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Claroline, an Internet Teaching and Learning Platform to Foster Teachers' Professional Development and Improve Teaching Quality : First Approaches

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This article describes the findings of a survey of Higher Education teachers and students using the eLearning platform Claroline. This survey is enhanced by direct observation of the tools really used by teachers. Claroline was initially developed (in 2001-2002) to sustain and foster pedagogic innovation at the Université Catholique de Louvain (UCL) in Louvain-la-Neuve (Belgium). It is now used across the world. In Louvain-la-Neuve, Claroline is mostly used in hybrid configurations, mixing traditional lectures and online use of technological tools. The survey aimed to identify the changes that teachers and students observe in their own courses when they work with this platform. We find that teachers who make most use of this virtual campus have evolved in their pedagogic practices towards more innovative or active learning methods. The more they use the platform, the more the richness of the pedagogic setup increases, and the more their perceptions of learning evolve. We also investigate the changes which students observe when their teachers use this pedagogic platform. The catalytic effect of Information Communication Technology (ICT) in producing more active learning methods is often discussed. This investigation confirms this suggestion, showing that a significant proportion of students observe pedagogical changes, in particular, an increase in interactions between students, in learning considered as a research process, and in the active engagement of students in

their learning. After a presentation of the pedagogic principles underlying the development of the Claroline platform, this article describes the most interesting findings of this study and presents some differences between teachers' and students' perceptions.

This article discusses the use of an eLearning hybrid configuration in a Belgian Higher Education institution (the Université Catholique de Louvain (UCL) in Louvain-la-Neuve). This institution is developing and using a technological platform, Claroline, to sustain and foster pedagogic innovations. Since 2000, the managers of the university have been trying to encourage the development of pedagogic styles closer to the needs of society in terms of student competences, recent advances in techno-pedagogy, and innovation studies (learner-centred activities, professional development for teachers, etc.). This article describes some quantitative tools which may be useful in monitoring the development of such a pedagogy within an institution. Briefly we will focus on two main ideas:

- the relationship between the types of tools used and their development as an indicator of the development of value-added pedagogy;
- the relationship between the technological richness of a pedagogy and teachers' and students' perceptions of the learning quality.

Fostering Pedagogic Innovations?

To build a technological tool devoted to student learning, which will give teachers opportunities to develop pedagogic situations with added-value learning, and to assess their impacts, it is necessary to have a pragmatic model of pedagogy. This must cover various levels: (a) teachers, (b) faculties, and (c) the institution. It is difficult to assess the impact of a technological tool (or, indeed, pedagogical innovations in general) without a model against which to measure the impact of the innovations on pedagogy and the pedagogical involvement of teachers. Lebrun (2007) proposed such a model, particularly adapted for Information Communication Technology (ICT) uses, which consists of three different and coherent inputs:

- Society's needs (as expressed by universities, businesses and political associations) in terms of students competencies (critical thinking, problem solving, communication, teamwork, and citizenship).

This is mainly a question of **objective**s.

- The findings of educational research about learning factors such as motivation and interaction which promote quality learning. This is mainly a question of **methods**.
- The results of studies of the added value of educational technology tools in mainstream education. This is mainly a question of the development of **tools**.

The model may be described as follows: if it is useful that **information** (very often the only result of ICT) is made available (Saljo, 1979), it is equally important that learning takes place in a genuine, **motivational** context (Biggs & Telfer, 1987). High level cognitive **activities** (abstraction, analysis, synthesis, evaluation, and critical thinking) can then be activated. These activities are sustained by the **interactivity** of the pedagogic setup (Savoie & Hughes, 1994) and lead to the contents and methods being absorbed by the learner, who constructs knowledge, who constructs itself (Lebrun & Viganò, 1995a; 1995b).

Figure 1 shows the synthetic results of this analysis presented as a dynamic picture. This Figure may also act as a check-list for the design and evaluation of educational resources (their nature, structure and attributes, and the lay-out of the information), pedagogic software (the context of the proposed activities or directives to be followed), educational web sites (the activities suggested to the students or the place of the web site in the pedagogic scenario), pedagogic plans (carefully considered individual and collaborative activities), students' output and, finally, the development and evaluation of pedagogic innovation inside an institution (Lebrun, 2002; 2005; 2007).

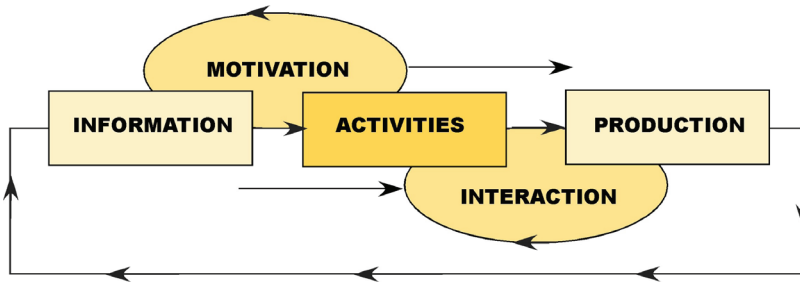

Figure 1. A pedagogical model of ICT-based pedagogical development

The three rectangles in the centre, are inspired by the constructivist approach: information is transformed into knowledge by the students' activities and this new knowledge feeds into the next set of information gathering (a systemic loop). This process is enabled by motivational factors and sustained by interactions with the environment (functional interactions) and with other students and teachers (relational interactions).

An eLearning Platform to Sustain Pedagogy Within Institutions?

In the academic year 2001-2002, a decision was made by the *Université Catholique de Louvain* to develop an eLearning tool with basic functionalities. The interface was to be kept as simple as possible so that the teachers could focus their attention where it mattered most: on students' learning.

Since the beginning of the project, the platform has been developed according to the main components of the pedagogic model: (a) tools covering information and motivation such as "Documents and Links" and "Agenda"; (b) tools on interactions between students and teachers such as "Announcements," "Groups" and "Forums"; and (c) finally, tools allowing and sustaining students' activities and production such as "Exercises," "Works" and "Wiki."

Claroline's development team (initially located in Louvain-la-Neuve and rapidly supplemented by a team at ECAM, a higher education institution located in Brussels) has continued to work on emphasising student learning, the autonomy of teachers, and avoiding "technological acne" (the development, which is a feature of many platforms, of more and more buttons and functionalities, which allow complicated things to be done but make simple things complicated). Our general hypothesis is that such a platform should release teachers from technical difficulties and give them time to enable student learning and their own pedagogical development (Docq, Lebrun, & Smidts, 2007).

Our research on such effects is original. Morgan (2003) declared that "there is little empirical evidence that course management systems (CMS) actually improve pedagogy. Study findings suggest, however, that using a CMS does invite faculty to rethink their course instruction and instructional environment, resulting in a sort of accidental pedagogy." We wanted to go a little bit further by showing this transformation in the pedagogy empirically, and exploring whether teachers moved from purely transmissive modes to interactive or proactive modes, in other words to a more student-centred

pedagogy.

To test this hypothesis, we undertook two studies:

- Longitudinal observation of the use of the platform tools by teachers. We have already suggested that the development of this intuitive platform will encourage teachers to adopt different pedagogical methods. The alternative hypothesis is that teachers will reproduce their traditional ways of teaching by just putting documents or resources onto the platform.
- Students' perception of their own learning. We often hear that "the tool is only a tool" and that the most important thing is the pedagogical environment developed by the teacher "around" the tool. This appears to be true; however a technologically rich environment may be a sign of a pedagogically rich environment especially if the tool was developed to induce pedagogical transformations. Do students' perceptions of their own learning depend on the richness of the technological environment created by their teachers? For us, this is an important factor in the perceived quality of the learning. The alternative hypotheses is that students' perceptions of learning are independent of the tools on the platform.

Hypothesis 1: The usage of tools by students and teachers and the development of this usage is a sign of pedagogical innovation

In our institution, the main teaching method is still lecturing. Pedagogical innovation involves encouraging the teacher to adopt more interactive and active methods, that is, a more student-centred pedagogy. By observing the tools activated and used on the platform from year to year, it should be possible to detect any movement towards these more innovative pedagogical methods. Technology only offers an occasion for the teacher to experiment and develop different methods, it cannot force a change to occur.

The Claroline platform does not presuppose a particular pedagogical style. The platform allows teachers to use complements to traditional lectures (e.g., the tools "Documents and Links" and "Agenda"); it also allows collaborative supported work (with inter alia, the tools "Announcements" and "Forums") and student activities (using "Works" or "Exercises"). In the year 2006 we investigated, by way of a questionnaire, the perceived use of the various tools by the teachers (Prs; N =153) and students (Sts; N=1179). The questionnaire was completed through the platform so only users gave their opinions. Figure 2 shows the percentage of "yes" answers to the ques-

tion : “Have you already used this tool?”

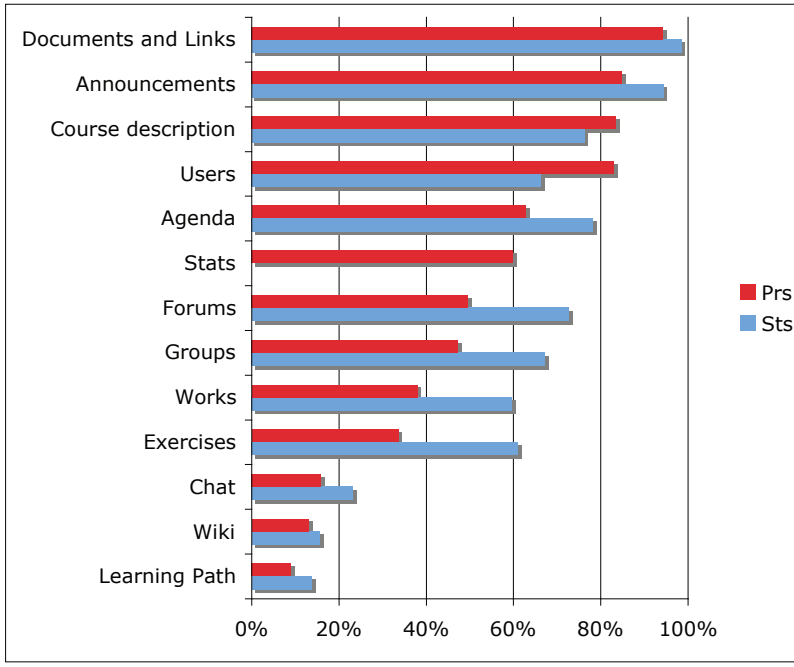

Figure 2. The use of tools by teachers (Prs; N=153) and students (Sts; N=1179)

The differences between the teachers’ and the students’ responses are significant. For “Documents and Links,” the difference between teachers (94% yes) and students (98% yes) has a $\chi 2$ value of 10.8 with p= 0.001. For “Forums” and “Groups,” the p value is <.0001.

Except for tools mainly dedicated to teacher use (Course Description, List of Users, Course Statistics, etc.), Figure 2 indicates a good knowledge of the tools by students, especially in the interactive (Forums, Groups) and proactive categories (Works and Exercises).

The most widely used tools, such as Documents and Links, are part of the **information** pole in our pedagogical model. The **interactional tools** (e.g., Forums and Groups) are less widely used, and the **activity and production** tools (e.g., Works and Exercises) are least used. This is also in accordance with theories about teachers’ professional development such as the early Katz model (Katz, 1972). At the beginning of their careers, teachers

are more interested in the transmission of content (information). After some years, they pay more attention to the pedagogical setup (interaction with students), and as mature professionals teachers become more concerned with student differences and activities (activity and production). These findings are compatible with recent developments such as the "Scholarly Teaching" proposed by Shulman (1999) as a foundation for the "scholarship of teaching and learning" (the way of excellence).

Over the years, we have investigated the logons to the platform and measured the "density" of the uses of the various tools within one course. The density is measured by the number of resources in a given tool compared to the total number of resources: for example, the number of documents and links uploaded to the "Documents and Links" tool, the number of exercises in the "Exercises" tool, or the number of subjects in the "Forums" tool, compared to the overall total. Table 1, below, shows the most recent results, those for 2007. These results cover all the 2446 "Courses" which were identified on the platform when the data were taken[1]. The cells of the table give the number of courses in which each tool contains the given number of objects (for instancee.g., there were 120 courses for which there were three documents in the tool "Documents and Links"). When a course is first opened on the platform, the each active tool contains an example object (or resource) to help the teacher with the tool use. In theory, this resource should be destroyed by the teacher before the tool is used, but sometimes teachers forget to do this. For this reason, our main indicator (see the bottom row of the table) is the number of courses containing more than one object.

[1] It is necessary to briefly explore the notion of a "Course" here, because it is very variable. For some teachers, a course is only some documents uploaded in the active Documents tool. For others, it is a complete interactive setup with a highly developed pedagogical scenario.

Table 1
The Use of Tools on the Platform in 2007

Number of objects or resources in the tool	Tools activated: Documents	Description	Agenda	Announcements	Forums	Works	Exercises	Total
1	351	316	487	564	1820	769	2239	
2	217	87	84	201	110	95	59	
3	120	93	56	112	57	45	19	
4	98	90	41	87	41	29	6	
5 or more	954	200	358	559	366	115	30	
>1 (2007)	1389	470	539	959	574	284	114	4329

The usage of tools generally increases with the number of courses. Table 2 (which is the same as Table 1, but only shows the bottom line) contains the results for 2004, when the total number of courses was around 1,200. This suggests that the results multiplied by around two in roughly three years.

Table 2
The Use of Tools on the Platform in 2004

>1 (2004)	909	300	246	267	160	107	23	2012

To compare these results better, and make it easier to see whether the use of tools increases or decreases, we normalised our data to 100% for each year. This gave us the mean density of the tools used during the year. We also divided the absolute numbers, tool by tool, to get the tool-use ratio "2007/2004," which is expected to be around two. Table 3 presents these results.

Table 3
A Comparison of the Use of Tools in 2004 and 2007

	Documents	Description	Agenda	Announcements	Forums	Works	Exercises	Mean
>1 2007 (%)	32%	11%	12%	22%	13%	7%	3%	
>1 2004 (%)	45%	15%	12%	13%	8%	5%	1%	
2007/2004	1.53	1.57	2.19	3.59	3.59	2.65	4.96	2.15
+/– s.d.	+/– 0.09	+/– 0.18	+/– 0.23	+/– 0.33	+/– 0.43	+/– 0.41	+/– 1.49	

Figure 3 displays all these results.

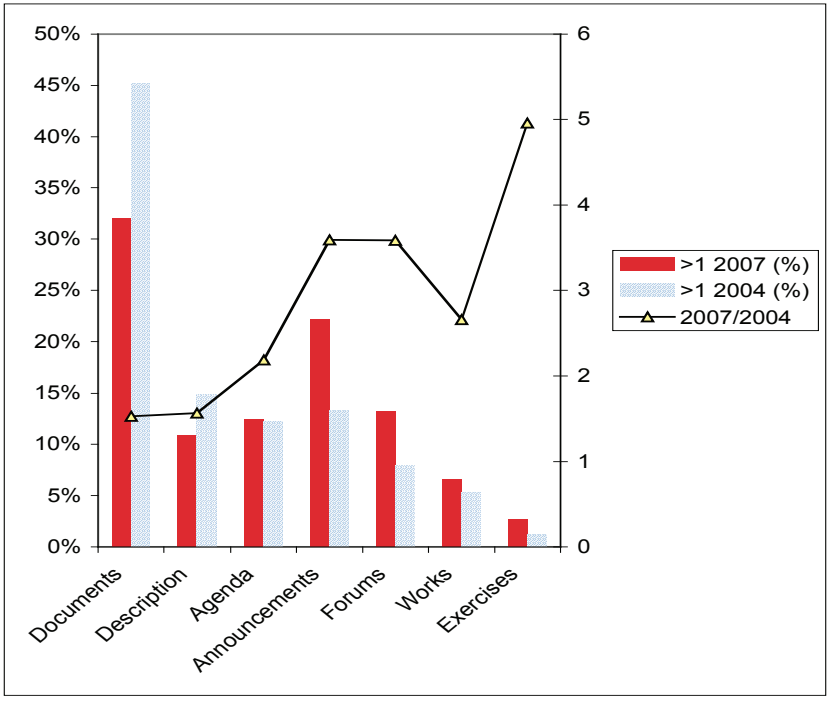

Figure 3. The mean density of tool use on the platform (in %, left), and its development (absolute ratio, right) between 2004 and 2007

Summarizing, this Figure gives the following results for some tools : on the left scale, the mean (over courses) "density" of the uses given in percent (relative values) for the years 2004 and 2007 ; on the right scale, the ratio (2007 over 2004) of the number of resources tool by tool (ratio of absolute values). With an homogeneous augmentation related only to courses augmentation, this ratio should be around 2. Figure 4 shows these results (ratios) including the error bars for each tool.

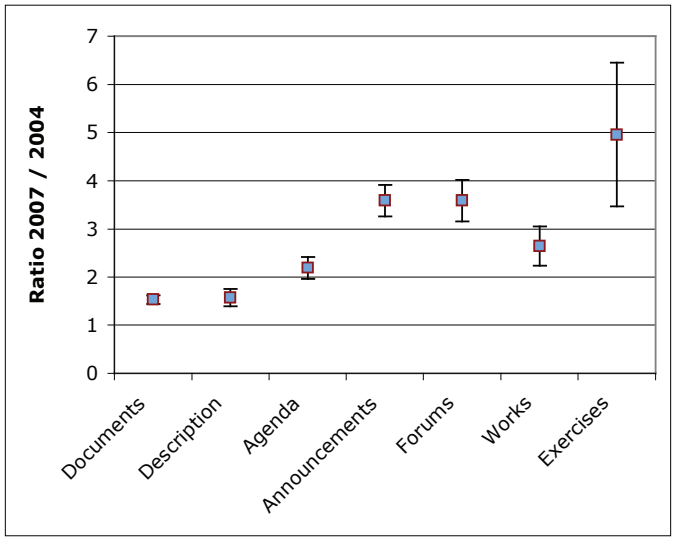

Figure 4. The ratios of tool use in 2004 and 2007, showing the error bars for the increase in each tool

Clearly the absolute use of each tool increased between 2004 and 2007 as the number of courses on the platform increased. What is more interesting is that the density of the use of transmissive tools such as "Documents and Links" and "Description" decreased between 2004 and 2007, while the density of the use of interactive and proactive tools such as "Announcements," "Forums," "Works" and "Exercises" increased. This is a sign of a change in pedagogy towards more learner-centred approaches through the use of this technological tool. We could call this the "catalytic effect of ICT." These results are compatible with the Morgan's (2003) supposition that "faculty tend to first adopt the static content tools that let them post announcements, syllabi, and text and graphic content. Once they're more familiar with the system, they begin using the assessment, gradebook, and communication tools."

Hypothesis 2: Students' perceptions of pedagogy are linked to teachers' adoption of a pedagogical enriched approach to eLearning

A question which is becoming more and more important worldwide in Higher Education is that of professional development for teachers. This question is often described as a transformation of the teacher toward more learner-centred methods, or a movement from a transmissive paradigm to more interactive or proactive paradigms.

In a recent study (Docq et al., 2007), we presented students and teachers using the platform with a series (26) of statements about a pedagogic shift from traditional teaching to interactive or proactive teaching. The stem was: "Compared with courses where you don't use the platform,…" and the statements offered comparisons covering five categories determined by the pedagogic model some of which were: quality of resources (information), student engagement in tasks (motivation), interactions between students, interactions between students and teachers (interaction)….The more of these statements the participant agrees with, the more he or she perceives a change of pedagogy towards interactive or proactive activities. Again the questionnaires were available on the platform and only registered teachers and students could answer them. The number of responses was 153 for teachers and 1179 for students.

Table 4 shows the five statements which were most frequently accepted by teachers and students, in decreasing order of agreement. There is an interesting difference between the two groups in their perception of interactions. Students and teachers more or less agree that interactions between students increase when the platform is used, but they disagree strongly about interactions between teachers and students. Although 67% of teachers think that there is more interaction between students and teachers when the platform is used, only 44% of students agree; this is the largest disparity between students and teachers in the study ($p<0.0001$).

Table 4
The Five Statements With the Highest Levels of Agreement Together With the Percentage Agreement (PA), the $\chi 2$ Value Between Teachers and Students, and the Probability

Statements selected by teachers	Statements selected by students
Compared with courses where you don't use the platform ….	
1. The resources are more diversified PA = 73%; $\chi 2 = 3.9$; $p = 0.047$	1. There are more opportunities for students to interact with each other PA = 64%; $\chi 2 = 6.3$; $p < 0.012$
2. Students learn more about using ICT PA = 70%; $\chi 2 = 5.9$; $p = 0.015$	2. Students develop their ability to find information PA = 63%; $\chi 2 = 8.3$; $p = 0.004$
3. The teacher interacts more with students PA = 67%; $\chi 2 = 21.4$; $p < 0.0001$	3. The resources are more diversified PA = 63%; $\chi 2 = 3.9$; $p = 0.047$
4. The management of work groups is easier PA = 54%; $\chi 2 = 15.7$; $p < 0.0001$	4. Students learn more about using ICT PA = 57%; $\chi 2 = 5.9$; $p = 0.015$
5. There are more opportunities for students to interact with each other PA = 51%; $\chi 2 = 6.3$; $p < 0.012$	5. Students are better motivated PA = 46%; $\chi 2 = 2.1$; $p = 0.14$

We compared these opinions about a possible pedagogical shift (measured by the mean percentage of agreement) with the richness of the pedagogic setup encountered by the participants (as measured by the total number of platform tools used). Figure 5 gives the results for students, and shows a strong trend toward better perceptions of pedagogy when a lot of tools are available.

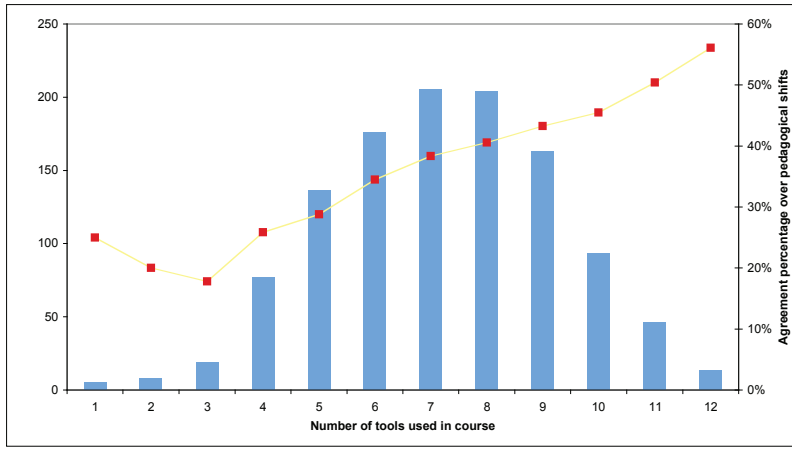

Figure 5. Comparison between the number of tools used in the course (frequency given on left) and the agreement percentage with the pedagogic shift statements (right)

The results for teachers are very similar : a great richness of the setup (number of tools) is related to greater agreement with the pedagogic statements. Figure 6 gives the error bars associated with the pedagogical shifts shown in Figure 5.

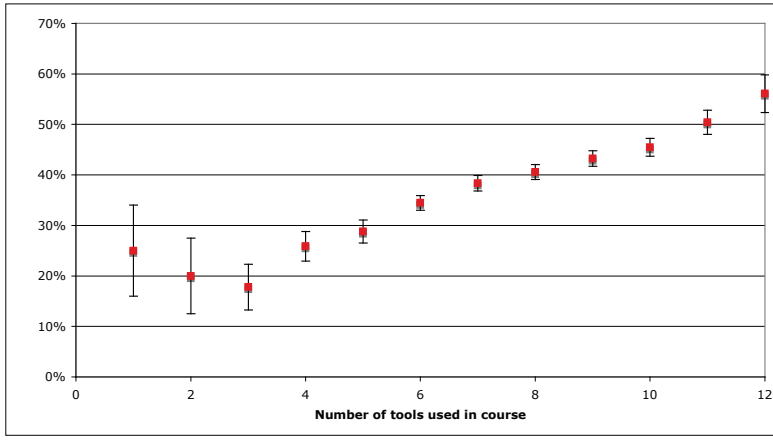

Figure 6. The comparison between the number of objects used in the course and the percentage agreement with the pedagogic shift statements, showing the error bars for the percentages

Conclusions

A lot of publications have emphasised the catalytic effects of technology on pedagogy (promotion of active pedagogy, teacher development, etc.). Empirical evidence of such a process is much rarer. We have tried to contribute to this important point by collecting relevant data, and also by using an appropriate methodology.

1. Our analysis of data on the use of the platform tools over the past three years, has shown a statistically significant movement from traditional uses (transmissive mode) to more innovative uses based on interactions between students and teachers, and the motivation of students' independent work. This kind of study should be undertaken elsewhere, and with different platforms. Our work might prove to be a benchmark for future pedagogical platforms.

2. To measure the impact of a pedagogic tool is very difficult. As a first step in this direction we investigated teachers' and students' perceptions of the pedagogical shift linked to the intensity of use of the Claroline platform. To do this, we measured the shift along the five axes of "our" pedagogical model. Such a shift cannot be evaluated without a pedagogical model to refer to. The mean perceptions were lower than expected (a mean percentage agreement of 38% over the 26 propositions), but we showed that the results were strongly related to the richness of the pedagogical setup developed by the teacher. Here too it will be necessary to repeat these measurements elsewhere, on other platforms and over time.

We believe that an intuitive platform like Claroline encourages the use of experimental methods by the teacher, who becomes more autonomous. Teachers may start their "pedagogical journey" by reproducing traditional practices with the new tool (using only documents upload) but step by step, year after year, they will experiment with other tools, and so develop a pedagogical setup which is more interactive or more motivating. The platform only allows the teacher to use these other tools. The incentive factors have to be sought elsewhere. In this respect, it is important to mention the impact of institutional efforts to encourage teachers to introduce pedagogical innovation. In this exploratory study, we cannot separate the platform effect from the institutional environment where it is located, which includes messages from managers, encouragement, the financing of projects, and the valorisation of teachers' pedagogical innovations. However, teachers' pedagogical efforts do seem to generate better perceptions of their learning among students, and this perception can stimulate and facilitate learning. It will be interesting in the future to study teachers who received help from other teach-

ers of the institution, and to investigate the sources of motivation of these innovative teachers.

Using two different approaches (one more objective, based on the logs of the platform, the other more subjective, using teachers' and students' perceptions), we have obtained some evidence that this eLearning platform contributes to the development of pedagogy. More thorough investigations need to be made to distinguish any effect of eLearning from the effects of other changes introduced by the institution (such as funds for pedagogic developments and valorisation of pedagogic effort by teachers).

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