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What becomes of the learner who uses information and communication technology (ICT)? Case of the students in engineering of Tunis

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It is evident that it is not easy to determine the multiple components and facets which a learner could have in a classic class situation considering the complexity, the character and diversity of such situations. However, on the basis of a didactic theoretical framework which illustrates the relations between a learner and technologies used in class, we will try to "remodelise" it so that we can set up pedagogies which take into account this main actor of the educational system; the learner. Research that we carried out left the observation that many teachers converted with new technologies propose strategies including the use of the computer. Information and communication technology (ICT) invades the classes and is essential as an instrument "supporting" the lesson as well as the school learning. The objective of this work is to see what this learner has become? And to what extent he tends to change and adapt himself to the renewal of the institution in which he is actor. This is why we asked 145 students in engineering to express themselves, on the basis of a questionnaire, on the vision which they have of their statute in this system where ICT start to become omnipresent. The results are revealing a situation where the learners have to be reconsidered as central in the teaching-learning process.

Key words: ICT, students in engineering, Tunisia.

INTRODUCTION

The social sciences and didactics particularly, already studied learning in parallel with the use of the information and communication technology (ICT) under its various facets, tending to note that proposal as well as the answers given to the question: who is the pupil? are multiple and sometimes contradictory (Viau, 1996; Aumont and Mesnier, 1992; Rouet and Tricot, 1995). This question is of a main importance in the Tunisian education system which starts to integrate new technologies and which considers them as "solution" of a certain number of problems such as: the massification of the university, the lack of laboratories or even the delocalization of the institutions. ICT is regarded as one of the most effective means to overcome the problems of the Tunisian education system. Indeed, the new technologies of information and communication have now

integrated into the process of teaching and learning and are used by teachers and learners to access knowledge and to present it. The computer and its educational applications are ubiquitous and highly accessible for all. In this work, we focus on learning activities using chat, e-mail; search the Web or word processing programs. We are not interested in e-learning or distance learning.

The answer to the question on top would allow the taking into account of these dimensions which would make it possible to conceive and to develop its educational tools as well as teaching strategies which go in the direction of the institutional trainings.

The questions which we put are the following ones: who is this pupil who learns with new technologies? How is the person registered in this innovative process at the teaching level where he is engaged in a whole of

relations including his pars, his teacher as well as all these technologies used in class? Which are the dimensions that are adopted in a situation of training using a computer? To answer all these questions, we set up an empirical research which touched 145 pupils of the National school of Engineers of Tunis and which has as objective to locate the results of this learning compared to the various theorizations available in order to determine the reality of a situation which is long in being explored.

THEORETICAL FRAMEWORK

In the digital revolution that Tunisian education undergoes, the physical objects disappear, time and space are decompartimentalized and reality and the virtual one are replaced. Students makes experiments through simulations and continuous to realize his class from home. He becomes that "numerical learner" making use of new technologies of information and communication. But what do their roles become. Are they implied and more participants in their trainings? In this part, we will expose and examine the various relations that a learner can have with ICT.

User learner

In the field of the didactic of sciences as well as sciences of education, the learner is the most important consideration in any e-learning project. He is presented under its three facets: that emotional (viau, 1996), that cognitive and that social (Aumont and Mesnier, 1992). These three dimensions are requested and put at contribution each time a pupil is confronted with a process of training. Things become complicated when new technologies appear. Indeed, the pupil is not only any more a learner but also a user. User who must control and utilize these new tools to be able to reach the trainings. Stage before did not exist and which requires a more work from the part of the learner. The latter, added to the cognitive constraints ones, must support a "cognitive overload" (Rouet and Tricot, 1995) due to the necessary control of the software used at the time of the trainings.

The stress is laid here on the implicit difficulty which falls on learners and which could delay their trainings. Difficulty in particular related to the need to modify the framework of reference or the designs of learners (Giordan and of Vecchi, 1987). The processes of rupture and deconstruction which cause the trainings, at the base of logic constructivist, are disturbed and are long in being set up. However, focusing on the designs which could have been learnt by them, with respect to new technologies that they use in class and sounds outside, we will be able to say that this learning has two distinct dimensions. The first is to the stress the relation which

could exist between one learning and a tool. Also, it stresses the role of this tool in facilitating the work of a user and in reducing the complexity of its spot. In this case, the learner is passive. The other focuses rather on the relation of the pupil to the knowledge and seeks to develop the interrogations of learning in the teaching field (Coptlin and al., 2001). In this case, he is active.

Learning learner

Learner is conceived here as actor of his own trainings. He is an active subject which builds his knowledge and whose initiative to learn is very strong. The learner becomes more autonomous and active in the learning process. He becomes the principal pole of training. Indeed, the teachers as well as the teaching strategies that he sets up are put to his needs in order to direct his autonomous training and to facilitate his appropriation. The learner is no longer a simple user. He is responsible for his training. Taking into consideration his needs, his interests, his training styles, his strategies, his psychological problems: all is made to optimize his chances of success. Learning autonomy implies that he takes charges actively on all what constitute a training, meaning its definition, its management and its evaluation for its realization. Autonomy can not do without the red reflection of the enthusiasm that pushes students to work even harder to achieve their goals (Camilleri, 2002)

Confronted with various educational technologies, the learner adapts certain tasks which consolidate its school learning. Thus he seeks information, which carries out his projects and which collaborates, divides and transmits his knowledge and his "savoir-faire". He is active and responsible. His knowledge of the use the technological tools that he continues to acquire, enables him to go further in the knowledge of the tools used in class. Thus he will be able to use it in his trainings without worrying about the obstacles which the use of the ICT in class could present. Learner sets up a plan, and a strategy for his learning process. He learns not only how to look for information in these new tools when he is asked to do, but also learns what he needs to learn.

Teacher learner

In this case, it is the student who regulates the computer. Within the framework of a particular situation, the learner implements the variables that the machine will take into account and it is him who dictates the operation to be made and the steps to be followed. Logic constructivist takes to the top on that behaviorist. Learners are active and simulate the operation of an experiment or a machine. They must understand its operation to be able to display the anticipated results. In this case, the computer is handled by the students who seize some to

take the top of them. They feel superior by dictating on the machine. This supposes that they have a minimum of knowledge on this software which they handle and which they are supposed to make it into function.

Taught learner

In this case, the learner is not implied in the lesson lavished by the technological tools available in class. He does not feel concerned and completely forsakes the trainings which are exempted. He is rather passive and encounters difficulties because of the ignorance of the use of the ICT. In addition to handicaps related to the lack of manipulations pre-necessary disciplines, learners face obstacles when they use computers and certain software. The students are not engaged in an active way in the teaching strategy of the teacher. They undergo the imposition of didactic situations installed not taking account of their characteristics as well as their differences. The teachers count, in their preparation, on a model of student confined in the role of consumer and receiver of information as a tabula rasa.

In certain cases, learners do not have any direct contact with the technological tools available in class. It is rather the teacher who handles and uses in a purely transmissive objective. It is teacher, generally, who presents the chapters or elements of course through slides by using a computer.

Problems

In this work, we want to study the perspectives that students have on their roles in an education system where the ICT are, more and more, present. We want to determine various dimensions that a learner could have when the lesson which is exempted to him makes use of technological information and communication. We want to study the roles that students allot themselves and which they use to reach the trainings.

METHODOLOGY

Hypothesis

Our questioning relates to the type of dimensions that the students in engineering of the national school of engineers of Tunis allot themselves and make the assumptions that these learners are very at ease with ICT and that they would tend to be active and exceed the statute of passive user. However, we suspect that it is, especially, the teachers who motivate students in engineering to use ICT in class.

Method

Methodology that we adopted is based on the study of the copies left by the subjects which took part in our experimentation. The answers to the questionnaires which we built make it possible to determine the various manners with which engineering students conceive their position in an education system using ICT in teaching. The analysis of these questionnaires will help us to measure certain variables, at the same time, that are qualitative and quantitative. With this intention, there was some discussion about carrying out an analysis of contents likely to characterize these dimensions that allot our subjects and to answer the questions that we were asked. The questionnaire we used consists of three open questions that engineering students responded on paper. The questionnaire was constructed based on our prior assumptions that we suspect and we want to check. 145 engineering students who participated in this research have the same socio-economic and cultural background. The three questions which they answered freely are:

(a) Which are your computer skills?
(b) Which role do you have in the lesson using ICT?
(c) What motivate your use of ICT at the school?

The students who took part in this research are of second year of the following specialities "industrial engineering" and "mechanical engineering". They were informed by the experiment that we carry out and chose to take part in it in a voluntary way. No instruction was given to them as for the manner of answering. We have considered all the responses of the subjects participating in the research. We divide these responses into units of meaning that may be classified and analyzed. The answers to the questions reflect the individual views of engineering students reported about their vision of their status in relation to the integration of ICT into their lessons. The answers to the questions reflect the individual views of engineering students reported about their vision of their status in relation to the integration of ICT into their lessons.

Analysis of contents

The methodology of research that we adopted for this research is the analysis of contents which is defined as "a technique of research for objective description, systematic and quantitative of the manifest content of the communication" (Charaudeau and Maingueneau, 2002) and which presuppose "two fundamental operations", "pre categorization set of themes of the textual data and their quantitative treatment, generally computerized" (ibid). It is the item which will constitute the unit for the analysis of the answers of the pupils - engineers to the questions that we asked. The whole of the answers was divided into units of direction making it possible to take some so qualitative measures of the quantitative type. The answers to these open questions were gathered by items, then classified and analyzed. When the answers given did not correspond, in their contents, with item under which they were registered, it was held by it account as much as possible in the analysis, but they were also used to feed the interpretation made on the subject that they really concerned.

Description of the population of the guarantors

The 145 students in engineering solicited within the framework of this research are not representative of the students in engineering of the school. They are not, either, representative of the class of Tunisian students. They belong, however, to the same school level (second year: Vat + 4) and with the same beach of ages (22-23 years). We did not carry out any particular sampling: our work aimed to be descriptive of a "new" situation which is established in the Tunisian educational landscape. Situation where the ICT are, more and more, present. Let us note however, that the girls are represented only by 37 subjects and that the boys are 108.

RESULTS

Computer skills

Although, the analysis of the use cannot be limited within the framework of experimentation in qualitative matter, the various answers enabled us to have a rather clear idea on the institutional uses which students in engineering of technologies make, in the class and outside.

The on line communication

All the questioned subjects agree to give importance to the on line communication tools. They are at ease with email, discussions on forums. Indeed, 95% of the students in engineering declare to use free these communication tools to communicate with their partners but also with their friends. They make use of them for institutional purposes and further other needs. 80% of the subjects use the discussion forums and the chat to remain in contact with the others. They make use of them also to exchange messages and files of several types. They use also other formats like jpg, MPEG, wave, mp3, pdf and others are known within an extra school framework.

Word processing

The word processing is also omnipresent in the answers of the participants to the experimentation. Indeed, 98% of the students in engineering use "Word" as a tool of communication exclusively in an institutional framework. The totality of these subjects already prepared projects for the account of some courses and some teachers.

Presentation of numerical documents

The totalities of the participants were brought to set up presentations for the account of certain courses and to expose them for their colleagues. They have a very good knowledge of "Powerpoint" and its multiple functions. However, 74% among them affirm to have known it at the university contrary to the email, the discussion forums and "Word".

Software of simulation

All the questioned participants work now on new experimental devices, were familiarized with the probes, the sensors and the software and do not have any problem to treat graphs or to analyze results posted on screen. For 46% of them, the software of simulation make possible to treat the data quickly and effectively. They give the possibility of simulating and of modelling certain phenomena which are dangerous to handle or impossible to make by traditional practical works. The software of simulation allows 34% students in engineering to remake the experiments as much once as they want with a good speed, an excellent precision and a very satisfactory reliability. For 28% of them, this software facilitates the analysis of the results and make possible to have more time to reflect on the studied phenomenon.

However, 24% of the questioned participants seem to be interested more in the monitoring of the variables on screen and the discussion around their variation. They seem to be more tallen by the dimensions on analyses and results given by the machine than that on handling one. We should not deny that pupils must test directly on real phenomena. Simulations should never replace the real experiments systematically (Nonnon, 1998).

The creation of web pages

The results concerning the creation of web pages are astonishing. Indeed, a good part of our participants have already created a web page within an extra school framework. 46% of the students in engineering who answered the questionnaire affirm to use tools for the creation of web pages. 78% of them say that they started by putting on line a personal page using free sites to control, thereafter, certain interactive software which make possible to create more developed pages and where we have the possibility to personalizing things.

Spreadsheets

Contrary to all that preceded, the students in engineering do not seem very interested by the spreadsheets. 64% of the students say that they do not make use of it currently in their trainings. The majority (89%) seem to know, in a superficial way "Excel" and seldom use it when automatic calculations are asked. 32% affirm that they use spreadsheet when they made statistics following a request made by a teacher. Indeed, rare are the guarantors (14%) who clarify that they were motivated by the training of the spreadsheets as well as by their use (Figure 1).

The results which precede show at which point, the students in engineering, are at ease in the use of the TIC. They show that their technological knowledge is developed enough and that some of them were acquired out of school framework. This knowledge is a major asset which could reinforce the emergence and the adoption of a personal dimension tended to be developed with regard to technologies in class.
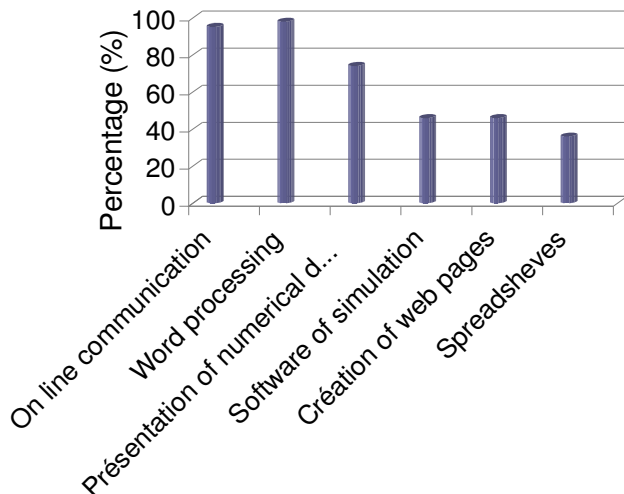
Figure 1. Declared aptitudes of the students in engineering in computer skills.

Dimensions of the engineering students using ICT in education

Through the questionnaires which we collected, we could distinguish four dimensions or roles that allot the engineering students confronted with lesson and trainings where the ICT intervene.

User learner

Only 7% of the students participating in this experimentation are seen as simple users of a technology. They are rare to clarify their incapacity to use the material available in class or they agree the utility of these new tools for the future engineer. However, 85% of them insist on the speed of technology evolution and on the impossibility to follow its rate/rhythm. They have difficulties when a teacher introduces a concept by using a software or a program which they do not control yet. 65% of the students in engineering estimate that they become passive users of ICT when the teacher forces them to not do anything but to follow his own exposition. It is in this precise situation that students feel they are obliged to be passive and to act consequently. 42% among them insist on the need to permit them to work on the software which they will use before making them work on the concept that the teacher present. They agree (86%) to be distinguished from the other students considering the specificity of their trainings and their very technical character.

Learning learner

It should be noted that a majority of the students (68%) in

this experimentation said to be autonomous in the trainings that they make by using ICT in class. 92% sent E-mail and files regularly and 45% use frequently forums of on line communication sites. It is very current that the students in engineering seek information on the net and that they divide them while collaborating on various subjects of work. 72% among them confirm that they learn by using ICT inside and outside the class. They give importance to certain sites which they are accustomed to consult when they need to find relevant informations for their trainings. Our students do not trouble too much about the evolution of technologies and consider them, rather, like tools helping in trainings. Learning is done, from now on, in a traditional way but also with the support of ICT (Figure 2).

The development of the knowledge and "savoir-faire" are considered as inherent in the process of teaching-training. These future engineers do not worry too much about the speed of this evolution. Indeed, 87% of them are addicted of technology and continue to use it outside the class. Thus 54% of our students are said very concentrated on the trainings when the strategy of the teacher includes a shutter using ICT. The use of technology does not constitute an obstacle to the acquisition of institutional knowledge.

Teaching learner

In this case, students in engineering (64%) who "program" the computer. They implement the variables which the machine will take into account and dictate, thus, the operation to be made and the steps to be followed. The constructivist logic takes the place of that behaviorist. In this case, the computer is handled, especially, by the students. 53% of them feel superior when dictating on the machine. The role of learner changes and is considered as teacher having to control the operation of a material which they will use in their trainings.

This role of teacher is prolonged to take into account their colleagues to whom they provide personal explanations and interpretations. Indeed, 71% of learners are said to have used the multiple communications tools, already-noted and assist some of their classmates. This strategy used in classic classes continues to exist in a context, where technologies are present.

Taught learner

In this case, it is ICT and particularly the computer which guide the students in engineering towards certain kinds of trainings. 24% of them acknowledge that the tools available in class lead them to follow a number of stages and tests. They confirm that the errors that they commit have the objective to help them to recognize their gaps and to acquire knowledge with or without "the intervention"
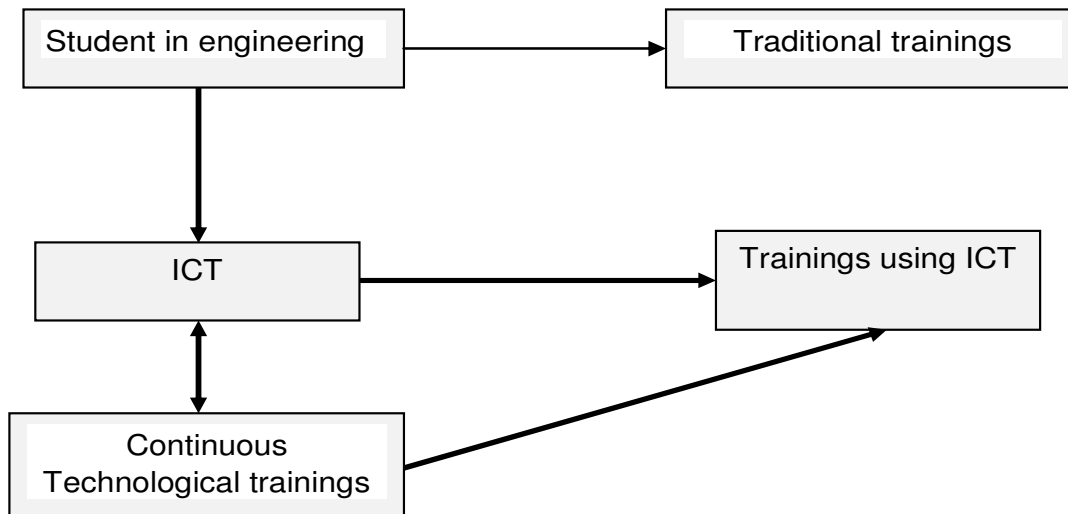
Figure 2. The student in engineering learning with and without ICT.

of the teacher. 12% of the learners do not hesitate to use and re-use this option to give themselves more chances to reach the trainings. Indeed, when learners are not able to understand the explanations of the professor, they can be folded back on certain software which allows the repetition and which can be the subject of out of the class. Moreover, the interactivity of these technologies (18%) makes the presence of the teacher "temporarily" possible.

The results which precede show that the students in engineering, confronted with the use of ICT in class are seen as active actors. They exceed the traditional stereotype of learners on whom tasks are imposed. Indeed, they are considered, generally, like "learning" or "teaching" in an institutional environment using technologies. Our student in engineering sees himself learning and evolving/moving with the support of a computer. His technological knowledge which is developed enough, and which constitutes, generally, a handicap for the other students, facilitates his trainings. Thus we confirm our first assumption by proving that students in engineering have a developed control of ICT and are active in its use in class. The roles which they allot can constitute a platform to the construction of pedagogies using ICT and where trainings will have better quality. In fact, taking into account learning styles of engineering students, newly faced with the use of ICT, could be studied, analyzed and taken into account to build lesson plans. A detailed study on this theme would help to understand this point.

Motivations behind the use of ICT at school

The motivation is this internal force which pushes us to act and involve us in the life without having clear reasons.

The motivation directs the attention towards people, situations or tasks. It is closely associated to our personality and our own history. In the absence of a theory on the motivation of the pupils to learn in a technological environment, we will try to determine the factors which could be involved in this new environment. In answer to the question: What motivates you to use ICT at the school? The students in engineering give answers which are mitigated but revealing a situation that we suspect and that we will expose in the paragraphs which follow.

Myself

In this case, 20% of the questioned students in engineering are said to adopt a favorable attitude with respect to the new technological environment. Attitude conditioned by witnessed experiments in contact with ICT and the familiarity which results from this. This kind of motivation is often correlated with needs like continuing, making a success of a task or to collaborate with other users of ICT. The expertise and the ability that these students have to handle and control these new technologies confer them stability and impulse their trainings. Perception that they have on their future job and their being as students in engineering, distinguish them from the other students, the thing that reveal on them a very positive evaluation of their capacity to carry out a task or activity using ICT.

The others

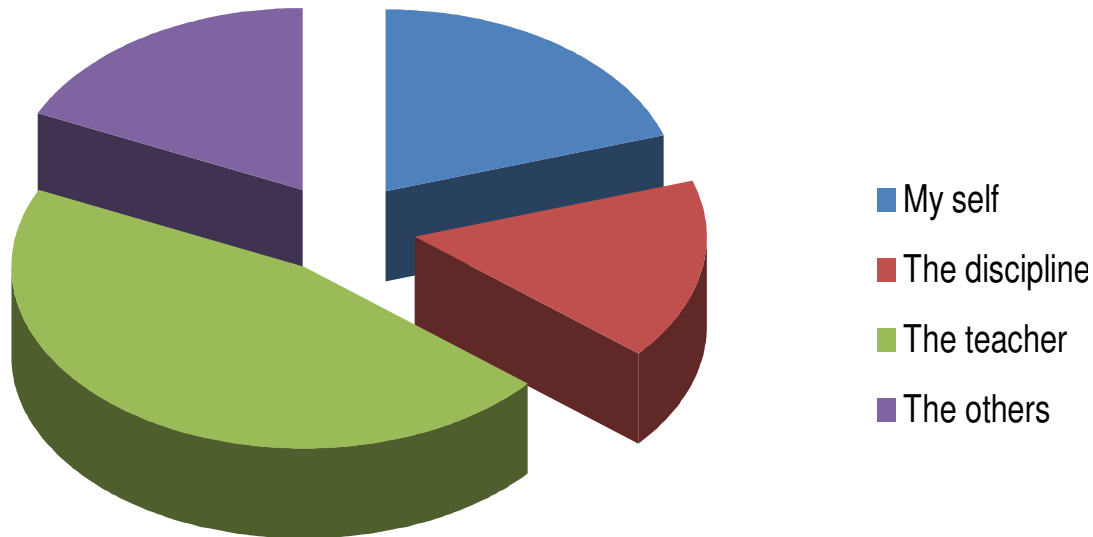Learners belong to a number of networks in which some influence him more than others (Wentzel, 1999). He

Figure 3. Motivations behind the use of ICT.

attracts much satisfaction of the members of his family, of his team of foot or his class. His co-operation together with his competition with the others offers him both gain and benefits. The interactions between learners, which appear in a socioconstructivist technological environment, constitute an undeniable source of motivation. Thus 18% of the participating students relate their motivation to use ICT to support their partners as to the feeling of membership which justifies their engagement with respect to the trainings supported by ICT. For 43% of them the interest with new technologies emanates from a certain pressure and encouragement of those around them who think that the control of the technological tools is synonym of success.

The discipline

For 16% of the students in engineering, some scientific disciplines are adapted to pedagogies directed towards the realization of training tasks. These pedagogies exceed the traditional model where the teaching practices aim, especially, the development of cognitive abilities. These teachers adapt the disciplines to the use of ICT and centre the lesson on learners in class. They encourage collaboration between students and help in the development of effective strategies of training. In these disciplines, the students in engineering seek information, make simulations to measure certain variables, and even see themselves sending job files on behalf of their teachers. They are constrained, thereafter, to make presentations by using numerical tools. It is also noticed that for 11% of the students in engineering, the use of the ICT in these disciplines supports the interdisciplinary trainings in a constructivist technological

environment.

The teacher

In this case, learners answer to an external stimulation which maintains them active. The presence of computers in class constitutes a stimulating change which reveals reactions. Indeed, for 46% of the student engineers participating in the experiment, the new teaching practices initiated by the teacher and the new ways of teaching involve a social dynamics which creates cognitive needs at learning. For 29% of them, the emotions of the technophile teachers and his motivation for the use of ICT in education can be transmitted to them. These teachers help their students to set up a positive evaluation of the tasks which they carry out on behalf of the trainings using ICT. The extrinsic reinforcements operated by the teachers developing the trainings of their learners and reinforce their motivation to use ICT in class and out of it. The freedom which the students in engineering (32%) enjoy when they are brought to use the computer, in a didactic situation built by the teacher, provide them an autonomy which represents an additional source of motivation (Figure 3).

The preceding results show, at which point, the students in engineering, who took part in this experimentation, are conscious of the importance of technologies in their trainings. Their motivation regarding ICT takes form in intrinsic personal attitudes but also through external elements such as the nature of the discipline taught or "the others" and particularly the teacher. This last seems to take a great importance in the motivation of the students to the use of technologies in class. It is "the person" who transfers his enthusiasm,

which legitimates the use of the computer and which justifies it. He encourages and pushes his learners to go further in the trainings using ICT while proposing it as a sample of reference. We confirm our second assumption and affirm that the teacher remains the first source of motivation of the students in engineering as for the use of technologies in class.

OBSERVATION

The literature shows that there are differences between the sexes in the use of computers and technology in education (Atan et al., 2002; Fortunati and Manganelli, 2002). Even if we did not thought from the start to do a work on this kind, we think that it is useful, in this experiment, to provide you with the result which we noted and who shows the distinction between boys and girls in the use of ICT in class. Indeed, girls seem to have less preliminary knowledge in informatics than that of boys. 64% of girls are motivated, generally, by their teachers in the use of ICT in class and 67% of them are presented as users of technologies. Girls do not appear spontaneously bent towards learning new technologies and tend to avoid technology (Cooper and Weaver, 2003). They are comfortable with ICT, but have no ability to take into account all developments in this field. They have always been users of the computer without, however, go further in computer literacy.

We noted also that girls do not like the virtual environment because they consider it cold and unfeeling. They are for the classic face to face. However, even if they find that this way of learning depersonalize the relationship between educational actors, they adapt themselves and perform. The girls' attitude towards ICT seems to be different from that of boys in the Tunisian context. A future study is needed.

Conclusion

The work that we carried out, and which touched 145 students in engineering, confirms that the status of learner is transforming and evaluating taking into account the progressive integration of new technologies in education. The results show, at which point, these students are at ease with ICT. A tool which enables them to be seen as actors of their own trainings in an environment, more and more, technological. These learners are conscious of the importance to monitor ICT and do not regard themselves any more as simple passive users of technologies. Their trainings are also done using ICT.

The elements which justify the use of technologies in class are intrinsic and come from a positive attitude regarding them and extrinsic coming from the influence of the others, of the nature of the taught discipline but especially of the teacher. This last, often technophile, remain the first source of inspiration and motivation of the learners. It will be, consequently, useful to deal with his techno-pedagogical training and to generalize this kind of research to take into account all engineering students and also their teachers.

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