

Information & Communication Technologies vs. Education and Training: Contribution to Understand the Millennials' Generational Effect

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Abstract—Information and Communication Technologies (ICT) are increasing in importance every day, especially since the 90's (last decade of birth for the Millennials generation). While social interactions involving the Millennials generation have been studied, a lack of investigation remains regarding the use of the ICT by this generation as well as the impact on outcomes in education and professional training.

Observing and interviewing students preparing an MSc, we aimed at characterizing the interaction students-ICT during the courses.

We found that up to 50% of the students (mainly female) could use ICT during courses at a rate of 0.84 occurrence/minutes for some of them, and they thought this involvement did not disturb learning, even was helpful. As recent researches show that multitasking leads people think they are much better than they actually are, further observations with assessments are needed to conclude whether or not the use ICT by students during the courses is a real strength.

Keywords—Education, ICT, generational effect, training.

I. INTRODUCTION

TEACHERS explain daily the difficulties they have to catch their students' attention by their lectures in classroom or theatre while the students "play" with the iPad, iPhone, laptop computers... "As a professor, complaints that mobile phones distract from learning are ubiquitous. Text messaging, Facebook, and Twitter are the usual suspect applications. I personally hear these complaints from other professors, administrators, and a lot of people over the age of 40" [1]. In classrooms, it has become difficult for teachers not to be disturbed by mobile phones ringing and strategies must be invented by them to cope with the problem such as using electronic devices producing interferences during the course making mobile phones useless. Recently, the Ofsted chief inspector for schools (UK) declared to the Daily Mail that mobile phones had to be banned from schools. The article's author reported: "The new chief inspector of schools [...] blamed mobiles for constant low-level disruption which hampered learning and called for them to be barred from classrooms" [2].

In workplaces, experienced engineers complain about young newcomers running to their smartphone whenever there

is a time break. During an intervention at a French nuclear Power Plant in 2012, an experienced worker in a maintenance department said: "when I was young, it was not like that: any break was an opportunity to discuss and learn more about the job." According to Martin [3], for people born after 1990 "growing up in the digital age, be connected, that is what counts. They spend most of their time 'online'. According to a survey of young professionals in the world, one third of the respondents said that Internet was just as important as the food, water and air, while half of them, it ranks just behind these three elements."

These observations may be done in the workplace because of an increasing recruitment of young workers combined with a "skills drain" phenomena due to a massive retirement of experienced workers [4]. Statistical data illustrates the need of young workers to renew the global ageing population: the world population older than 60 y. will increase from 11 to 22% between 2012 and 2050 [5].

Combining these "skills drain" and renewal of working population with the last years immeasurable progress of software and Information and Communication Technologies (ICT), the world of work tends now to be made of new talents empowered by innovative ICT sometimes within old-rules organizational systems [6]-[9].

These findings, among other factors beyond behaviors and attitudes at work [9], [10], contribute to make experienced workers think that new generation is less involved in the work than they themselves could be whilst younger [11], [12]. It is clear that the nowadays newcomers generation does not learn as the new employees used to do twenty years ago [11], [13]. Observations in the universities or in the training sessions of companies, or observations of teenagers' daily life show how they switch fast and often from one source of information to another, how fast they integrate intuitively the operating of new software, what experienced workers cannot do so easily. The so-called "Millennials generation" (born between 1979 and 1994 [12]) is more exposed to and uses more ICT than previous generations and this has an impact on the work [14] from different standpoints: educational, organizational, interpersonal...

In this context, our study aimed at giving qualitative and quantitative data regarding the way Millennials generation is used to working in academic context. This pilot research intends to contribute to cope with the lack of research

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regarding the new generation and its possible potential to enhance organizational and operational performances [12]. The final purpose is to contribute to identify the way education and furthermore professional training must adapt in order to match the new generation's expectations and capacities on one hand, and the institutions need of performance on the other hand.

II. METHOD

The study was based on observations and interviews in individual and collective approaches. All were done at the London School of Economics and Political Science (London, UK) in December 2012.

Observations aimed at objectifying students' behavior in relation to ICT during the lectures and courses. Here, ICT were understood under five designs: the mobile phone, the iPhone, the iPad, the tablet, and the laptop (Fig. 1).

Interviews aimed at giving elements to understand the observed behaviors.



Fig. 1 The five designs regarding the Information and Communication Technologies observed: from bottom to top, the mobile phone, the iPhone, the iPad, the tablet, and the laptop

A. Collective Approach

Three observations were made during a weekly two-hour lecture course. Each observation lasted one hour every week.

The theatre (Fig. 2) in which observations were carried out is divided in two levels. The first level is the floor stall, close to the lecturer standing on the stage. In the floor stall, teachers and professors attending the lecture are used to sitting. The second floor is the balcony where none of them sit. The observations were made on the balcony during one hour each.

This choice is fundamental: indeed, being far from the lecturer and the attending teachers favored a natural behavior. Many studies have demonstrated that the behavior may be different depending on the fact that subjects feel responsible about what they say or what they do in relation to someone or something else that make or not authority (see for example Milgram's pioneer work [15], [16]).

The constitution of the samples of subjects depended on the students' attendance. Therefore, the samples changed from one observation to another. Details are given in Section III-A.

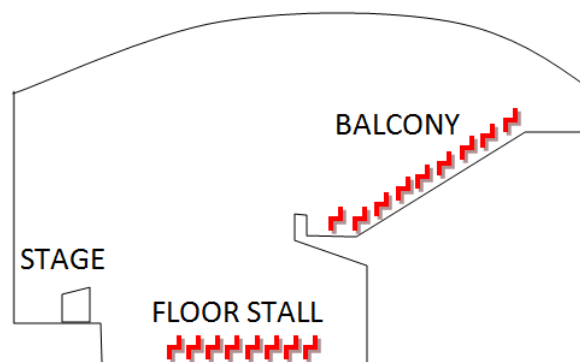


Fig. 2 Drawing of the theatre

B. Individual approach

Three students, female, 23-25-yo., were observed using iPhone and tablet during three courses in a classroom gathering about 10 to 15 students.

Student A was observed from a qualitative standpoint while students B and C were observed both from a qualitative and quantitative standpoint. For students B and C, the work activity was observed close to the subjects in order to identify the purpose of each of the operations carried out and everything was time recorded.

To avoid a bias due to observation, students were not aware of observation before doing it; they were said to have been observed after it and were then asked their agreement to use the data.

Following these observations, an interview after the last course observed aimed at better understanding what students did with iPhone and tablet and why.

These interviews also aimed at understanding the motives of students observed in the collective context.

III. RESULTS

A. Collective Approach

Table I gives the constitution of the samples for each of the three observations and indicates the proportion of students involved in the use of ICT at least during several minutes.

The samples were mainly female students (male were less than 33% for the higher rate). The population was young as mostly preparing a Master of Science (less than 25-yo. for more than 83%) thus representative of the Millennial

generation.

The rate of students involved in ICT was varying from 22 to 50%. The higher rate was obtained for the lower number of students in the sample. This rate was the higher likely due to the fact that most people involved in ICT were always present at the lecture on the balcony, perhaps not to be seen by the teachers.

TABLE I
CONSTITUTION OF THE SAMPLES AND INVOLVEMENT IN THE USE OF ICT

observation #	N	male	age <25yo.	ICT involved (total)	ICT involved (male)
1	40	33%	88%	50%	10%
2	60	20%	83%	22%	2%
3	80	18%	88%	29%	4%

The data also showed that students involved in ICT were mainly female: when 20% male attended the lecture, only 2% of the global population were males involved in ICT; the higher rate was 10% involved for 33% males present.

B. Individual Approach

The students observed in individual context were female as observations in collective context showed that mainly females were involved in ICT.

Student A was observed using frequently but shortly the iPhone. The frequency was between 10 to 15 uses per hour, and the average time length for the involvement in ICT was mostly less than 1 minute.

During the interview, student A explained being involved in checking sms, personal emails, but also checking internet information concerning the course including the London School of Economics and Political Science website providing useful complements about the lessons. Fig. 3 gives an insight of the kind of web resource available for students. Thanks to WiFi, wherever they are inside the university, students can browse the contents of pages directly related to their courses. The slides of the lectures are available on line.

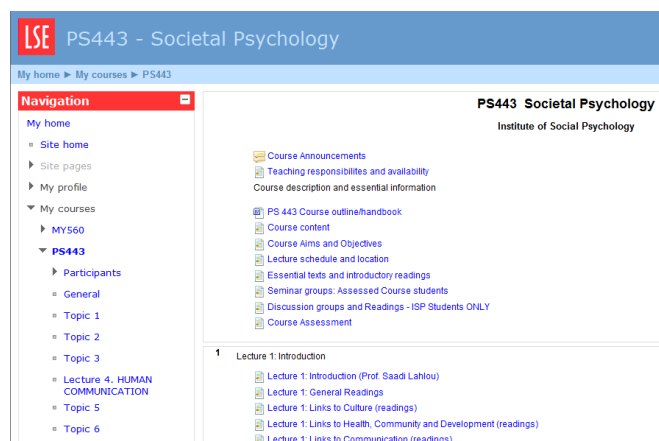


Fig. 3 Example of web page related to courses available for students on the London School of Economics and Political Science web site

Basically, subject A explained that the use of ICT helped

her to better understand the course and that these involvements being very short; they did not disturb her to understand correctly the course.

Subjects B and C were involved in a close and careful observation. During the course, the observer was sat beside subjects as a student like others, taking notes related to the course and at the same time notes linked with the present study, recording time for each operation done by the subjects.

Student B was using both iPhone and tablet. Her work activity could finally be decomposed in four main sub-activities:

- 1- uses iPhone for sms and personal purpose,
- 2- uses tablet for other purpose than the course,
- 3- uses tablet for course such as checking information related to the course (see Fig. 3),
- 4- listens to the teacher or participates to an exercise.

The time length of the observation was 39 minutes 20 seconds. The measurements showed a higher frequency of ICT use than for subject A. Fig. 4 shows the evolution of the rate of ICT use per minute. The value ranges from 0 to almost 4 occurrences per minute (occ/min), with a mean rate equal to 0.84occ/min (about 50 occurrences per hour). During the 39 minutes and 20 seconds observation, subject B had 27 interactions with ICT of type 1, 2 or 3 among which 6 were of type 3 (related to the course).

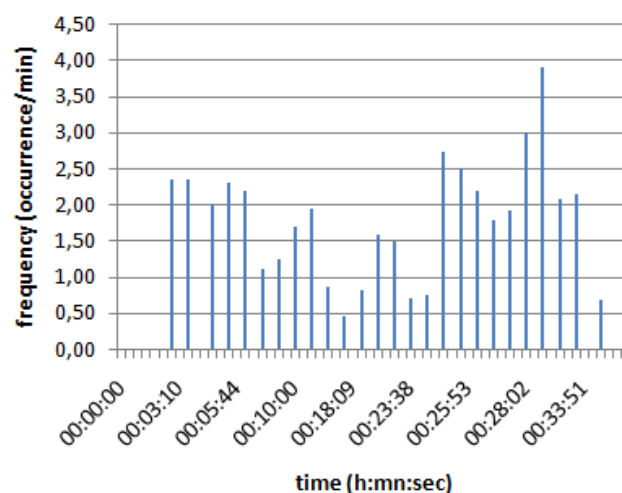


Fig. 4 Evolution of the rate of ICT use per minute for subject B

The distribution of time length for ICT interaction is shown Fig. 5. This modal analysis is done considering classes of 5 seconds each. The mean time is 31 seconds with a high standard deviation equals to 37. Yet the higher proportion is obtained for the 6-10 seconds class. The class "41+" is linked with the use of type 3 (related to the course).

Fig. 6 draws how student B switched from one sub-activity to another. Two periods are distinct, separated at time 00:11:00 (11 minutes after the beginning of time recording). This bound was associated with the course transition between the lecture and the exercises. The chart Fig. 6 illustrates that during the lecture done by the teacher, student B switched

among the four types of sub-activities, while being involved in doing exercises between 00:11:00 to 00:20:00 and then in correcting exercises from 00:23:00 to 00:33:00, student B mainly switched from using iPhone to listening and participating.

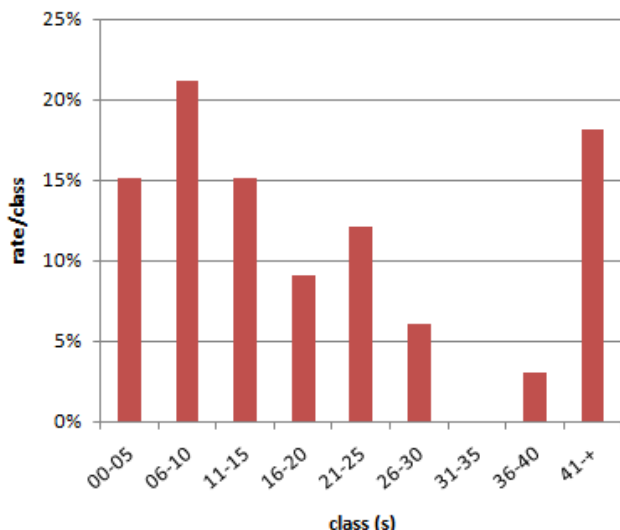


Fig. 5 Distribution of time length for ICT interaction for subject B

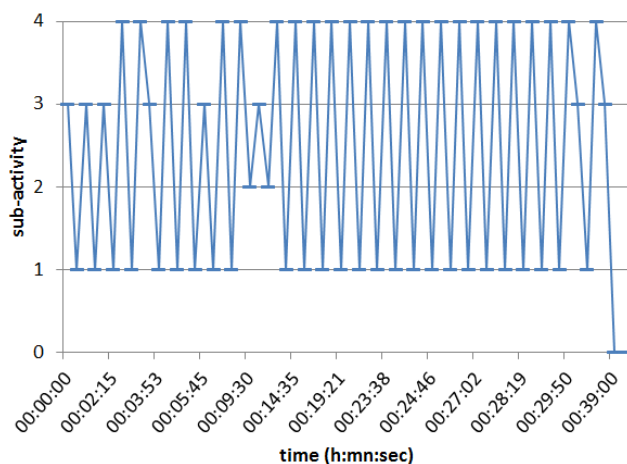


Fig. 6 Distribution of student B's switches from one sub-activity to another

Sub-activities are: 1- uses iPhone for sms and personal purpose, 2- uses tablet for other purpose than the course, 3- uses tablet for course, 4- listens to the teacher or participates to an exercise

The total of time during which student B was involved in the use of ICT of type 1 and 2 during the 39 minutes 20 seconds observation was 10 minutes and 55 second. This represents a rate of 27.7%.

Subject C was using only iPhone. Fig. 7 draws the distribution of her sub-activities over time observation. As we can see, compared to subject B (Fig. 6), the behavior is quite different. Subject C used ICT only at the beginning of the course and then put it on her desk likely without paying

attention to it. The total time spent for the ICT use is 5.0% (compared to 27.7% for subject B).

Subject C spent time on iPhone just twice: the first time for checking messages on her iPhone, and the second time to send an sms. The rate of ITC use is for this subject 3.05 occ/h.

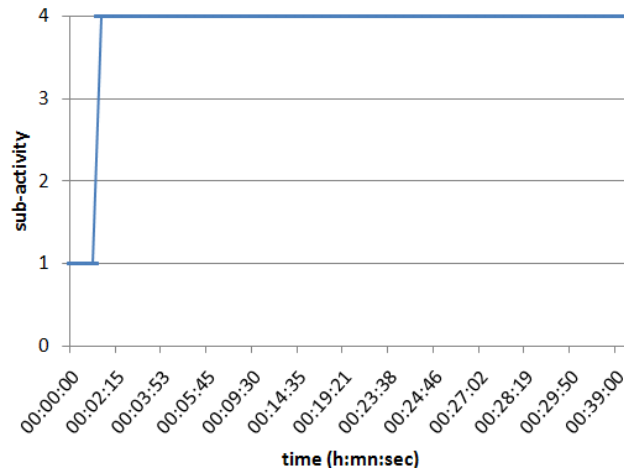


Fig. 7 Distribution of student C's switches from one sub-activity to another

Sub-activities are: 1- uses iPhone for sms and personal purpose, 2- uses tablet for other purpose than the course, 3- uses tablet for course, 4- listens to the teacher or participates to an exercise

TABLE II
SYMBOLS & UNITS

Symbol	Quantity	USI
N	Number of subjects in a sample	none
r	Correlation coefficient	none

IV. DISCUSSION

These findings showed that mainly female students were involved in the use of ICT during courses and that students may think that this involvement does not disturb their comprehension of the lesson, even it helps them as they check information related to the course through ICT.

Doing so, they switch from one task to another: hearing the teacher, writing notes, checking sms, personal emails, checking internet information concerning the course or the lecture. Individual observations of three students showed a disparity in terms of rate of ICT use. Subject B revealed a permanent zapping between four different sub-activities during a course observation lasting 39 minutes, including 27 switches: this behavior is in the domain of multitasking activity. Subjects A and C were involved in a quite different way of ICT use, with much less switches of this type.

Yet, recent studies have shown that multitasking is not so efficient than what is thought by the concerned subjects [17]. Assessing and observing about 275 students performing multitask job such as remembering a set of two to five letters while performing simple mental calculations, it was found a "lack of concordance between perceived and actual multitasking ability". While 70% (193/275) were confident in

their multitask skills (assessing themselves over the average capacity), the correlation between this self-assessment and the actual performance was very poor: $r(275) = 0.08$. The best performance was obtained by monotasking subjects.

Such results applied to our research context lead to the assumption that, despite a self-assessment by some students saying that using ICT during the courses does not disturb their understanding of the courses, this self-assessment might be (highly) over-estimated and the actual understanding might be worth than what they think.

As a consequence, thinking that the Millennials generation has a potential performance resource through ICT during the courses or any training sessions (including professional training) might be a mistake for some of them (subject B type).

This hypothesis, if true, would be in complete disagreement with what was assumed in section I: the possible potential of the new generation to enhance organizational and operational performances [12] might be not a potential at all but a latent weakness for some of the Millennials generation.

To mitigate these words, we must nonetheless notice that i) there was a significant difference between subjects A/C on one hand and B on the other hand, and ii) there was a significant difference between the first and second periods of subject B's activity. This suggests that a generalization of results is not possible, or in other words, the conclusions are necessarily nuanced. It is essential to be careful and to notice that there might be at least two modes of multitasking in the studied context: an obvious constructive multitasking and a likely damaging multitasking. The constructive multitasking would consist in using ICT in the way of the sub-activity 3 to sustain the course in progress. The damaging multitasking would combine sub-activities of type 1 and 2 with a high rate of occurrence.

To illustrate these considerations, let us analyze subject B's activities devoid of the sub-activities of type 1 and 2 (use of ICT for personal purpose). In this case, the mean occurrence of ICT use is reduced to 0.15occ/min equivalent to 9.05occ/h (compared to 0.84occ/min for the observed situation). This rate is closed to subject A's behavior estimated at a rate of 10 occ/h. In this hypothetical case, the time spent for ICT use decreases to 16.6% of the total observation time (compared to 27.7% for the observed situation).

V. CONCLUSION

Collective observations during lectures at the London School of Economics and Political Science (London, UK) conducted with Millennials students in Master of Science showed a significant amount of students involved in the use of ICT during the lecture in theatre. Despite a lower rate of male students attending the lecture, quantitative data showed clearly that female students were more involved in ICT use during the lectures than males.

Individual interview indicated that students might think using the ICT help them to better understand the lesson when dedicated to browse information related to the lecture while

using ICT for personal purpose did not disturb the learning process.

Yet, recent research regarding multitasking shows that this kind of self-assessment is not correlated to the actual performance. Thus, switching from one task to another during the courses, from the lesson to the iPad or iPhone or laptop, may appear as strength while in fact it might lead to an opposite effect. If so, the ICT-based boredom of teachers in universities or the one of the experienced workers about their new coming colleagues could be justified. If not, the Millennials generation has effectively a new potential that could perhaps be better operated in academic or professional training.

The present research has established that Millennials generation has effectively a new way to work and study during training courses and has proved that the use of ICT in a learning context may be significantly intensive. It assumes that there is at least two modes of multitasking in the studied context: an obvious constructive multitasking (using ICT in a way to sustain learning) and a likely damaging multitasking (a combination of using ICT for another purpose than learning with a high rate of occurrence).

Further observations and assessments are needed to objectify that this new way to work and study is efficient or is just a decoy.

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