OBTAINING TEACHING EXPERTISE FROM F2F LEARNING INTERACTIONS

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***Abstract*—Learning environments are commonly used nowadays, but they exclude face-to-face interaction among teachers and students what is a successful basis of traditional education. On the other hand, in many cases teachers are imposed to use technology, what they do in an intuitive way. That is, teachers "learn by doing" and do not fully exploit its potential benefits. Consequently, some questions arise: How do teachers use F2F interaction to guide learning session? How can technology help teachers and students in their day by day? Moreover, are teachers and students really opened to be helped by technology? In this paper we present the formal process carried out to obtain information about teachers' expertise and necessities regarding the direct interactions with students. We expose the possibilities to cover those necessities and the willingness that teachers show to be helped.**

Face to face interactions; learning systems; Interaction design;

I. INTRODUCTION

Teachers use the existing learning management systems, such as Moodle, Blackboard or Edvance360 as a support in the traditional teaching. The main functionalities of these systems are to manage users and resources (materials and pedagogical activities), administer access, track learning, evaluate, generate informs and manage communication services (forums, chats, videoconference, etc.). Meanwhile, web-based intelligent learning environments evolved from the first tutoring systems and learning hypermedia to cover the adaptation to learners as individuals. AHA! [1], DCG [2] or MAgAdI [3] are some examples. These systems try to adapt the learning content to each student according to his or her knowledge. Furthermore, other tools give feedback to teachers about the students' behavior so they can choose the next step when it comes to teaching. These tools usually use data mining as statistical techniques. Teacher Advisor [4], LOCO-Analyst [5] and SIgMa [6] belong to this group. Mazza and colleagues propose to help instructors [7] by means of graphical representations of tracking data obtained while students are using learning tools. However, the feedback that teachers receive is about interactions between students and other learning systems, not about the direct interactions between themselves and students.

All of the above mentioned systems try to help teachers and students in different manners providing them interesting information, for example about the student progress or how to plan the next learning session. Nevertheless, these systems cannot infer the motivation or participation of the students in class as a teacher can do. Computer systems cannot *see*, *listen*, or *know what happens* in the board or in the documents that teachers and students exchange. Because of that, teachers don't receive as much feedback as they obtain consciously or unconsciously from F2F interactions with students. This feedback comes from different sources, such as classroom attendance, tutorships or other communication media –e.g. electronic mails. It provides clues to analyze the progress of the learning group and lets the teacher to tailor the rhythm of the class. Therefore, education systems will produce incomplete help while teachers and students do not feed them with data about their F2F interactions.

Despite the learning technological support, teachers and students are still main actors in regulated learning, and the effectiveness of the traditional face-to-face sessions lean on the context and the conditions in which the learning interactions happen. For example, the teaching experience in classroom, the time that a subject has been running or the way in which subject information is transmitted among teachers, may influence a lot the teaching development and so, the way in which students improve their skills.

On the other hand, most of current teachers are not *digital natives*, so this generational gap impedes them to deal with all the information that education systems treat and many times they get lost and renounce to use these systems.

Considering this group of reasons, we believe that a founded knowledge model of teacher-student interactions could be useful to enrich current learning systems and so facilitate the use of educational tools in a global teaching-learning process for teachers and for students. Thus, in order to discover teachers' needs related to the management of learning interactions, we have designed an experimental guide to derive *teaching expertise*. The aim of this process is to capture the relevant information in traditional learning sessions so we can model these interactions.

This paper describes the whole empirical process we have carried out for seeking teaching experience from face-to-face learning interactions. The first phase was to elaborate a questionnaire for teachers. Its purpose was to promote an introspection process in teachers to allow them to express, articulate or identify that relevant information used as the base of their learning-teaching activities. This process is parallel to that carried out in [8], where a questionnaire for teachers is presented to investigate their needs for tracking student-computer systems interactions. This phase has followed a refining iterative lifecycle. It has been carried out by a multidisciplinary team composed of three teachers -on

computer science and psychology- and a computer science researcher. The final questionnaire is described in the section II. The next phase was to design the process of data treatment and interpretation to be applied on the obtained teachers data (section III). In section IV we present a validation of the questionnaire through a pilot test. And finally, some conclusions and future work are drawn in section V.

II. SEARCHING FOR RELEVANT INFORMATION

The main purpose of the designed questionnaire is to *know how teachers and students interact with each other*. If we discover the actual and desired interaction mechanisms we will be able to provide them with more adapted help, in useful contexts. This questionnaire pursues to foster an introspection process about the teaching activities carried out in classroom to improve the students' learning conditions; so, it may help teachers to specify, articulate and identify that deal of information This information will make up the ground basis for a *model of interactions*.

The questionnaire is composed of 31 questions. Firstly it included a big list of questions that were identified as meaningful by the designer team. However, through the iterative design process we obtained a more compact question set categorized in four item blocks, which was more understandable and less tedious for teachers. The four blocks are: *Teaching context*, *Planning of learning sessions*, *Interactions with students* (attendance classes, tutorships and evaluation) and *Technological help* to cover the teaching learning necessities.

Basically three types of questions have been used: multiple choice, scaled and open questions. With the aim of facilitating the selection of answers and maintaining teachers' motivation, the most of them are multiple-choice items. Scaled questions have been set mainly in the last block, where teachers can show their interest about some proposals. In all cases teachers may give their opinions or suggestions in the final open entry called *Others*. The survey contains two open questions too where we needed more explanations to analyze teachers' behavior. Next is presented block by block a summary of the questions:

A. Teaching Context

The purpose of this block is to establish the teachers' background with the aim of later discovering how the teachers' idiosyncrasy affects their teaching styles and use of educational tools. The last ones will be reflected in the remaining questions of the survey. Several associations and correlations will be explored by means of searching patterns. In this part we have included questions about teachers' aspects (`age` and `teaching experience`), about the subject they teach (`degree`, `course`, `credits`, `number of students`) and about the different material, tools and functionalities they commonly use.

For example, question 6th deals with the functionalities teachers usually use or seek in educational tools (see Fig 1). This is a multiple choice question where teachers can choose different opinions: `Repository`, `task definition`, `file uploading`, `examinations`, `exercise evaluation`, `access visualization`, `individual notifications`, `global notifications`, `calendar`, `blog`, `forums` and `chats`. A final entry allows teachers to explain whether they miss any functionality in the educational tools that they usually use. Fig 4-a shows the teachers' answer to this question in the pilot test by means of a graph.

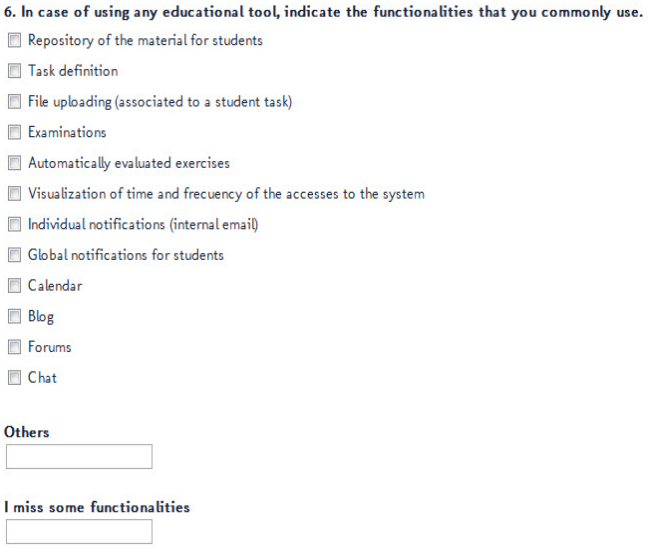

Figure 1. Sixth question of the questionnaire about the use of the functionalities in educational tools

B. Planning of Learning Sessions

This block tries to find teachers' habits when they plan learning sessions. The designed questions concern: the use of planning tools, whom the planning is meant for (the entire class, different groups of students, an individual student, etc.), information included in the plans, what is shown to students, and the typical modifications during the course and their causes. All this information will help us to find work patterns about the content preparation and teaching management.

C. Interactions with Students

Here we try to identify *how teachers interact with students* as the basis for a model of the interactions among teachers and students. Three different learning moments have been focused: `classroom attendance`, `tutorships` and `evaluation`. Next, a summary of the questions divided in the mentioned groups follows:

- For the aspects of the *classroom attendance* we have focused in the activities fulfilled, the information registered about these activities, the formation of groups of students and the reasons to change the planning of the day. These questions will help us to know the most used interactions to guide learning sessions.
- *Tutorships* become a main way for communicating and exchanging knowledge that cannot be forgotten when teachers-students interactions are modeled. The designed questions refer to: the communication media outside the class (email, face-to-face, chats,

etc.), the type and frequency of tutorships, the types of problems that students need to solve, and the influence that tutorships has in teachers' decisions. By means of these questions we try to find out the actual use that students make of tutorships and the way to fully exploit them for a better learning.

- In the *evaluation* part we try to deduce how the evaluation processes are carried out and whether a tool for managing evaluations would help teachers. Because of that, we revise different types of evaluations, the ways to record students' results, the issues in which teachers pay attention to evaluate the student behavior and, finally, the teachers' conclusions from those evaluations.

D. *Technological Necessities/Help*

Finally, the last block studies the interest of teachers in *recording* the different aspects mentioned in the previous blocks. Questions about the *student characteristics* and the *information storage* in classroom attendance, tutorships, and evaluations are here included. Besides, the willingness of the teachers to work coordinated with the rest of the teachers in the same course is explored. After all the introspection process, the final question of the survey allows teachers to valuate some proposals of functionalities in a helping tool.

III. DESIGNING THE STUDY OF THE DATA

In this phase we elaborated a plan to guide the study of the teachers' answers in order to anticipate possible meaningful associations and correlations. The purpose of this plan is: to establish *how to use* teachers' answers to extract information, to *find relationships* among discovered characteristics and their representations, and to *determine the statistic operations* to apply. The graphical visualizations will facilitate data interpretation.

For the extraction process, we have established a set of pairs of crossed variables —each question has been represented by a variable— where the statistic operations have been applied. Graphs of parallel bars have been mainly used to represent data, but also bubble charts and population pyramids in some cases. Teachers with the same behavior have been clustered in order to find characteristic patterns.

Fig. 2 shows some of the proposed crossings among the questions of the *Teaching Context* and *Interaction with Students* blocks. For example, crossing questions 16 and 2 ("*how do teachers form groups in class"* and "*teachers' age and teaching* experience", respectively*)* produces two parallel bars graph. In Fig 3 is shown the second relationship: `teaching experience|group formation`.

IV. THE PILOT TEST

Once designed the questionnaire and the process to be applied to the collected data, both were validated by means of a first pilot test. As result of this phase, the survey and data processing were improved, and a first set of conclusions was derived from teachers' answers.

After evaluating several alternatives, the pilot test was carried out through Google Docs due to its presentation characteristics and allowed types of questions. First of all, four members of the research team completed the survey and the early conclusions obtained allowed us to refine the questionnaire.

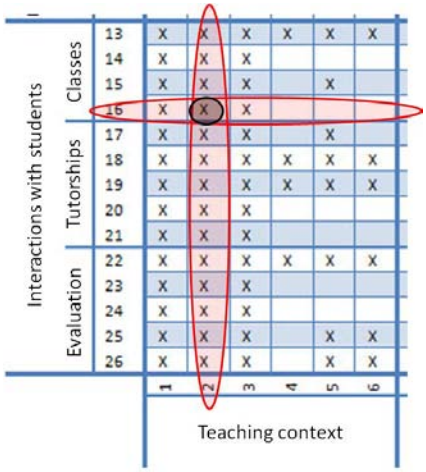

Figure 2. Proposed crossings among questions

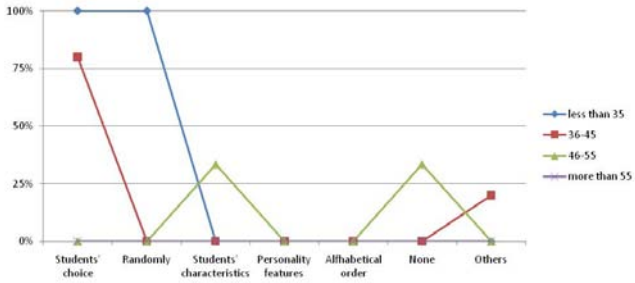

Figure 3. Chart obtained from crossing questions 16 and 2

The pilot test was developed through three stages: selection of the teacher study group; the survey process itself; and finally, analysis of data and improvement of the questionnaire.

Nine teachers from the Computer Science Faculty of the University of Basque Country formed the study group. To maximize significant results, several selection criteria were established to study whether the teachers' background influences their interactions with students. The considered criteria were: age, teaching experience, sex, department, course and use of educational tools. (1) Regarding the sex, we selected a balanced group of 5 women and 4 men; (2) with respect to the age, three 3-person groups were considered (less than 30 years, between 30 and 45 years, more than 45 years); (3) two groups of 3 and 6 person respectively were established for the teaching experience criteria (less than 25 years, more than 25 years). (4) Three people of each department (LSI, CCIA and ATC) were chosen as the foreseen differences among subject matters could influence their teaching styles. (5) We also tried to cover different courses, so 6 teachers give a compulsory subject and 3 an optional one. And finally, (6) we took into account just teachers that generally use education tools.

Once identified the study group, the selected teachers received an invitation mail to participate in the survey. A special care was taken to explain the survey general purpose in order to involve them and motivate their participation in the project. The response was very positive. One week later they received the questionnaire with a brief description of the purpose and the questions of each block (similar to the Section II of this paper). When all teachers fulfilled the questionnaire, they were interviewed individually to get whatever comment, suggestion or incident arisen during the survey. The aim was to detect the doubts or problems that teachers had while fulfilling the survey (for example, whether it was too long or difficult to understand), and to know their opinion about the different parts of the questionnaire. At this point we detected some difficulties and, together with the analysis of the teachers' answers, we improved the survey by modifying several questions.

Next, we expose the relevant results obtained from the pilot test. Although they are provisional and perhaps, at the end, not very significant results, they have provided us with clues about teachers' behavior and useful information about their interactions with students. The general survey planned for the very next future will help us to confirm, refine and enrich the discovered teaching behavior.

A. *Teaching context*

The Context block refers, among other aspects, to the functionalities that teachers use in educational tools. Fig. 4-a shows the percentage of teachers that use each of these functionalities. So, repository, definition of tasks, files uploading, global and individual alerts and forums seem to be the most used functionalities. On the other hand, teachers rarely use the students' access visualization, calendar or blogs, but they never chat, evaluate or examine through one educational tool. Fig. 4-b shows the relationship between the percentage of teachers using each functionality and the number of attendant students. Then, a positive correlation seems to arise between the use of the educational tool and the number of attendant students, so the more students in classroom the more use of educational tools. Therefore, we suppose that *teachers seek more support in educational tools when more students they have*.

B. *Planning of Learning Sessions*

This block has revelaed interesting reasons about teachers' replaning. By crossing the teachers' features with this aspect, several evidences point out the *course* as a probable motivation. Nothing can be said course by course, but its compulsory or optional nature make up perceivable differences; for example, teachers that give an optional subject replan considerably more times than others. Generally, this type of subject enrolls less students, which may be another possible cause; thus, teacher is allowed to go more quickly in the lessons or even pay more attention to the students. As shown in Fig. 5, teachers who give optional subjects replan their subject when interactions with other subjects or external factors arise. So we may set that *the rhythm of optional subjects is more adjustable, probably due to the number of attendant students, and allows replanning more frecuently than the compulsory subjects*.

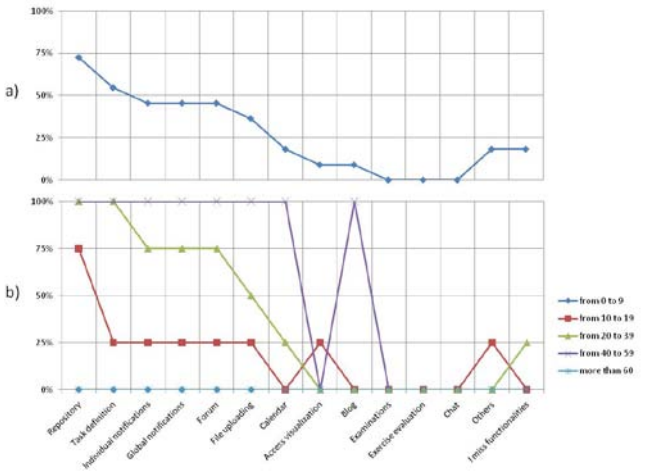

Figure 4. **a)** Use of tool functionalities and **b)** relationship with the number of students in class

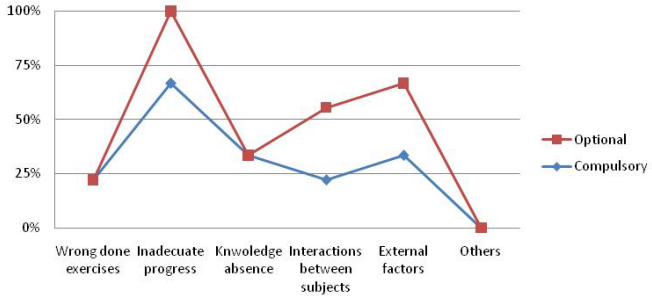

Figure 5. Relationships among reasons to replan / type of course

C. *Interactions with students*

Aspects of evaluation have been stressed in this block. Curiously, many teachers (56%) still use paper to register students' evaluation. This fact becomes more remarkable as teachers in the study group are computer engineers. As we can see in the Fig. 6, it seems that *the age plays an important role in this aspect as the younger teachers tend to use more technology support than the older ones*. So this issue will be considered for facilitating the evaluation register process.

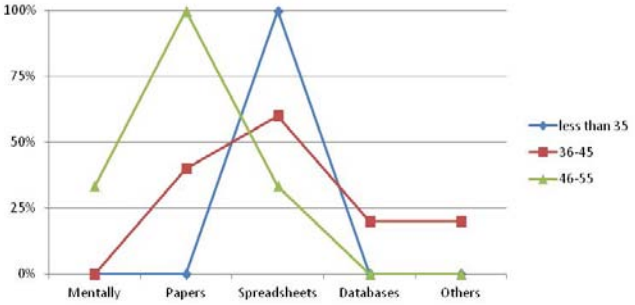

Figure 6. Relationship among supports for recording evaluations / teachers' age

D. *Technological Necessities/Help*

Teachers have evaluated their *needs of recording* several aspects by means of a helping tool, in the range "not at all interesting, not very interesting, fairly interesting and very interesting". Teachers' answers show some remarkable information.

First of all, *the more teaching experience teachers have, the more interest they show in recording the interactions happened in tutorships* (see Fig. 7), which makes tutorships an interesting issue to focus on. About the coordination among teachers, *most of them are fairly or very interested*, above all *about the students academic workload in the rest of the subjects* (see Fig. 8). The size of the bubble is related to the number of teachers that give the valuation; for example, for the *student's academic workload*, seven teachers gave 4 points, what means they were very interested in having some type of help in that sense.

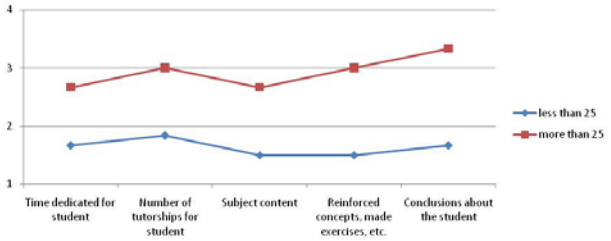

Figure 7. Teachers' evaluation of recording different characteristics of tutorships / teaching experience

In the last question we presented some ideas about the functionalities that a helping tool could contain. Fig. 9 shows that the *media of valorations was positive*. As a final conclusion, we found that the issues about teachers show more interest in are the ***coordination between themshelves*** and the ***detection of students with problems in their learning***.

V. CONCLUSIONS AND FUTURE WORK

The work here presented aims to model interactions among teachers and students in traditional sessions in order to build supporting learning-teaching tools applicable to face-to-face interactions in a blended context.

In this paper we have described the experimental process carried out to capture information about significant *teaching behavior* used by teachers to make strategic teaching decisions. The process included the design and application of a *pilot test* to teachers, the statistical study of teachers' answers, and individual interviews post-test. Its results show some interaction mechanisms among teachers and students.

Once improved the questionnaire from the teachers' answers, the opinion shown in the interviews and the statistical analysis, the next step is to pass the general test to a significant sample group. Teachers from the Computer Science Faculty and from the Psychology Faculty of the University of Basque Country will take part in this process during this year. This way, several teaching viewpoints will be taken into account because of the different characteristics of careers considered. Students' needs differ also according to the characteristics of the career, be technique or humanistic, so the behaviors and interactions will be different too. These differences will be also analyzed in the general test.

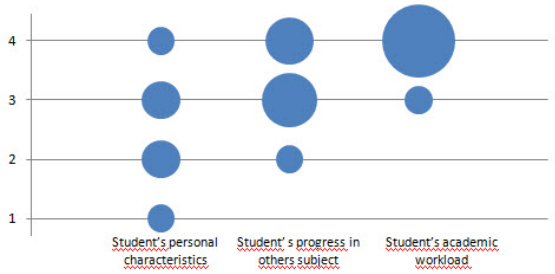

Figure 8. Teachers' evaluation of the coordination ways among teachers

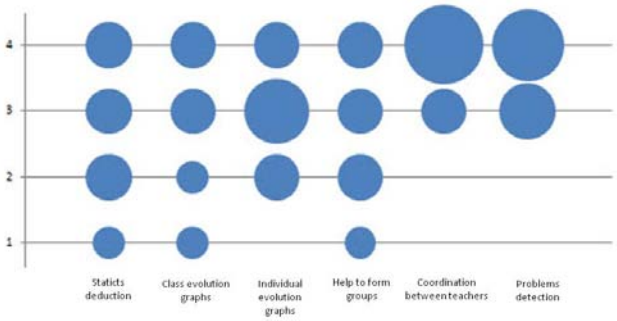

Figure 9. Teachers' evaluation of different functionalities proposed for a teachers helping tool

The study of the general test will allow us to confirm the preliminary pilot test results shown in previous sections, and to get more significant data. Besides, we will seek patterns in the teachers' behavior in function of their features by means of an inferential analysis of the data, instead of descriptive. We hope to reach a rich and sound set of conclusions to define a Model of Interactions.

Another aspect to take into account is the opinion and needs of students. Teachers and students viewpoints are to be considered to develop a powerful tool to helps teachers and students in the same way. Therefore, we will carry out a survey with students for this purpose once we have finished the proposed study about the teachers' viewpoint.

ACKNOWLEDGMENT

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