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# Distance education engineering

## Interactive method and virtual pedagogy for French learners

### Keywords

training engineer – interaction paradigm – virtual method – experience – pedagogy

### Abstract

A field description of training engineers' work in distance education allows us to test the interaction paradigm in current social realities. The training engineer's work is about tuning a software to provide undergraduate students with a virtual learning method. It therefore appears to confirm the interaction paradigm : learning is a dynamic of human actions and software reactions, similar to a serious game in a virtual world. But the course's final assessment through a case study reveals the limits of the interaction paradigm. This complex problem, based on real-life situations, is rather seen as a "mental experience" by the very professionals working in this educational institution. We therefore put aside the interaction paradigm to take into account cognitive realities stressed by the training engineers' pedagogical activity.

### *Introduction*

Digital revolution reaches standard mass education. In France, the government has set up C2I ("Certificat Informatique et Internet") to meet the European policy aiming at a computer competencies universal pass. In order to prepare students for this certificate, the French national institution for distance education (Cned) has implemented a training device based on educational computing, on a large scale. Cned's undergraduate students learn how to use office software through a didactic software. This very didactic software proposes many exercises in a virtual simulation of the office software to be learned by the students. Our

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article presents the work of a training engineer 1/ tuning the didactic software to meet the requirements of the learners' profiles and goals and 2/ designing a final assessment procedure through a computer-based case study.

### *Literature review*

There is an abundance of literature dedicated to educational computing and, more generally, the use of computers in education (collective work such as Cornu, 1994 ; the review *Computers & Education*). However, the pedagogical device we present is not about using a computer within a classroom, but turning a computer into an (almost) self-sufficient learning tool since it is about distance education (Moore, 2012). The students are non-computer specialists and they are able to navigate on the Internet in full autonomy. Our focus will be the teacher, in this case the training engineer in charge of tuning the software to prepare the students to work with it. As a trainer, his job is limited to the preparation of the course : he does not have to deliver it in presence of the students. He is neither the one who designed the software, nor a mere learner. He is the mediator, in charge of adapting the instructional device to the students in order to guide them in their learning process. He then completes the process by assessing the students, with the same software.

### *Field study method and hypothesis*

We collected empirical material through a field study at Cned. Participating and observing the work of training engineers allowed us to gather raw data that we have analyzed within the *interaction* paradigm. Erwin Goffman's social sciences interactionism (Goffman, 1959) has helped us as an enquiry method. But it is the educational computing interaction analysis that we have used to understand the results of this enquiry. David Squire presented this interaction paradigm in 1994 (Squire, 1994) and our hypothesis is that this paradigm is

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still partially valid : the work of the training engineer can be described as the preparation of the interactions between the students and the software.

Furthermore, this *interaction* hypothesis relies on a sub-hypothesis : learning is an *action*, an activity of the learner (Barbier, 2011 ; Mucchielli, 2012). If we consider that the training engineer's work is to prepare the learner-software interactions, we infer that learning is an action (here an action on a software). We will now test these hypotheses, confronting them to the raw material and showing their limits.

### *1/ Learning process*

In order to understand the training engineer's work, we have to fully describe the learning process. The didactic software is used by undergraduate students enrolled in the compulsory computer course for the French diploma *Brevet de Technicien Supérieur* (Bts). We will take the example of a Bts in tourism : it requires the students to acquire basic knowledge of databases management. This course is described in the national curriculum as a twenty hours course.

Cned provides the students with this twenty hours course, but it is not delivered by a teacher within a classroom : the students have to learn how to use a database software through a twenty hours course set on M+ (the didactic software). They have access to M+ on their personal computer, either at home or within the company where they are doing an internship. During approximately twenty hours, they will learn through M+ how to manage a database. The didactic software M+ gives them access to a virtual simulation of a database software where they have to solve almost a hundred problems in order to discover, understand and use all the functions of the simulated database software. Therefore, we can define M+ as an exerciser : it provides the students with exercises in a virtual environment.

How could the students' learning process be described in this exerciser ? When one uses M+, one watches the screen where the software to be learned is simulated and one navigates within these simulations by clicking on menus. One has to read the text of the exercise box (usually a simple question) and the text on the menus of the simulated database where he has to find the answer of the question. The answer is very often a manipulation such as "open file named X", "fill in table A" or "link table A to table B". The student reads the questions and then answers them by using the simulated software as if he was using it in a real life situation. If he doesn't know how to answer, he can launch a tutorial video about the question. This video is a recorded scene within the virtual software, where he sees exactly what he has to do and listens to a recorded voice commenting the actions taking place on the screen.

This learning process can be summed up with verbs referring to actions : to read, to click on, to navigate, to watch, to write down.... Therefore, our sub-hypothesis that learning is an action seems to be confirmed : the students are not passive in front of the computer, they are active. This activity requires their attention and implicates them for repeated one or two hours sessions, till all the exercises are completed.

However, these actions are not unilateral : the didactic software "answers" to them. To each student's action there is a reaction from the computer. When the student clicks to open a file, the simulated software opens it and it is visible on the screen. Then the student clicks on "check your answer" icon and, if correct, a congratulations message appears on the computer screen – if not correct, the student has the opportunity to redo the exercise. Once done, the student clicks on the "next exercise" icon and the computer answers by another question box (appearing on the screen). This chain of actions and reactions can be described as an interactive process between the learner and the software. Our main hypothesis that Squire's

(1994) interaction paradigm is still valid is therefore confirmed. We will however study its limits in the next paragraphs to prove it is only partially true.

The interaction learning process can be more carefully studied by describing how the actions of the student are progressively shaped by the reactions of M+. At the beginning the actions are rather slow because the learner takes time to fully read all the menus, looking for the one he thinks he has to click on. Then he gets to know all the menus and can quickly access to the function he wants to use. Therefore the frequency of the interactions increases with the learning process. Their very nature also changes gradually : at the beginning the questions are rather easy (“write down this text” / “find within the table this element”) and the student can answer directly. But then the difficulty increases (“edit the formula”, “print this part of the table”) and the students have to watch the videos giving the key elements for them to answer. The nature of the interaction is therefore modified. The material of the interactions, however, remains constant : they never have to find elements out of M+ (by surfing on the Internet or consulting a complementary book), all the interactions take place within the didactic software. The dynamic analysis of the interaction (variations of frequency, nature and materials) shows how the student progressively learns. His actions are shaped by the software, this process being comparable to an elaborated conditioning process.

All these interactions lead the students to learn the *logic* of the software : the *vocabulary* describing all the items (“file”, “table”, “folder”,...) and the *operations* they can command by clicking (“opening a file”, “clearing a table”,...). They discover all the items of the software to be learned and how to use them : they learn a virtual world and the competencies to act within it. Therefore, this kind of computer-learning can be compared to the current trend of serious games. Indeed, many serious games simulate a virtual world where the player has to play. In order to play, he has to understand all the other characters and the rules commanding them. He also has to acquire specific competencies to interact with

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them. It is the same idea of learning how to live in a virtual world, acquiring its logic (both vocabulary and operations). The main difference being the interest of the game : what motivates the player to play, the learner to learn ? In the case of a serious game, he acquires points and gets pleasure in it (self-achievement, competition with other players,...). In the case of our didactic software, he needs to get points since these are going to be his final mark for the national diploma. This is precisely what the training engineer has to prepare: tuning M+ so that it fits the undergraduate students profiles and the requirements of the Bts national program.

## *2/ Training engineers' main work and discussion of the hypothesis*

The training engineer's work is to study carefully the students' profiles (what do they already know about the database management software they have to learn ?) and the learning objectives (the level required by the diploma as described in national texts). Thus, he gets a precise idea of the competencies they have to learn (the difference between what they already know and what they are supposed to know) and tunes M+ to limit the exercises to what is strictly necessary. Then, to reach the legal compulsory 20 hours of training, he adds basic exercises that will strengthen the students' general knowledge of database management. The yearly group of two hundred students for a Bts is toursim, scattered all over France, is not homogeneous. Therefore, some of them will go very quickly over these basic competencies (that is to say without watching the explanatory video), while others will have to repeat some exercises many times before answering them right. Furthermore, when the training engineer collects all the marks tracked by the software, he/she finds out that some students only achieved 50% of the exercises, whereas others have it 100% right. A brief statistical study of the marks shows that a few students don't understand the exerciser and miss their learning goals, a few others do half the exercises, and most of them have great marks – regardless of the time they spend on the software. The 20 hours is frequently not respected : a majority of

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the students get good mark in about 15 hours. A very few other complete all the exercises in 40 or more hours. Once again, it all looks like a serious game that the student has to play (that is to say understand and enjoy) if he/she wants to learn efficiently (fully and briefly). The master of the serious game being an invisible engineering teacher, setting the rules and collecting the points.

The hundred or so exercises of M+ can be described as a virtual learning path. The Greek word for *path* (*hodos*) is the etymology of the word *method*. Therefore the idea of a step-by-step method can be fully understood. Each step being an action on the virtual path, the software's reaction is an opportunity for the student to take another step in the right direction. It is a virtual and interactive method. The work of the training engineer is to prepare this path for the learners and to put them on the right track. He has to determine what is going to be the first step (what is the lowest student's level), what are the majority of the steps going to be about (what are the main items most of the students still have to learn) and what is going to be the final step (as determined by national texts).

The training engineer finally collects the results without meeting the students : he extracts from M+ all the data representing the results of each student to every exercise. The training engineer's work is about training conception and software management much more than a live lecture in presence of students. As opposed to traditional teaching, distance learning through educational computer has nothing to do with theater. The trainer is no longer an actor placed on a stage, with a script to deliver to a more or less active audience. He is a training developer, focusing on the preparation of the course and its programming on a software. The students will learn by acting and interacting with the software on exercises he has prepared. The hypermedia software will answer potential questions with recorded videos delivering the lecture on demand. The training engineer will then collect the grades to hand them in to the diploma manager. As a teacher would do, he can analyze the difficulty of his



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training and assessment (by selecting a more or less difficult learning path). The training engineer's work is therefore to prepare the interaction between learners and software. But his work does not end here, he has further responsibilities.

In the following paragraphs we will highlight the limitations of the interaction paradigm.

### *3/ A computer-based case study as complementary assessment : a shift of paradigm*

Training engineers and directors working at Cned consider that the use of the software to teach and assess the students is not sufficient. They complete it by a case study that the learners have to take at the end of the course. This case study is compulsory and graded. Whereas the software M+ provides them with a set of brief exercises, helping them to solve these exercises with precise videos, Cned's training engineers have collectively decided to oblige the student to rethink the material they acquired throughout the year through a single complex case study. The knowledge and competencies developed by the hundred simple exercises is required to solve the unique complex problem they have to solve at the end of the year. It is still distance working since they do it at home and have no time limitation. They can be helped by someone and they can also search on the Internet or any other source of information. But all they need has been learnt through the interactive virtual learning method. They are presented with a case study taking place in an environment virtually identical to their internship or future work. For example, the description of a company dealing with clients and resources. Then, they are asked to manage a database provided with the case study (in a separate file) and to answer a few questions using this database. This complex problem experience contrasts with the simple exercises they had to go through with the exerciser : here they have to link many elements they have learnt separately, sometimes at very different moment of the course. This experience is both a tool for learning (digesting) and assessing the

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students (long-term memorization, critical-thinking), in a situation similar to what they will have to handle in the coming years of work situations. Can this experience be described as an interaction ? We will now defend that it can't : this problem is irregular and cannot be handled with the interaction paradigm.

The final case study is usually prepared and corrected by a teacher working for Cned. The training engineer provides the teacher with data about the student's targeted job, the national text of the diploma and a copy of the interactive and virtual method he has built in M+. The teacher hands in a two hours case study including all the files necessary (database, description of the test, questions, correct version). The training engineers will send it by electronic mail to the students at the end of the course and they have a week to complete and send it back. Then the teacher (sometimes helped by correctors) will correct the case and give a grade. The training engineer, in this case, acts as a teacher manager, in charge of coordinating the assessment event. He no longer has to prepare an interaction between learners and a software. What he prepares is different : it is the specific learning and assessment experience of a case study.

How do Cned's workers present this final assessment ? Being a large national educational institution, counting 200 000 learners and trainings ranging from primary school to master degrees, Cned has been a source of intense didactic creativity. This creativity can be tracked through university books (for example : Cornu, 1994), but also by many broadcasted and recorded videos. We will now take one of these videos as raw material (Berbaum, 1997), in which the institution explains and legitimates its didactics. The video gathers selected learners testimonials and questions, teachers' answers and specialists' pieces of advice (intervention of a senior university professor in education sciences, a consultant from another national institution). During a few hours, all these people converse and define learning norms for a targeted audience of Cned's students. We assume that this kind of video has shaped the

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current conceptions of Cned's training engineers since their current discourse about the assessment is very similar to that of the video. The evaluation is never presented as an interaction, but rather as an activity described as mental experience.

The vocabulary used in the video deals with cognitive psychology applied to education sciences. An exercise similar to the case-study prepared by training engineers, is described as something mental since the students have to be cut off from reality : they are advised to work in an isolated room, far away from any noise or inconveniences (as if in a examination room), during a dedicated time and in relaxed mood. Thus, the video describes student activities in terms of mental processes and cognitive functions : self-questioning, memory (short term and long term), perception determined by learnt conceptions, links between the different dimensions of the exercise, mental representation of the situation, stimulation of creative imagination to solve problems, attention span determined by motivation, ... All these formulae and cognitive explanations deal with a mental experience and the word interaction is only pronounced once (during the video, running from minute 20 to minute 45).

We can now come back to the case study set up by training engineers and describe it the way they talk about it (influenced by the institution's didactics such as presented in the video). The case study consists in dealing with a complex situation and crossing knowledge in order to answer it. There is no longer action nor reaction (there is no M+ to react dynamically to the students findings) : thus no interaction. Instead, the learner is led to a difficult situation that will require concentration and a lot of mental effort. It is a fruitful experience because the learner will have to reorganize what he/she already knows and therefore know it differently while strengthening it (the very term "reorganize" appears as a leitmotiv in the video). He has to make sense of scattered data and to produce a correct answer. In the video, the senior university teacher explains that what one sees in the current situation is determined by what has previously been learnt. As if the student would see reality through the glasses of what he

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has learnt. The student is assessed through the use of the database management software : he has to solve specific questions. The software is therefore a communication tool for the student.

As we've shown it, the complex problem solving is no longer an interaction. It is a three dimensional experience as recently described by Jean Marie Barbier (2011) : the case study represents 1/ a particular event, 2/ that the student has to feel and think and 3/ about which he/she will communicate. Therefore, the work of the training engineer is to prepare an experience. The training engineer stands as a distant guide who leads to a fruitful event (a complex problem), helps the student to make sense out of it (because it is a case study similar to work situation) and to express a valid meaning (the correct answer). As a distant guide, the training engineer leads the student to the problem, obliges him/her to understand it the right way (the way learnt during the interactive path) and to come back with the proper answer. As a distant guide, the training engineer's work appears to be about pedagogy, since the word pedagogy includes in its etymology the Greek word meaning *to lead (gogein)*.

### *Conclusion*

M+ is an instructional device providing the students with a method, that is to say a learning path ; the computer case study is a better suited pedagogical tool : the possibility for the training engineer to guide the students through a rich and difficult experience. The work of Cned's training engineer is both about method and pedagogy, thus fully didactic. This social sciences field study in an educational institution requires a modification of the interaction paradigm in order to take into account the mental experience.

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## Biography

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