Evaluation of distance learning systems

to be included in the TeleRegions Report

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1. Indicators for evaluation of distance learning systems

1.1 Introduction

Studies on distance learning and communication are mostly based on the program rather than on theories or experiments. Researchers are more interested in designing new products than in evaluating their efficiency on a theoretical and/or experimental basis. We will describe some experimental studies in the field of CMC, CSCW and distance learning. Their goal is to measure the comparative effects of various factors. They are grouped together according to the following well-known distinction between context, process and product. The major result of these studies is that using new medias does not have a significant effect on communication or learning.

First of all, we will briefly define some terms:

• CMC (Computer-Mediated Communication): asynchronous communication between computers like electronic mail.

• CSCW (Computer-Supported Cooperative Work): a kind of CMC centered on collaborative tasks performed by groups of people.

1.2 Characteristics of context studies

Studies on context are concerned with the preactive teaching, for instance: course planning, students' features, materials, etc. We found two studies about context: Bajtelsmit (1990) compares a distance lecture and a traditional lecture about life

insurance. A questionnaire about anxiety level was given to the students. The author pointed out that the anxiety had an effect on the achievement. A similar experiment was designed by Parker (1995) in the domain of English and sociology. He measured the success ratio according to some students' personal features like locus of control. He showed that the students' locus of control and richness are correlated with course failure.

1.3. Characteristics of process studies

The process studies are centered on the characteristics of teacher-student interactions. We only found a few interpersonal communication studies in a teaching context. Most of them were in a context of working meetings. Anderson et al. (1996) made an CSCW experiment on travel planning. They compared face-to-face situations versus voice-only versus videoconference. They conclued that turn-takings were shorter and decision-making was more frequent in face-to-face. Except that, there were no differences between groups. O'Connaill et al. (1993) showed that even in a videoconferencing system with optimal video quality and negligible delays, the conversation parameters differ from a face-to-face dialog. Contrary to the authors' expectations, formal techniques are used to achieve speaker switching: there are fewer interruptions and overlaps and longer conversational turns. This distortion of the conversation may affect teacher-students interactions.

1.4 Characteristics of product studies

These studies are evaluative and achievement-centered. Galegher and Kraut (1990) were interested in CMC document writing. They compared face-to-face groups versus CMC groups and they measured the quality of the production and the students' judgements. They found that the media does not affect the quality of production but rather the students' judgement on the task, which seems to be easier in face-to-face. Seigel et Davis (1990) compared a TV-course versus a traditional course in engineering. No significant differences on achievement were found between the two groups.

1.5 Discussion

It seems that, at the current stage of research, no significant effect could be attributed to mediated distance learning. However, through these studies were found interesting paths of work, especially about the teacher's discourse, the teacher-student and the

student-student communication, the pre-conception the students have about the media, etc...

2. Experiment 1: comparative morphosyntactic analysis of the teacher's discourse (present or distant)

2.1 Introduction

Recent innovations in technology have expanded distance education opportunities. Besides the technical aspects, it is important to study the consequences of these new ways of teaching on the teacher's activity.

In the university of Grenoble, France, a college-level course in economics is given by the same teacher in two different ways:

— the first one is a 3-hours traditional lecture;

— the second one is a 2-hours live distance lecture to students located in Valence, a town situated 60 miles from Grenoble.

A software called TéléPresentation™ transmits the teacher voice as well as predefined slides on a numerical line. The teacher is in Grenoble, he wears headphones and a microphone and he controls the slides switching from his computer. He does not see the students. In Valence, students watch a TV screen showing the slides and listen to the teacher's voice. There is a microphone in their room for them to ask questions whenever they want.

This device is much cheaper than usual videoconference and it is interesting to compare a distance lecture using that system to a traditional lecture. After a few weeks observing these lectures, we had the strong intuition that the distance lecture was much denser and more authoritative than the traditional one. This hypothesis needed to be confirmed by comparing both situations through an observation.

Our goal is to perform a comparative study of traditional and distance lecture.

2.2 Justification of the Method Used for Analysing the Teacher's Discourse

There are several methods for analysing texts. Some of them are purely descriptive whereas others are more predictive. In particular, some try to relate the conditions under which a text is produced to its content. Our goal was not just to express differences

between two teachers' discourses but also to relate them to the underlying cognitive processes. We wanted to know more about the teacher's cognitive activity.

One of these methods has the advantage of relying on a cognitive model of discourse production. This method was designed by Bronckart et al. (1985). Another argument in favour of this method is that, for some reasons, we could not collect discourses on the exact same content (working on the same content would have anyway introduced an experimental bias since the preparation of slides by the teacher for the distance lecture would have affected the structure of his traditional lecture). We could not then perform a semantic analysis and we had to fall back on a morpho-syntactic analysis of the texts.

2.3. Bronckart's Method

The main goal of Bronckart and his colleagues is to link the occurrence of morpho-syntactic units in texts with the conditions under which they were produced. They defined 3 situations: situated discourses (theatre dialogs, oral dialogs), narrations (novels, tales) and theoretical discourses (scientific texts). The hypothesis is that these different conditions will affect the cognitive processes of the speaker, therefore leading him to choose such modal auxiliary, such verb tense, such connective to express his ideas. For each situation, Bronckart's model predicts the occurrence of 27 such linguistic units. The model also provides an explanation for these values.

For instance, a theoretical situation will lead the speaker to structure his discourse, therefore using more argumentative connectives such as nevertheless, since, therefore, etc. On the other hand, a situated discourse will contain a great proportion of pronouns of the first and second person because of the live presence of participants in the dialog. In order to test the relevance of this model, Bronckart et al. calculated for 150 texts, 50 of each category, the number of occurrences for 27 units. A discriminant analysis showed that these 27 units were sufficient to discriminate all the texts. In other words, given a text, the method can predict its type (situated discourse, narration, theoretical discourse). Therefore, it can suggest the cognitive operations which governed the text production.

Using this model, we will be able to characterize the distance lecture with respect to the archetypal texts. For instance, is it more of a theoretical discourse, or a situated discourse? Afterwards, the values for each of the 27 units will give us indications on the discourse itself as well as on the underlying cognitive processes.

2.4 Methodology

For each lecture, we recorded the teacher's discourse. Out of the 3 hours of traditional lecture and 2 hours of distance lecture, we picked 10 minutes of each teacher's discourse. We got 2 texts of approximately 1000 words each in which we counted the occurrence of each of the 27 units.

2.5 Results

Applying the counting of the linguistic units for each text [see Tab. 1] to the results of Bronckart's discriminant analysis allowed us to calculate coordinates for each discourse and to place them in a plane beside the 150 texts Bronckart analysed. It appeared that our 2 discourses were within the scatterplot of the theoretical texts. Therefore, the model cannot explain globally the differences that exist between the two lectures. However, specific values for each linguistic unit gave us indications on the nature of the discourses.

Linguistic units	Traditional lecture	Distance lecture
1 — Pronoun/adj. 1st person singular	14	25
2 — Pronoun/adj. 1st person plural	2	1
3 — Pronoun/adj. 2nd person singular	0	0
4 — Pronoun/adj. 2nd person plural	7	11
5 — Indefinite pronoun "on"	18	11
6 — Present tense	72	58.1
7 — Futur tense	25	22.1
8 — Perfect tense	2	8.1
9 — Imperfect tense	0	8.1
10 — Preterit tense	0	0
11 — Conditional tense	1	3.5
12 — Temporal deictic	0	0
13 — Auxiliary "aller" (to be going to)	12	20.9
14 — Aspect auxiliary	0	0
15 — Modal auxiliary	13	5.8
16 — Auxiliary "pouvoir" (can)	6	9.3
17 — Passive form	1	4.7
18 — Emphatic form	1	8.1
19 — Non declarative sentence	12	4.7
20 — Temporal organizer	0	2
21 — Argumentative lex.synt. organizer	7	19
22 — Textual argumentative organizer	N/O	N/O
23 — Utterance modality	2	3
24 — Pronominal anaphora	11	26
25 — Non pronominal anaphora	2	1
26 — Verbal density	0.9	0.08
27 — Syntagmatic density	0.48	0.42

Note. Bronckart's method works on French texts. We have translated the linguistic units but the reader should be aware that there is not a one-to-one mapping between French categories and English categories. There are some decimal numbers in the second column because of an adjustment to the same number of verbs as in the first column.

Table 1: Occurrences of the 27 linguistic unit in each discourse.

2.6 Discussion

Results indicate that the teacher's discourse for distance students is much more structured and denser. For instance, the occurrence of linguistic units such as argumentative organizers or pronominal anaphora, which are both indications of structure and coherence, is greater in the distance lecture. This can be explained by the fact that the teacher had to design the slides beforehand which had forced him to prepare in very details the lecture content.

Another reason is that since the communication has been restricted to its digital side, the teacher do not get signs that would have revealed students failing to keep up (eyes on neighbour, frowns, etc.) Therefore the teacher cannot adapt his discourse and confine himself in what was prepared. His discourse is then very authoritative.

In a time of proliferation of distance education projects, these results seem important to us. In particular, the higher students' cognitive load a well as the greater teacher's planning activity should probably imply modifications on the duration of classes within a day as well as the total duration over a semester.

2.7 Towards a New Model for Studying Teachers' Discourses

As we said before, Bronckart's model is inadequate to discriminate globally the distance lecture from the traditional lecture. It would be interesting however to have a model that would characterize a pedagogical discourse on different media: book, computer, TV, videoconference, face-to-face, etc. For that reason, we decided to design the premises of a new model. The goal is to identify a set of morpho-syntactic units that would discriminate, at the beginning, our distance lecture from our traditional lecture. We saw that the important task of designing slides beforehand should result in a structured and coherent discourse. This hypothesis will lead us to look for linguistic units revealing this course planning activity.

We identified the following units:

1) *Number of intra-textual connectives*: subordinating conjunctions, coordinating conjunctions followed by a verb and other locutions linking up phrases: if, then, because, etc. All these elements reveal the discourse structure.

2) *Sentence mean length*: an indicator of the discourse planning (we used the following criteria for determining a sentence: a period is put every time two independent propositions can be cut without altering the syntax).

3) *Delivery*: in words per minute. It is also a symptom of the mastery of the discourse.

4) *Syntactic correctness rate*: defined as the ratio between the number of sentences

syntactically correct and the total number of sentences. This measure reveals a planning task prior to the course.

5) *Number of redundancies:* defined as the local repetition of a word or a group of words that do not provide additional information. A redundancy reveals a low planning but is also a natural way of trying to "rescue" students who would have temporarily failed to keep up. Therefore, the number of redundancies is expected to be higher in the traditional lecture.

6) *Mean sentence interweaving level*: calculated from the maximal level of proposition interweaving for each sentence. This is also an indication of the mastery of the discourse content.

We also added 4 of Bronckart's criteria. The following should characterize the live discourse:

7) *Number of modal auxiliaries*: indication of the action of the speaker on the hearer.

8) *Number of non declarative sentences*: for the same reasons.

On the other hand, the following criteria should characterize the mediatised discourse:

9) *Number of lexico-syntactic argumentative organizers* whose goal is to organize the discourse by means of textual markers.

10) *Number of non pronominal anaphoras* which contribute to the text coherence.

These 10 elements should discriminate the mediatised discourse from the live discourse. According to our hypothesis, we expect the values of items 1, 2, 3, 4, 6, 9 and 10 to be lower in the live discourse and values of items 5, 7 and 8 to be higher. Table 2 shows the results on our discourses.

Linguistic units	Traditional lecture	Distance lecture
1 — Intra-textual connective	58	51
2 — Mean sentence length	20.2	26.8
3 — Delivery	102.9	107.1
4 — Syntactic correctness rate	78.4	80.0
5 — Redundancy	18.5	12.1
6 — Mean sentence interweaving level	1.6	1.8
7 — Modal auxiliary	13	5.8
8 — Non declarative sentence	12	4.7
9 — Lex.-synt. arg. organizer	7	19
10 — Pronominal anaphora	11	26

Table 2: Occurrences of linguistic units in our new model.

Except for item 1, this analysis seems to confirm our hypothesis that the traditional lecture and the distance lecture are inherently different. A χ^2 test on items 1, 5, 7, 8, 9

and 10 indicates a significant difference ($\chi^2 = 23.04$, $p < .01$). However, this rough draft of a model should be tested on a lot of discourse in order to be validated. This will be part of our future work.

3. Experiment 2: Morphosyntactic, lexical and pragmatic aspects of teacher's discourse (present or distant)

This experiment is similar to the previous one, except that, in the traditional lecture, the teacher was provided with the same device as in the distance lecture, in order to have two similar teaching materials.

The teacher's discourse was fully retranscripted in order to analyse the following features and compare the two texts:

• lexical analysis: we performed a lexical processing of each of the two texts to get words on their canonical form (no plural, no conjugation, etc.). We plan to measure the lexical richness of each text.

• morphosyntactic analysis: we plan to perform an analysis similar to the one described in section 2.

• pragmatic analysis: we categorize the speech acts of each text according to the Searle's theory.

4. Experiment 3: Students learning achievement (distance versus presence)

With a similar context, we plan to measure student's learning achievement. Several tests will be passed to students :

• immediate and long-term recall of lecture notions,

• recognition of lecture notions,

• problem-solving.

5. Discussion

Although several results were pointed out, a lot of work remains to be done: a link between students' learning and teacher's discourse, more accurate tests, other contents for the lectures, other teachers in the same content, students' behaviours.

However, some theorists like Clark and Salomon claim that the media is not the more important thing in teaching (cf. section 1). In the future, it will important to design situations in which significant effects could be observed.

6. Bibliography

ANDERSON A. H., NEWLANDS A., MULLIN J., FLEMING A. M., DOHERTY-SNEDDON G. & VAN DER VELDEN J., « Impact of video-mediated communication on simulated service encounters », *Interaction with Computers*, *8, n° 2*, 1996, p. 193-206.

BRONCKART J.-P., *Le fonctionnement des discours*, Delachaux et Niestlé, 1985.

CLARK R. E., « Reconsidering research on learning from media », *Review of Educational Research, 53, n° 4*, 1983, p. 445-459.

CLARK R. E., « Media will never influence learning », *Educational Technology Research and Development, 42, n° 2*, 1994, p. 21-29.

GALEGHER J. & KRAUT R. E., « Computer-mediated communication for intellectual teamwork : a field experiment in group writing », in J. TURNER & R. E. KRAUT (Eds.), *Proc. CSCW'90*, A.C.M., 1990, p. 65-78.

LEMAIRE B., MARQUET P. & BAILLÉ J., « Comparative analysis of teacher's discourse and students' behaviour in traditional and distance lectures », in P. CARLSON & F. MAKEDON (Eds.), *Proceedings of the World Conference on Educational Telecommunications (ED-TELECOM 96)*, AACE, 1996, p. 167-172.

O'CONAILL B. & WHITTAKER S., « Conversations over video conferences : an evaluation of the spoken aspects of video-mediated communication », *Human-Computer interaction, n° 8*, 1993, p. 289-428.

SALOMON G., « Television is "easy" and print is "tough" : the differential investment of mental effort in learning as a function of perceptions and attributions », *Journal of Educational Psychology, 76, n° 4*, 1984, p. 647-658.

SALOMON G. & CLARK R. E., « Reexamining the methodology of research on media an technology in education », *Review of Educational Research, 47, n° 1*, 1977, p. 99-120.

SEARLE J., *Sens et expression*, Minuit, 1982.

SEIGEL A. E. & DAVIS C., « Delivering undergraduate engineering courses on television : how do grades compare ? », in N. ESTES, J. HEENE & D. LECLERCQ (Eds.), *Proceedings of the 7th International conference on Technology and Education, Vol. 1*, 1990, p. 165-167.