STUDYING COMPLEX PROCESSES

OBSERVATIONS FOR RESEARCHERS & LEARNERS

Keynote EARLI Conference 2003,
August 26-30, Padua, Italy

GERT RIJLAARSDAM*/**,
MARTINE BRAAKSMA*, MICHEL COUZIJN*,
TANJA JANSSEN*, MARLEEN KIEFT*
& HUUB VAN DEN BERGH**

Graduate School of Teaching and Learning, University of Amsterdam, the Netherlands,
***Utrecht Institute of Linguistics, Utrecht University, the Netherlands*

THIS IS A PAPER PREPARED TO PRESENT RESEARCH. PLEASE DO NOT QUOTE. A FULL PAPER WILL BE SUBMITTED TO L1-EDUCATIONAL STUDIES IN LANGUAGE AND LITERATURE. FOR MORE INFORMATION RIJLAARS@ILO.UVA.NL

Abstract. The study of writing processes now has a tradition of about 30 years. In this presentation, we will show highlights from our studies, applying think aloud protocols in two ways. We use them to study effective processes in students in secondary education, in two domains: writing argumentative texts, and interpreting literary texts. Research questions are: to what extent do processes differ in different circumstances (for instance: writing in L1 and writing in L2), and: to what extent are these differences related to the quality of the result (text quality, quality of interpretation). The other way we use think aloud protocols is in designing teaching sequences. Especially when being introduced to new tasks, students seem to learn more from observing other students (listening or viewing audio- or videotaped processes of peers) than from executing these tasks themselves.

1. INTRODUCTION

Dear colleagues,

In the next 45 minutes, I will present you some studies we undertook during the last ten years or so with our research team.

Slide Team

The focus will be on the study of complex processes, viewed from two perspectives. The first is using think aloud studies to get insight into the complexity of the process of writing in secondary school students.

Slide Processes

Think aloud protocols are surely not the only way to approach the complexity of writing processes, but using this methodology and adequate statistical analyses we learned a lot, although we raised more questions than answers. When I prepared this presentation, I also planned to pay some attention to another complex cognitive activity we are studying now – the process of reading and interpreting literary texts in upper secondary – but it emerged that I was creating a lack of time, and therefore I refer you to the three symposia about Interpreting Literary Texts Tanja Janssen and I organized in this conference.

The second perspective on using protocols is the use of certain kinds of protocols in education. The complexity of writing processes and the individual differences in writing processes, make it difficult, but not impossible, to teach writing. We claim that observation can be an effective learning activity. Observation of writers, readers and learners should contribute to the student paying more attention to learning-to-write, instead of producing writing only.

PART 1: LESSONS FROM STUDYING WRITING PROCESSES

DURATION: 10 MINUTES

1.1 General approach

In our studies on writing processes, we try to tap processes via think aloud protocols. All studies are targeting at students of 9th grade, aged about 15 years old. They write two persuasive essays, on two different occasions, using some articles and clippings we provide them with. Themes to write about are issues like "Homework: useful or useless?" and "My future: to live alone or together?" The duration of each session is 60 to 90 minutes. Then we type out the protocols, code them for cognitive activities, and we collect ratings for the quality of the text students wrote.

I will present five lessons we learned from these studies, in ten minutes

LESSON 1: PROCESSES CAN PREDICT QUALITY OF PRODUCTS

An important discovery was that we could reliably predict the resulting text quality score from the cognitive processes. The correlation between the observed quality scores and the predicted quality score was .87.

LESSON 2: COGNITIVE ACTIVITES ARE NOT DISTRIBUTED RANDOMLY

Even more important was the discovery that for a good prediction, we had to add the factor time to the analysis. That is, the contribution of cognitive activities to the resulting text quality was not constant:

SLIDE

here we really got insight into writing processes, being dynamically changing configurations of cognitive activities.

(See Sheet for an overview of the results).

From this table we learn that the contribution of cognitive activities to the quality of texts varies over process time. One cognitive activity, like Structuring ideas, can contribute positively in one phase of the process and negatively in another phase.
This figure also reveals how important it is to add the factor 'time' into the analysis of writing processes: if we did not do that, effects of 'Reading the assignment' and 'Structuring' would *not* have been observed, because of inverse effects in different phases of the writing process.

The third discovery was that

SLIDE

ONE AND THE SAME COGNITIVE ACTIVITY CAN FULFILL DIFFERENT FUNCTIONS DEPENDING ON THE CONTEXT (RELATION WITH OTHER ACTIVITIES)

When we code protocol fragments, we code them as manifestations of cognitive activities, adapted from the Hayes & Flower models of writing processes. We do not take into account that these actions can fulfill different functions. But we should. The function of Rereading already written texts for instance, is bound to the function of reviewing in the Hayes&Flower model. But from protocols we learned that many writers use rereading already written text as a springboard for generating ideas.

If we depict the course of development of Generating then this figure emerge for 20 writers.

SLIDE

The individual patterns differ: some start with a relatively high number of generating activities, other with a low number.

The next step is to see how processes are related with the resulting text quality.

SLIDE

The picture is clear. Generating in the beginning is related to low quality texts; Writers who generated relatively often at the beginning wrote weak texts; writers who gradually increased the number of generating activities wrote the best texts[1].

But this correlation between generating and text quality changes dramatically if rereading is accounted for.

SLIDE

It thus seems that the occurrence of rereading is related to the occurrence of generating. Rereading serves generating activities. It seems that Rereading compensates for generating: the effect of generating on the quality of text is masked by rereading. Rereading already written text seems to be a support strategy for writers not very good in generating.

Case two: Generating. Another route in research to find functional relations is to connect cognitive activities with preceding activities. For this reason we went looking for functional relations between several other cognitive activities and generating.

[1] *Note that if time were left out in our analyses, the net result would have been a correlation of about zero.*

Here we distinguish five types of generation.

SLIDE

We based our typology of generating ideas on the cognitive activity that preceded the generating activity itself, if the preceding activity triggers the generation activity.

SLIDE

This slide shows that different combinations with generating contribute differently to text quality, that the patterns of contribution change over time, and that these patterns of change vary for the various combinations. This picture shows that a distinction between these types of generation of ideas is warranted, or, in other words, we have to take into account in what kind of context the activity of Generation is employed.

Time Part I: 6.43

SLIDE

LESSON 4: CONFIGURATION OF ACTIVITIES IS PARTLY TASK DEPENDENT

What we try to figure out, is how stable processes are within young writers, and what the differences are when they have to cope with new, difficult tasks. Now that within the European Union, all students shall learn at least one foreign language, one of the important questions is how learners apply that they got used to in writing in L1 when they have to write in L2. Just as an appetizer, I present some findings from a preliminary study, in which ten students aged about 15 wrote two essays in their L1 (Dutch) and two in a foreign language (English).

To give you an impression of the resulting texts:

Student A (Start of text): Homework: sense or nonsense?

I'm think that home work not nonsense is, whenn you make it evryday in the week.

Hoem work is nessecery beaucaus how must you learning your tests or examsn?

But homework is not fine and its is evry day very big. You sit a long time to school, and when you are home, you must doing your homework

Homework is not nonsense beaucaus you must learning verry lot, and that can't not to school, than sit you a long time at school.

You sit than from 8.30 to 19.00 at school. And you have not free time, when you are home.

Bud meany peoples make not their homework Beaucaus, she nicer to play out of watching t.v.

There are children come achter to learning and go not to school.

Student B (Start of text)

Well, I think that it's good for later, so much home work, Because if you woulden't practice at home, wou will forget what you learned that day and when you have a test, you don't understand it. And if you pay attention in class, it won't be too hard to do your homework. What is very important is that when you don't understand what your theatcher says you ask what he's saying. There are always students who say they have much homework, when they only have to do one thing, and also studends who say that they have too less homework, because he thinks it's easy.

LESSON 4A: STABILITY OF ACTIVITIES INVOLVED

An initial finding is that the processes of L1 and L2 writing are, in one sense, stable within individuals. The correlations for the different cognitive activities are, in general, rather high. The values ranged from .20 to .98.[2]

LESSON 4B: PATTERNS OF ACTIVITIES TASK (L1-L2) DEPENDENT

[2] *Changing Written Text (.20), Generating (.53), Evaluating Written Text (.57), Monitoring (.62), Writing (.65), Reading Task and Documentation (.75), Rereading Written Text (.98).*

When we compare the students' L1 and L2 writing process, some striking differences in the general pattern emerged.

SLIDE

This slide shows that for six of the eleven distinguished cognitive activities, significant differences were observed between L1 and L2 in the course of the activities over the writing process.

Here I show two processes that are more complex in L2 than in L1.

While in L1, producing text or writing is steadily increasing, in L2 there is a decrease about halfway the process.

Rereading already-written text is an activity that is strongly increasing in L2, while the pattern in L1 is less pronounced, i.e. flatter.

SLIDE

LESSON 5: INDIVIDUALS DIFFER IN THE EXTENT TO WHICH THEY ADJUST THEIR PROCESS TO THE TASK AT HAND

To discover the individual differences, we plotted individual patterns.

For Rereading already-written text, the patterns in L1 are parallel, more of less, while in L2, two groups of patterns can be distinguished. It seems that variation within some writers is large. Writers 1 and 5 in L2 for instance start at a very high level in L2 for one writing task, while in the other writing task in L2, they show behavior at a minimum level.

What we have observed is that writing in a foreign language is both similar to and different from writing in the mother tongue.

It is similar because the same cognitive activities are involved. It is similar because the course of about half of the cognitive activities is not influenced by writing in a different language: especially planning or pre-text activities – self-instructions, goal-setting, generating, structuring, commenting. For text production and post-writing activities, it is the other way around: the patterns of these activities – writing, rereading text, evaluating already-written text, revising text – are different in L2 compared with L1.

We have also observed large individual differences: differences in stability within L1, and differences in coping with the L2-task.

And learning to cope with new tasks, that is one of the aims of teaching writing. That is what Part two of this presentation is about.

Additional Time: 4.51

SLIDE

2. INTERMEZZO

So far about writing processes. Complex things to study, intellectually rewarding, but too complex findings in a too early stage to apply in a direct way to education. And yet, we are educational researchers, and education can't wait until we know the intricacies of writing processes. So, in another branch of our research program, we try to design and test instructional sequences. When we know that writing is a complex phenomenon, then we infer that the learning process of writing must be even

more complex. How can we design good opportunities to learn in secondary education?

3. PART 2: LEARNING TO WRITE IN SECONDARY EDUCATION: LEARNING FROM PROCESSES OR LEARNING BY OBSERVATION

The most frequent learning activity we see in MT-classrooms is practicing, doing exercises. Students carry out reading and writing tasks, occasionally get some feedback when they have finished, and then go back to other tasks.

When students compose a written text, most of them are completely involved in writing, in completing the writing task, in writing a text that fulfils the aim of the task. Given the complexity of composing, the involvement in all kinds of subprocesses and the co-ordination of these subprocesses, it is clear that learners cannot learn much during practicing: they simply are not in a situation where they can learn. That's not to say no one does: good students may take the practicing opportunity as an opportunity to learn. Because good learners are active learners: they see writing assignments not as just tasks but also as learning tasks.

SLIDE (new curriculum)

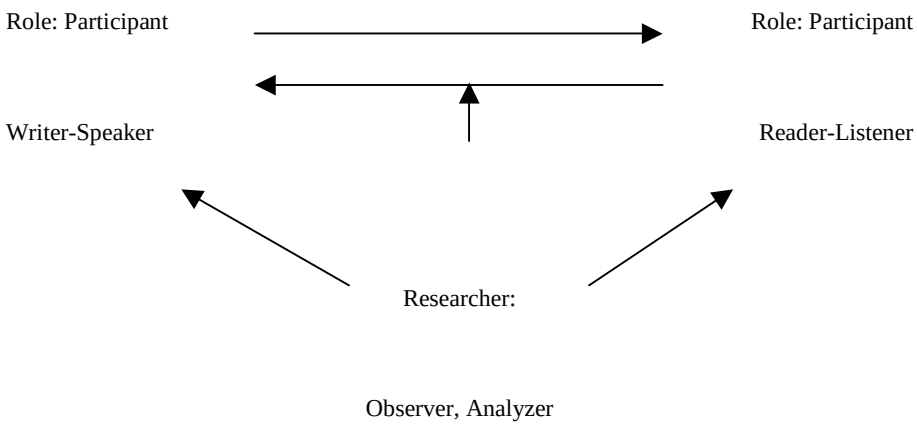
They have enough effort for dual tasking: *to write* and *to learn from that writing* at the same time. In doing so, they develop metacognitive and meta-communicative skills; skills that are necessary to develop to become a proficient language user. Good learners develop these skills under their own steam. What, nowadays, societies want us to do is to help all students in developing these skills. That is why practicing, as the major learning activity in MT-curricula, is not enough.

SLIDE cartoon

In our intervention studies, we study the effect of an alternative learning activity: observation of practice instead of practicing itself. Observation can help students to develop awareness of communication, of the dynamics of language use and communication, of how meaning is (re-)constructed, on the process of meaning making in the writer, the reader, in the communication partners, and between the communication partners.

SLIDE student participation model

To acquire this kind of awareness students must play different roles. First, they must be in a position to experience communication, to experience, that is to undergo and observe the effects of written and spoken communication. That is, they have to participate in communication. Creating situations in which students are involved in communicative pairs or groups is a first requirement for teachers and curriculum developers.



SLIDE intervention studies

In the following sections, we will present three teaching sequences from our research about teaching writing skills to pupils aged 14 to 16. In all examples, students are doing other things than just doing writing exercises. They experience communication, they observe effects of writing, observe writing processes.

Time intermezzo: 4.00

SLIDE

EXAMPLE 1: LEARNING TO WRITE BY OBSERVING READERS' PROCESSES

So a central question is: How can we help children to develop knowledge about effective communication? I will now present some data from a study by Michel Couzijn. His idea was simple: children should *experience* how communication works. One very strong communicative text type is a manual. Therefore, he constructed a simple physics experiment, and trained children to perform this experiment.

The experiment was as follows (see Figure 13):

First, you take an Erlenmeyer flask, you put a cork with a hole on the flask, and put a funnel in the hole. Then you put some water in the funnel. What happens? The

water does not flow from the funnel into the Erlenmeyer. Why not? The air in the Erlenmeyer needs space and will not let the water in.

Then put a straw into the funnel, with your finger upon the top. Nothing will happen because the air cannot go away. But when you lift your finger, the air can flow out through the straw, and then the water will flow into the Erlenmeyer along the straw.

This is, in short, how the experiment works. Couzijn individually taught students how to do this experiment. On a table several Erlenmeyers were present, different sizes, various corks, different sizes, and with holes of different sizes, and funnels and straws, both present in different sizes. Only one combination fitted best. He showed pupils the experiment, step by step, and added the physical explanations. Then he coached the student to do the experiment unassisted until the student mastered the experiment.

Then, he asked the student to write a manual for the experiment for a classroom peer. The manual should be so clear that the reader could perform the experiment perfectly.

This is a manual from that sample:

SLIDE

Slide: manual; *Show Text of a manual (transparency); Read text aloud.*

Then he invited other students, who didn't know anything about the experiment, individually. He gave this student a manual, and asked him to perform the manual while thinking aloud. He videoed these processes.

Three weeks after the first writing session, we invited the writer, and showed him two of his readers on videos. The writer of the manual I showed you, saw this…

Start: Video Playing: [Here I show you a short fragment of such a video, 2.30 minutes

Most writers were a bit shocked when they saw their readers at work, as you may imagine. This learning is the effect of *reality TV*, not of instruction. Then we returned his original text to him, and asked him to rewrite or revise the text.

We measured the quality of the manuals resulting from various conditions.

SLIDE: Effect sizes

This slide presents the results of several conditions in which students rewrote their first version after having been exposed to readers' processes on video[3]. The condition in which writers saw their own text processed by readers, with written comments in addition, outperformed all other conditions.

[3] *Some saw the readers of their own text, some saw readers of texts written by other writers, some having access to written comments by readers, some not having this kind of extra support. All three reader-observation conditions scored significantly better than the first versions and the first versions/rewriting conditions.*

Additional to measuring the effect of observation on writing was taken three weeks later. Couzijn asked all participating students to write a letter of advice to a new classroom mate, about how you should write a manual. With this measurement, Couzijn tried to assess the knowledge about the manual as text type, as a prerequisite for transfer.

Results: Writers who saw their own texts being used and got written comments, knew the most.

SLIDE

In this experiment, Couzijn showed that a relatively simple instructional device could have large effects. Show writers a video. From viewing this, young writers are capable of deducing knowledge about a good text: they can build a set of criteria for a good text, and they can apply these criteria, without any intervention of the teacher.

Time Example 1: 5 +reading the text (1), + reading a letter of advice (1), + video (2): 9

4. EXAMPLE 2: LEARNING TO WRITE AND READ FROM OBSERVATION LEARNERS-WRITERS AND/OR LEARNERS-READERS OR BOTH (COUZIJN)

4.1 Learning and transfer effects for writing and reading (Couzijn)

In a series of studies, we taught thirteen to fifteen-year-olds to write argumentative texts.

In the first experiment I report here shortly, students got four lessons on argumentative writing. In the traditional variant, students read some theory, checked their knowledge via a quiz, and then applied the theory in short writing tasks.

SLIDE

In the experimental condition, students did not execute these exercises, but watched on video how two peers fulfilled such a task. They had to choose which of the two executed the task the best and had to explain their choice. These two conditions were also implemented for Reading Argumentative Texts.

SLIDE

I will show you how it works. In one of the lessons, students learned to write an argumentative text from an argumentative scheme like the one on this slide.

Then, students got the assignment:

SLIDE

“You will see two students on video who tried to write a text based on this scheme. Watch the video, and explain which one did a better job.”

STOP PRESENTATION; START VIDEO PLAYING

SLIDE

Transparency, parallel with video on OHP: The protocol of the student on video.

Dependent variables were Writing and Reading Skills.

SLIDE

At last it turned out that observing other processes caused a larger learning gain than executing the exercises yourself, for writing as well as for reading. When we compare the effect for Writing: Observing Writing had an effect of .78 standard deviation compared with Practicing Writing. The effect for Observing Reading on Reading was 1.00 standard deviation.

SLIDE

The transfer effect from Observing Writing on Reading was enormous (.92) (We took Practicing Reading as Basis).

SLIDE

We may conclude from this experiment that in learning to write, observation of writing is sometimes more effective than writing itself, and that observing writing has a big transfer effect on reading.

In subsequent studies on the effect of observation, Martine Braaksma concluded that students especially learnt by providing arguments to warrant the claim that one of the two writers did a better job than the other one. In addition, in a study in which she closely observed the observational behavior of students, we learned that indeed

students are building their own mental solution before choosing which student did a better job.

4.2 Interaction between students' features and instructional choices

In other studies, we investigated whether instructional factors interact with learners' characteristics and whether observational learning affected the writing processes, as one may assume when meta-cognition was affected by the learning condition.

To start with the first issue, the question was: is it better to focus on a weak model, who makes mistakes, or on a good model, who processes the task in a better way?

SLIDE: cartoon

The answer is: it depends. It depends on the learner's proficiency level.

SLIDE

Weak writers:

1. A weak writer acquires a new task by comparing two students ('models') who are performing the task, focusing on the weaker student;
2. When the task is not new any more, you may continue with this approach, but weak students learn also from performing the task themselves.

Good writers

3. A good writer acquires a new task by performing the task himself, or by observing a pair of students who perform the task, focusing on the good writer in the pair.

4. When the task is not new any more, the good writer doesn't learn from performing the task, but by observing a good writer in a pair of good and weak writers

Slide: Interaction Effects

For students with a medium aptitude, we found no significant differences between conditions. But students with a low aptitude learned more in the observation/weak-focus or direct-writing condition.

Students with a high aptitude learn most in the observation/good-focus condition and in the practicing condition.

4.3 Effect on writing processes (Braaksma)

In another experiment we used the same learning tasks, implemented the same procedures with one exception: we measured the effects of the conditions on *writing processes*, using think aloud protocols. Now we return for a moment to the first part of this talk.

To illustrate the differences in orchestration due to instruction, we present this slide.

SLIDE: Analysis & Goal Orientation

For two activities, goal orientation and analysis, you see that the distribution of these activities over process time is more complex in the observation condition than in the control condition.

SLIDE: summary table plusses & minuses

Compared to the control condition, the configuration of cognitive activities in the students from the observation conditions was more complex than the configuration in the control condition, with more planning all over the process, and more analysis and less transcribing in the beginning than in the control condition.

5. EXAMPLE 3: PRACTICE OF LEARNING TO WRITE: YOUNG STUDENTS AS RESEARCHERS

SLIDE Intervention 3

A last stage in our research program is the development and testing of lesson plans. The lessons aim at learning to write, stressing the acquisition of strategic knowledge: what makes text effective? We are trying to develop lessons in which young students themselves investigate qualities of texts, so that they come to possess this knowledge and in so doing have learned how to acquire this knowledge. We try to avoid the knowledge transmission model, and instead focus on the already available but mostly implicit knowledge. In this lesson series, we tried to cover all roles from our student participation model: students as participants in communication (writers and readers) and students as researchers (observers).

The lesson series I will show you consists of four lessons of 45 minutes. Participants are 18 students in grade 7, the first grade of secondary education. Students are

then 12 to 13 years old. I will present the lesson series with some video clips: the story can tell itself….

SLIDE

Start video (six clips of 30 sec.)

This is the start of the series, the teacher introduces the case in the computer room.

(presenting on transparency): reading aloud

Monday, April 7 2003, 3rd period, lesson 1

Task: writing a convincing letter, version 1

Imagine:

On the wrappers of the Yummy Yummy candy bars, which you occasionally eat, you have seen that you can get two free cinema tickets.

The wrapper reads:

SAVE FOR TWO FREE CINEMA TICKETS!!!

This is what you must do:

On each Yummy Yummy candy bar wrapper there is 1 point.

Collect 10 points and send these in a sufficiently stamped envelope to: Yummy Yummy Candy Bars Points Offer, PO Box 3333, 1273 KB Etten-Leur, the Nether-lands.

Also include € 0.39 in stamps to cover postage. Clearly write your name, address

and postal code, and the free (FREE!) cinema tickets will be sent to your home as soon as possible.
This offer is open until April 15 2003.

It is April 7 2003. You have collected a total of 8 points, but you cannot find any more bars with points. The bars in the shops have no points on the wrappers, but it is still not April 15. Thus, you cannot get your 10 points together. Nevertheless, you wish to receive the two cinema tickets. Therefore, you send your 8 points along with two complete wrappers without points.

Write a letter to enclose with the points and wrappers. Explain why you are unable to send ten points. Convince Yummy Yummy Candy Bars that you want to receive the two cinema tickets and that there was nothing you could do to get ten points. Make sure that they send you the cinema tickets! Then address the envelope.

Show SLIDE: At Work!

This first lesson results in letters like this one:

SLIDE: Read Omars first letter from screen.

Then lesson 2 starts.

SLIDE: text

The teacher divides the class into four groups. Two groups form a Management board of Yummy Yummy Candy Bars. Each board has to select three out of 18 let-

ters that get the free cinema tickets: the action was so successful that only three packs of free tickets were left in stock….

The other groups are researchers: their task is to listen to the discussion in the Yummy Yummy Management Board, to collect the arguments and criteria the board uses to select the three letters….There we go

SLIDE: filmclip board meeting

SLIDE: poster

Then the research team has to compose a poster to present their findings to the whole class. The students from the research group work on listing the criteria of the Yummy Yummy Candy Bars board and write them on a poster. The Yummy Yummy board group is now the observation group and pays attention to the meeting process. Its members must make notes of what goes on.

SLIDE: poster

Then lesson 3 can start, where each of the two research groups will present their findings, and where the Yummy Yummy Management Board will present the three winners, and, invited by the teacher, will relate their choices to the research.

Slide: presentation poster

Slide: presentation winning letter

The series end with the fourth lesson in which students revised or rewrote their letter and evaluated the whole series. They assigned an 8 out of 10…!

SLIDE: Lesson 4: Rewriting/revision original letter (computer room). Evaluation.

What were the results?

In general, the revised letters were better than the first letters

SLIDE: results

SLIDE: interaction figure.

From this figure, you may conclude that the research group learnt more than the Management Board.

SLIDE: Effect Sizes

And indeed, the learning gain of the research group was significantly larger than the gain of the students that played the role of Manager.

Given the few participants (16 completed data sets) and the enormous effect size for the Researchers (figure 21), we tend to think that the research position in learning to write can contribute to learning to write.

6. CONCLUSIONS

Dear colleagues, lunch is waiting, time is limited, even for such an intriguing subject as writing and the teaching of writing, and an involved audience. Let me conclude with listing some of the points I would like to have settled in your mind in these 45 minutes.

Writing is a complex activity, with interacting components. Various cognitive activities can fulfill different functions, dependent on the context in which they operate.

When we *study the writing process*, we must try to find methods that take into account:

SLIDE

1) the changing functional relationships between cognitive activities during the process (activity is not equal to function)
2) the contribution to quality depends on moment in the process
3) the effective configuration of cognitive activities depends partly on tasks
4) student-writers differ in the stability of their process configurations
5) student-writers differ in the extent to which they can cope with new writing tasks.

When we *teach writing*, a few new insights could be exploited.

SLIDE

1) create observation/inquiry tasks:
    a. observation of the effect of text on readers (Physics experiment, Yummy Yummy bars)
    b. observation of student-writers in learning conditions
1) be aware of the interaction between learner characteristic and learning task: sequence: compare weak-good writers (focus weak), practice, compare weak-good writers (focus good)

When *studying the effect of interventions*:

SLIDE

1) add measurement of processes as dependent variable

2) add learner characteristics in the measurement design

Thank you for your attention and patience, and have a nice lunch.