant
Conditions of speak x Type of environment	Significant (X2=5.27, 1-p = 97,83%)
Interaction to the trainer x Type of VMT	Significant (chi2 = 3.67, 1-p = 94,47%)
Interactions with peers x Type of VMT	Significant (X2 = 6.83, 1-p = 99,10%)

Table 2. Satisfaction: Differences between virtual class and distant class

5.2. Learners' satisfaction factors are their previous IT experience and their interest in innovation.

Satisfaction crosses to...	Relationship
Previous IT experience	Significant (X2 = 4.45, 1-p = 96,50%)
Interest in innovation	Significant (x2 = 17.45, 1-p = >99,99%)

Table 3. Factors of satisfaction (X2 analysis)

Previous chi2 analysis was completed by lexical analysis of answers to an open question. The first question was: "If you are satisfied by the experience, which are your reasons?" The occurrences of each of the most-commonly used words in the responses are as follows: new (12), trainer (8), interactivity (4), topic (4), pleasant (4). We draw here a sample of texts containing the words that are frequently quoted:

INNOVATION INTERACTION – TRAINER
INNOVANT and fun
INNOVANT and PRACTICAL
INNOVANT and playful
INNOVANT – create a NEW atmosphere
NEWNESS
NEW technologies

Table 4. Factors of satisfaction: sample of lexical analysis

This interest for innovation is an instrumental use that learners assigned to VMT (fun and exploratory purpose).

5.3. Learners in virtual class reported more positive attitudes to VMT than learners in remote class.

This result is derived from the Chi-square test crosses between types of videoconferencing environments for training (Virtual/Distant) and from several aspects of the perceived usefulness variable.

Perceived usefulness	Relationship
Training through videoconferencing contribute to decrease the professional training travels in the future x Type of VMT	Significant (chi2 = 2.83, 1-p = 90,75%)
Training through videoconferencing is more efficient than face-to-face training x Type of VMT	Significant (X2 = 3.07, 1-p = 92,04%)
Training through videoconferencing brings an additional interest in training comparing to face-to-face training x Type of VMT	Significant (X2 = 4.16, 1-p = 95,85%)
Interactions with peers are more frequent in training through videoconferencing than in face-to-face training x Type of VMT	Significant (X2 = 6.83, 1-p = 99,10%)
Training through videoconferencing is adequate to skills training in the company x Type of VMT	Significant (X2 = 5.30, 1-p = 97,87%)

Table 5. Learners' attitudes: Differences between virtual class and remote class

Moreover, learners reported high motivation for real operational gains. This result is based on lexical analysis of responses to two open questions:

Question	Occurrence of the most-commonly used words
According to you, what are the main interests in training via video conferencing	Time (13), No Travel (21), Gain (7).
For you, what are the advantages in videotraining ?	Time (5), #Teacher (6), Gain (4), No travel (7)

Table 6. Operational gains: sample of lexical analysis

5.4. Trainer prefers to control interactivity and interactions whereas learners prefer interactions between peers, notably “best practice” interactions.

This result is issued from systematic observations of VTM sessions and focus group interview with learners.

We may say that teacher preferred a specific pedagogical gender (transmissive courses) while learners preferred another one (exchanges between

peers). In the virtual class, learners did not discuss and interact with each other spontaneously while in the remote class they tend to discuss between them about the best practices in their day-to-day tasks and to exclude teacher from the debate. For this reason, the teacher reported the preference for the virtual class, which did not allow discussions between learners like in face-to-face class.

Therefore, intended purposes were different form learners and trainer.

5.5. Learners did not report a technical distance, although this distance did exist.

This result is issued from technical distance evaluation by the learners, from the systematic observations of the video conferencing sessions and from focus group interview with learners based on an interview guide. Thus, we observed several problems as follows: in virtual class, the remote learners hearing their own voice coming back at them; a howling created by feedback or a strong reverberation. Both in virtual and in remote classes, we observed that that bandwidth fluctuated during the videoconferencing session, that introduced sound delay, video blackouts or image flickers. Nevertheless, learners did cope with these technical problems and they reported a high level of satisfaction for the technical features.

6. Discussion and limitations

The main result of our study is that learners in virtual class reported higher satisfaction and higher intention to continue using videoconferencing than learners in remote class. This result contradicts media richness theory according to which “rich” media (defined by their ability to change understanding within a time interval – Daft & Lengel, 1984) are generally more effective and more suitable for ambiguous and uncertain tasks than “lean” media. In our study, the rich medium is the remote class (which allows interactions between learners like in face-to-face training) and the lean medium is the virtual class.

Nevertheless, our finding joins mixed outcomes about the influence of IT on the learning performance or on the learning satisfaction (Russell, 1999); (Mehlenbacher, 2002); (Piccoli et al., 2001); [Alai & Leidner, 2001]; (Benbunan-Fich & Hiltz, 2003).

How explain this result? We may link it with the other results: one factor of satisfaction for learners is their interest in innovation and learners in virtual class reported significantly higher perceived usefulness than

learners in the remote class. The virtual class offers more operational gains (decrease in travel, possibility to learn on the workplace) and then it appears more innovative. It is possible that learners consider virtual class being an original situation that they don't need to compare to face-to-face training, in contrast with the remote class, that is at the same time closer and far off than face-to-face learning. This possibility means that learners' perception of rich media is different from the "objective" richness of media according to the theory. That hypothesis must be verified by further research.

All the findings should be considered in the light of three limitations.

The major limitation of the study is due to the limited sample and the probability value is lower than the probability values currently accepted for statistical tests. For this reason, we may consider our study as an exploratory research that requires a new stage of the experiment using a larger sample. Another limitation is due to the experimental simulation of the distance, it is probable that the effects of the distance were made lesser, notably the effects in socio-technical terms (technical support) and in organizational terms. The experimental controls were less stringent than under laboratory conditions. Finally, our study focuses on the first stage before the videoconferencing implementation. At this experimental stage, the learners' motivation and their acceptable quality level of the videoconferencing tool may be linked to their motivation for the innovation or for trying a new tool. It is possible that, in the implementation process, the learners' perceptions and satisfaction were more mixed, as this process emphasizes the efforts and the risk of videoconferencing for professional training in the organization. This kind of outcomes is treated in the literature. For example, Chu and Robey (2008) showed that the use of an online learning system in a Taiwanese hospital declined in the period following implementation. It is possible that this limitation may be avoided by a longitudinal study, which is another objective for further research.

7. Implications for practice and conclusion

Our results have managerial, theoretical and methodological implications.

First, we showed that learners and trainer prefer the virtual class rather than the more traditional remote class. This is the environment that managers have to choose if they want to take into account users' perceptions and attitudes. Furthermore, managers have

to seek if the training purposes are conformed to the employees' needs of training.

Secondly, our observations showed that learners were able to cope with technological difficulties. The gap between the technical distance and the acceptable quality level of the videoconferencing tool suggests that company managers do not need to invest a lot of money for buying expensive videoconferencing systems that provide higher quality. If barriers to the videoconferencing implementation exist, they are not related to the technical quality of the system.

Third, learners reported a preference for interactivity between peers whereas trainer reported a preference for controlling all interactions with and between the learners. For this reason, managers have to seek if the training purposes are conformed to the employees' needs of training.

Concerning the methodological implication of our study, we showed that is very important to explore learners' and trainer's perceptions, attitudes and uses before the implementation of a new information technology within an organization. The experimentation of an IT is a key stage of the innovation process. Furthermore, several types of IT (e.g. several videoconferencing situations) have to be compared and experimented in order to choose the tool which may fit also the task and group structures.

Last, but not least, our research has two main theoretical implications. Our findings contradicted the media richness theory, according to which the remote class, which is the "richer" medium in our research, should have been preferred.

8. References

- Alavi, M. (1994), "Computer-mediated collaborative learning: An empirical Evaluation", *MIS Quarterly*, Vol. 18, n° 2, pp. 159-174.
- Alavi, M., & Leidner, D. (2001), "Research commentary: Technology-mediated Learning — A call for greater depth and breadth of research", *Information Systems Research*, Vol. 12 n° 1, pp. 1-10.
- Alavi, M., Marakas G. M., & Yoo, Y. (2002), "A comparative study of distributed learning environments on learning outcomes", *Information Systems Research*, Vol. 13, n° 4, pp. 404-415.
- Alavi M., Wheeler, B. C., & Valacich, J. S. (1995). "Using IT to reengineer business education: an exploratory investigation of collaborative telelearning", *MIS Quarterly*, Vol. 19, n° 3, pp. 293-312.
- Benbunan-Fich R., & Hiltz, S. R. (2003), "Mediators of the effectiveness of online courses," *IEEE Transactions*

on *Professional Communication*, Vol. 46 n° 4, pp. 298-312.

Briggs, R. O., & De Vreede G. J. (2003), "Special Issue: Information Systems Success, *Journal of Management Information Systems*, Vol. 19, n° 4, pp. 5-8.

Brown, K. M. (1996), "The role of internal and external factors in the discontinuation of off-campus students", *Distance Education*, Vol. 1, n° 1, pp. 44-71.

Carlson J. R., & Zmud, R. W. (1999), "Channel Expansion Theory and the Experiential Nature of media Richness Perceptions", *Academy of Management Journal*, Vol. 42 n° 2, pp. 153-170.

Chu, T.-H., & Robey, D. (2008), "Explaining changes in learning and work practice following the adoption of online learning: a human agency perspective", *European Journal of Information Systems*, Vol. 17 n° 1, Basingstoke, pp. 79-98.

Chiu C.-M., Chiu C.-S., & Chang H.-C. (2007), "Examining the integrated influence of fairness and quality on learners' satisfaction and Web-based learning continuance intention", *Information Systems Journal*, Vol. 17, n° 3, 271-286.

Chiu, C.-M., & Wang, E. T. G (2008), "Understanding Web-based learning continuance intention: The role of subjective task value", *Information and Management*, Vol. 45, n° 3, 194-201.

Clark R., E. (1994), "Media will never influence learning", *Educational Technology Research and Development*, Vol. 42 n° 2, pp. 21-29.

Collins, B. (1991), "Anticipating the impact of multimedia in education: lessons from the literature", *Computers in Adult Education and Training*, n° 2, pp. 136-145.

Daft, R. L., & Lengel, R. H. (1984), "Information richness: a new approach to managerial behavior and organizational design", In Cummings, L.L. & Staw, B.M. (Eds.), *Research in organizational behavior* (pp. 191-233), JAI Press, Homewood.

Dennis A.R., Valacich J. S, & Kinney (1998), "Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality", *Information Systems Research*, Vol.9 n° 3, pp. 256-274.

DeSanctis, P., & Poole, M. (1994), "Capturing the complexity in advanced technology use: Adaptative structuration theory", *Organization Science*, Vol. 5 n° 2, pp. 121-146.

Fallery, B. (2004), "Three visions of open learning and theirs propositions of norms : contents standardisation, tasks standardisation or interface standardisation?", *Systèmes d'Information et Management*, Vol. 9 n° 4, pp. 2-24.

Goodfellow, R. (1996), "Face to face language learning at a distance? A study of a videoconference try-out", *ReCALL*, Vol. 7, n°1, pp. 20-35.

Goodhue, D. L. and Thompson, R. L. (1995), "Task-Technology Fit and Individual Performance", *MIS Quarterly*, Vol. 19, n° 2, pp. 213-236.

Hara, N., & Kling R. (2000), "Students' distress with a web-based distance education course: an ethnographic study of participants' experiences", *Information, Communication and Society*, Vol. 3 n° 4, pp. 557-579.

Hiltz, S. R. (1993), *The virtual classroom: Learning without limits via computer network*, Ablex Publishing Corporation, Norwood.

Majchrzak, A., Rice, R. E., & Malhotra, A. (2000). Technology adaptation: the case of a computer-supported virtual team. *MIS Quarterly*, Vol. 24, n° 4, pp. 569-600.

Maki, R. H., Maki, W. S., Patterson, M., & Whittaker, P. D (2000), "Evaluation of a web-based introductory psychology course: I. Learning and Satisfaction in On-line Versus Lecture Courses", *Behaviour Research Methods, Instruments and Computers*, Vol. 32, n° 2, pp. 230-239.

Mathieu, J. E., Martineau, J. W. & Tannenbaum, S. I. (1993), "Individual and situational influences on the development of self-efficacy : implications for training effectiveness", *Personal Psychology*, Vol. 46, n° 1, pp. 125-147.

McGrath, J. E., Arrow H., Gruenfeld, D .H., Hollingshead A. B., & O'Connor, K. M. (1993), "Groups, Tasks and Technology: The Effects of Experience and Change", *Small Group Research*, n°24, pp. 406-420.

Mehlenbacher, B., Miller, C.R., Covington, D. & Larsen, J.S. (2002), "Active and interactive learning online: a comparison of Web-based and conventional writing classes", *Professional Communication, IEEE Transactions on Professional Communication*, Vol. 43, n° 2, pp. 166 – 184.

O'Conaill, B., Whittaker, S., & Wilbur, S. (1993), "Conversation over video conferences: an evaluation of the spoken aspects of video-mediated communication", *Human-Computer Interaction*, n° 8, pp. 389-428.

Ologeanu, R. (2005), "Videoconferencing experiments and uses in French higher education", *Distances et savoirs*, Vol. 3, n° 1, Hermès-Lavoisier, pp. 11-28.

Piccoli G, Ahmad R., & Blake Y. (2001), "Web-Based Virtual Learning Environments: A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training", *MIS Quarterly*, Vol. 25, n° 4, pp. 401-426.

Russell, T. L. (1999), *The Non Significance Difference Phenomenon*, North Carolina State University Press, Raleigh.

Rutter, D. R. (1984), "Looking and seeing. The role of visual communication in social interaction", Chichester, Wiley.

Sellen, A. J. (1995), "Remote conversations: the effects of mediating talk with technology", *Human-Computer Interaction*, n° 10, pp. 401-444.

Valacich, J.S., Mennecke, B.E., Watcher, R.M., & Wheeler, B.C. (1994), "Extensions to Media Richness Theory: A Test of the Task-Media Fit Hypothesis", *Proceedings of the Hawaii International Conference on Systems Science*, Maui HI, pp. 11-20.

Walther, J. B. (1995), "Relational Aspects of Computer-Mediated Communication: Experimental Observations Over Time", *Organization Science*, Vol. 6, n° 2, pp. 186-203.

Webster, B., & Hackley, P. (1997), "Teaching effectiveness in Technology-mediated Distance Learning", *Academy of Management Review*, Vol. 40, n° (6), pp. 1282-1309.

Yates, J., & Orlikowski, W. J (1992), "Genres of Organizational Communication: A structural approach to studying communication and media", *Academy of Management Review*, Vol. 1, n°7, pp. 299-326.

Yoo, Y., & Alavi, M. (2001), "Media and group cohesion: Relative influences on social presences, task participation, and group consensus", *MIS Quarterly*, Vol. 25, n°3, pp. 371-390.