Las TIC en los procesos educativos de un centro público de investigación

ICT in the educational processes of a Public Research Center

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Palabras clave
TIC, formación docente, competencias digitales, educación superior, centro de investigación

RESUMEN

Este artículo determina los factores que inhiben el uso sistemático de las tecnologías de la información y la comunicación (TIC) en los procesos educativos del Centro de Investigaciones Biológicas del Noroeste, SC (CIBNOR), y examina el nivel de afectación en la adopción de estas tecnologías para factores como edad, relación de la práctica docente, estímulos que perciben por su ejercicio, perfil laboral y profesional, entre otros. La investigación se desarrolló con enfoque cuantitativo mediante la aplicación de una encuesta a la totalidad del personal académico del CIBNOR, el análisis estadístico de la correlación de los datos y el análisis gráfico de dispersión y regresión. Los resultados demuestran que el perfil de los académicos de la institución, en general, doctores dedicados a la investigación de alguna rama de la biología, no constituye un factor que afecte la familiaridad, uso, actitud y competencias que tienen sobre las TIC; la edad se muestra como un factor poco significativo y, en cambio, la insuficiencia de los estímulos económicos hacia la docencia se perfila como el elemento que inhibe la adopción de la tecnología en su ejercicio y provoca que los académicos de la institución subordinen la práctica de la docencia a sus actividades de investigación.

Keywords
ICT, teacher education, e-skills, higher education, research center

ABSTRACT

This research determines the factors that inhibit the systematic use of Information and Communication Technologies (ICT) in the educational processes of the Centro de Investigaciones Biológicas del Noroeste, SC (CIBNOR). In the same way it examines the level of affectation in the adoption of these technologies for factors such as age, the relation of the teaching practice, the perceived incentive by its exercise, the professional and job profile, among others. Therefore, a quantitative research was carried out, applying a survey to the entire academic staff of CIBNOR, statistically examining the correlation of the data and the graphical analysis of dispersion and regression. The results show that the profile of the institution's academics, generally of PhD dedicated to the research of some branch of biology, does not constitute a factor that affects the familiarity, use, attitude and competencies that they have on the ICT; age is shown as an insignificant factor, however, the insufficiency of the economic incentives towards the teaching is outlined as the factor that inhibits the adoption of the technology in their practices, causing the academics of the institution to subordinate the practice of teaching to their research activities.

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INTRODUCTION

ICTs affect every aspect of our activities. The use of these technologies is established as an indicator of modernization and social progress (Vesga-Parra & Hurtado-Herrera, 2013). Education may take advantage of its use in multiple circumstances and from several models of action (García, Ruiz & Domínguez, 2007). These technologies pose as elements to make education and the development of processes that insert the university in the context of knowledge societies more flexible organizationally. However, the adoption of ICTs in educational processes has not been easy since there are still hurdles that hinder their adoption; some of these obstacles are external (extrinsic barriers), more specifically having authorities and governments provide technical resources; and others are inherent (intrinsic barriers) to the participants: feelings, beliefs and ways of working in the classroom (Ertmer, 1999).

The issues in adopting ICTs arise in educational environments which their substantive activity is teaching, as is the case of universities (BECTA, 2004). Therefore, it is imperative to revise how to size this phenomenon in an institution other than a university that offers masters and doctorate degrees in an eminently academic environment in which the substantive activity of the academic staff is research more than teaching. This is the situation in which falls CIBNOR [The Northeastern Biological Research Center], pertaining to the System of Public Research Centers of the National Council for Science and Technology (Conacyt [Spanish acronym]) in Mexico.

Background

In order to address the background of this topic, we have used Area (2005)'s proposal on studies that revise "the perspectives, opinions and attitudes of external educational agents (administrators, supervisors, support teams) and the teaching staff toward the use and integration of technologies in classrooms and in educational centers" (p.5).

In these studies, we once more go over the idea that the acceptance and adoption of ICTs in educational processes is multifactorial. The human factor, more specifically that represented by teachers, is of the utmost importance since teachers can become "the driving force of this new modality or the worst hindrance for its effective incorporation" (López, 2006, p. 408); they are "key to the success or failure of any initiative regarding the ICTs implementation in education" (Araiza, Doerfer & Castillo, 2012, p. 2). It is not surprising that they are at the center of the discussion and, at times, of the polemic, since, among other aspects, they are affected by the standards related to the technology, the requirements, the opportunities and the changes. In acknowledging theses challenges to the implementation and adoption of technology makes it possible to focus

the attention on the needs and adverse situations teachers are facing (King, 2002).

One of the main unfavorable scenarios to teachers is that ICTs are still considered a source of conflict in educational processes; they are considered a crisis area in which many participants play a role (Pelgrum, 2001). King (2002) claims that technology has the ability to confuse, intimidate and frustrate students and users. Meanwhile, Boza, Tirado and Guzmán (2010) point out that school is still thought as an ICTs enemy since a large number of teachers have not yet really integrated them, let alone use them, or if they do, they use them superficially and technically. Likewise, a large number of the study areas of teaching have not evolved enough to incorporate them.

Guevara (2010) comes up with another relevant datum that may become a source of conflict and affect the perspective with which a research work on technological integration may be seen. This author argues that facing technological integration is complicated since there is no common definition of the term, and that in general, technological integration has not been achieved. On the one hand, Ottenbreit, Glazewski, Newby and Ertmer (2010) claim that technology is not used to support the type of instruction the United States of America consider the most important. It is clear that incorporating ICTs in the teaching-learning processes means an educational change and innovation which process is complex and cannot be reduced to equipping the schools and preparing the teachers and students as mere users of this type of technologies (Vera, Torres & Martínez, 2014).

There is a complex relation between school and ICTs, more specifically with teachers; the beliefs that motivate or encourage their use are not clear (Ottenbreit *et al.*, 2010). One of the catalytic circumstances of the adoption of technology in the teaching-learning processes is the familiarity individuals have in regard to technology. Along these lines, Johnson (1984) infers that teachers with direct knowledge of external programs registered greater percentages in the high scores of receptivity than those that only had indirect or no knowledge at all.

The same author remarks that the participating teachers have a tendency in being positive and their skepticism diminishes with experience. In accordance with the foregoing author, López (2006) points out that teachers trained in the use of ICTs exercise a greater way of planning education than those that were not which, at the end, is transformed in a better technology mastery in regard to the development of classroom support materials.

Rivera (2009) points out that one of the most significant findings of his research is to have identified seven elements: the disciplinary knowledge, the teacher's conception of the student, the didactic planning, languages, technology, assessment and the person, which have an impact on the

didactic transposition process on what the teacher considers to be a greater value effort added to knowledge to foster the student's learning by using technology or not.

Furthermore, Boza *et al.* (2010) infer that, in general, technologically qualified teachers use technologies and newer applications and, they consider that teachers' training encourages structuring an opinion on the existence of ICTs in school. For Ottenbreit *et al.* (2010), when teachers learn to use technology within their specific content areas or academic level they can transfer this knowledge with greater facility in their own classrooms.

Vera *et al.* (2014), in the conclusions of this study, hold that "teachers who are trained in ICTs show significant differences in educational planning in comparison to those without any training; this translates into a greater mastery of information technologies in regard to the development of classroom support materials" (p. 151). Conversely to the evidence presented up so far, Rodríguez, García, Ibañez, González and Heine (2009) found that "it seems that there is no direct relation between the level of competences in ICTs and the adoption of an innovation based on these technologies as LMS" (p.47).

To know and to be familiar with are, as revised, essential to adopting ICTs and to influence positively the teachers' beliefs. For Ottenbreit *et al.* (2010), teachers' beliefs are the most important barrier to achieve the integration of technology focused on the student. Boza *et al.*(2010) assert "that teachers' beliefs influence the frequency at which they use technology and the positive assessment they make of the processes and resources they have for the integration of ICTs" (p. 14). However, they caution that training teachers to improve the teaching staff's beliefs on technological integration does not suffice but it will help create the appropriate opinion to involve teachers with awareness and consistency in a transformation of such magnitude. According to Guevara (2010),

> The conjunction of infrastructure, literacy and the *habitus* of teachers toward the integration of technology, has greater possibilities since it is the *habitus* of teachers that will link their beliefs and their actions to integrate the curriculum to technology, and not only acknowledging its importance but to keep away from it (p. 6).

Another significant topic for this study is the profile of the participants. The CIBNOR professors have a homogeneous professional profile and they distinguished themselves for having developed their career around biology and related careers; most of these professors have doctorate degrees. Therefore, Boza *et al.* (2010)'s consideration is important in regard to the professional training and competence that can be linked to factors associated to beliefs, values and attitudes of the teaching staff. Johnson (1984) has made another significant finding on professional characteristics which seem not to be decisive in the receptivity of the teaching staff even if this profile provided valuable clues to understand

acceptation differences. In this same study, negative considerations are exhibited toward the mediation of the technology of professors in the fields of medicine or dentistry in which the requirements of clinical practices represent an obstacle.

Another significant contribution is the inference that educational centers have met the technical needs of the institutions by providing them with the equipment necessary to develop their substantive activities which fosters the reduction of extrinsic barriers. Boza *et al.* (2010) agree with the previous statement and declare that intrinsic barriers do not represent a problem given the great investments of resources that continue to be made; however, these have not produced the intended results.

Guevara (2010) frames his study in a context where the investment in technological infrastructure in educational institutions grows even more. Along these lines, King (2002) observes that in the last years, many resources, public as well as private, have been designed to provide schools with hardware and software technology so the students may have the opportunity of learning and using technology in their academic activities. Meanwhile, Araiza *et al.* (2012), despite the fact that professors considered that the technical resources they had were sufficient, realized that the use of said resources was particularly low.

Boza *et al.* (2010) make a distinction between optimists and pessimists on the use of ICTs in educational processes; they point out that the former, in general, show a better *habitus* and satisfaction in regard to the services the Network offers, and the differences between them were statistically significant. Pelgrum (2001) found that many countries, on a regular basis, monitor the status of ICTs in education in order to revise the investments which, in some occasions, are enormous.

Age is an aspect which is a source of discussion and discrepancy and it is an interesting factor within the context of this study since CIBNOR professors are people whose average age is far beyond than that of a digital native. López (2006), in his results, infers that there is no relation between the age of a professor and his attitude toward the acceptance or rejection of situations that constitute an innovation. Conversely, Vera *et al.* (2014) assure that age is definitely a factor and they point out the that the younger generation are perceived as having a better mastery of ICTs and, the older a person is, his knowledge in regard to the use of ICTs diminishes. Taking into consideration the foregoing statement, Araiza *et al.* (2012) mention that professors are one element that may impede the use of ICTs in the Mexican higher education, since the majority of them are older than 40; hence, the projection for the integration of ICTs seems to be long and complicated.

The awareness of the advantages of ICTs is another recurrent fact in several revised studies; however, their use has not been consolidated yet. According to Pelgrum (2001), even in favorable environments,

approximately 40% of the education professionals considered the lack of hardware as an important obstacle. Ottenbreit *et al.* (2010) argue that professors with positive beliefs toward technologies do not always adopt them in their professional practice.

Boza *et al.* (2010), agree with this idea and they point out that the majority of teachers believe that technologies encourage students self-learning and improve their academic performance, even that of those students with special educational needs. Araiza *et al.* (2012) notice that professors, in general, have a favorable perception of the use of ICTs; however, they have found that teachers are visibly incredulous in that ICTs bring significant benefits to the teaching-learning processes, hence, the urgent need of supporting and training teachers in a timely and relevant manner.

This last analysis obliges us to revise the issue of the teachers' profile in the context of higher education, which are characterized by being efficient in mastering the knowledge of their subject area and their profession; however, recruiting qualified teachers, updating their knowledge and enhancing their qualities with didactic training programs in general, is still an important topic for higher education institutions (Rivera, 2009). One of the facts of university teaching in Mexico is that the majority of teachers lack "pedagogical training (especially didactics) to face instructional practice, and they often go from their original field of action to the classroom with the assumption that they do know how to do it, they do know how to teach" (Guevara, 2010, p. 2).

It seems that adapting ICTs to educational processes is a structural problem. Studies show the teachers' interest but the institutional environment lacks systematized strategies to achieve the adoption of technology, notwithstanding the fact that, in general, institutions have the appropriate information infrastructure. However, the lack of training of the teachers "implies requiring an institutionalized and systematic pedagogical training aiming at facilitating the learning of new teaching competences" (Vera *et al.*, 2014, p. 144).

THE RESEARCH

At the time when the research on technology and education has evolved and has focused its efforts and attention of the effectiveness of MOOC, the *moving learning*, the effect of social networks, among other topics, there are other contexts where the barrier of the basic adoption of technology in educational processes has not been transcended. This seems to be the situation inside CIBNOR, which has catalyzed the consideration of conducting those studies based on the following objectives:

- Determine how the academic and professional profiles of the CIBNOR academic personnel affect the use and adoption of ICTs, in general and in particular, in the teaching practice.

- Know if there are significant differences in regard to the age of the teaching staff concerning the perceptions they have on the use of ICTs.
- Explore the consideration of the academic personnel of the institution on teaching and the incentives they perceive in exercising the teaching profession and how it affects the adoption of ICTs.

Phases of the Research Development

Sample

The population who participated consisted of a group of CIBNOR researchers, as direct teachers or thesis advisors at the masters and doctorate levels of the postgraduate study programs of the institution, which number, according to the most recent documental revision, amounted to 113.

Our data are based as follows: trust level 95% (k=1.96), simple error 5% (e=0.05), proportion of individuals in the population with studies 50% (p=q=0.5) and population N=113, in such a way that n= 88, considering that the resulting number for the sample is close to the total sample. In order to avoid any sampling error, we collected the data for the totality of the population in such a way that: n=N.

Information Collection Instruments: Construction and Reliability

The data collection instrument was obtained through a survey with a Likert-type scale, built and adapted to the CIBNOR context from Orantes (2009), Tejedor, García and Prada (2009) and Ruiz (2012)'s proposals, besides taking into account the standards proposed by the United Nations Organization, Science and Culture (UNESCO, 2008 for the competences in ICTs that a teacher must possess and those proposed by the International Society for Technology in Education (ISTE, 2008).

The instrument consisted of two sections: The first was to collect information on aspects of general identification of the participant and to configure his/her professional profile (gender, age, belonging to the National Researchers System , weekly teaching hours, weekly research hours...) (16 items); the second section was made up of 46 items proposed to explore how familiar the participants are with the use of ICTs, the type of technological tools they use, and the technical skills they possess for their use, and to characterize the influence ICTs have had on their profile and professional practice, their attitude towards technology and the type of barriers that have greater influence on the adoption of ICTs (intrinsic and extrinsic). The 46 items of the second section are configured on a Likert-type scale: 1: strongly disagree, 2: disagree, 3: undecided, 4: agree and 5: strongly agree.

The instrument was validated through a pilot test with a small number of participants. We used the IBM SPSS Statistics Grandpack 23.0 academic

version statistic package, to conduct a reliability analysis with Cronbach Alpha criterion and obtained a .903 result.

The instrument was administered to 103 participants in printed format; 81 documents were returned which represents 71.68% of the established sample.

Data Analysis

We conducted statistical analyses (means, standard deviations and percentages), correlation analyses (Pearson correlation, determination coefficient) and dispersion and regression graphic analysis through the IBM SPSS Statistics Grandpack 23.0 package.

Research Results

The research results were as follows: the institution teachers staff is made up of 68.93% male and 31.06% female; with an age mean of 53.64 years; 98.8% have doctorate degrees; on an average, they have spent 22 years doing research and 17 years teaching: they spend an average of 37.44 hours weekly to research and 5.53 hours weekly to teaching in front of a group.

For this work, we went over the first objective proposed in regard to how the academic and professional profile of CIBNOR academic personnel affects the knowledge, use and adoption of ICTs in general and more specifically in their teaching practice. First, we conducted an analysis of the considerations the teachers of the institution have on how their profile affects the use of ICTs; furthermore, we presented a specific analysis on how familiar teachers are with ICTs, competences in ICTs, digital profile, attitude towards ICTs and the analysis of the considerations CIBNOR teachers have in regard to the provision of technical resources they possess.

According to the data obtained, the participants considered that their academic and professional profile (Academic and Professional Profile variable) is favorable to the integration of ICTs in their teaching practice; for 88.3%, their academic and professional profile did not represent an obstacle to the adoption of ICTs in the teaching-learning processes; a very low percentage, 5.2% said the opposite. As statisticians, we have the following values: mean of 4.08, median 4.16 and mode 4.00.

In regard to the familiarization that participants say having, we observe that they possess a good level of familiarization with ICTs and their use as educational technology (ICT Familiarization variable): 72.4% are familiar with ICTs, with a mean of 3.54, median 3.60 and mode 4. Only 9.2% considered they were little or not familiar with ICTs.

The results reveal that CIBNOR teachers show an appropriate level of competences in the use of ICTs in their practice (ICTCompetences variable): 63.7% said having ICTs competences, while a significant 18.8% disagreed in having said competences, with a mean of 3.24, median 3.33 and mode 3.33. Regarding the digital profile (DigProfilevariable), 84.8% make use of technology as support for their professional activity, while 8.9% make very limited use or no use at all of technology, with a mean of 3.73, median 4.00 and mode 4.14.

In regard to the consideration teachers of the institution have on possessing the proper technical infrastructure to exercise their professional activities, (Infrastructure variable), 68.7% considered having the proper infrastructure. However, 22.5% disagreed, with a mean of 3.29, median 3.33 and mode 3.56.

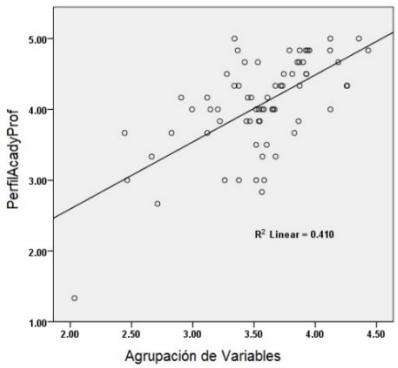
As for their attitude toward ICTs (ICTattitude variable) the participants were very much in favor: 91.1% showed a positive attitude; a very small percentage, 5.1, had a negative attitude with a mean of 3.29, median 3.33 and mode 3.56. In accordance with this result, we included a specific item on the consideration of feeling uncomfortable using computers; only 9.9% pointed out such condition, with a mean of 1.64, median 1.00 and mode 1.

In a correlation exercise of the variables described above in regard to the academic and professional profile, we obtained the results shown in Table 1 and Graph 1 that group the different correlated variables. We used the SPSS software for both analyses.

Table 1. Correlation of the academic professional profile

Variable	Variable	Correlación de Pearson	Sig (bilateral)	Coeficiente de determinación (r^2)
PerfilAcadyProf	CompetenciasTIC	.428**	.000	.183
	PerfilDig	.481**	.000	.231
	Infraestructura	.441**	.000	.194
	ActitudTIC	.381**	.001	.145
	FamiliaridadTIC	.539**	.000	.290

**The correlation is significant at level 0.01 (bilateral).



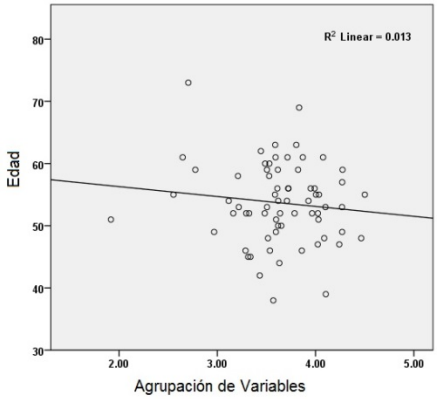
Graph 1. Regression of the academic professional profile.

The teachers' consideration on the influence of their academic and professional profile is clearly consistent with the positive correlation of this variable with the different dimensions revised, mainly with the familiarization they said they have with ICTs tools.

The second objective proposed is to know if there are any significant differences concerning the teachers' age on the perceptions they have of the use of ICTs. We conducted a correlation analysis and the results are shown in Table 2 and Graph 2. We note that there is a negative correlation but it is extremely weak and not significant; it is therefore feasible to reject the fact that age has an influence on the adoption of ICTs.

Table 2. Age Correlation

Variable	Variable	Correlación de Pearson	Sig (bilateral)	Coeficiente de determinación (r^2)
Edad	CompetenciasTIC	-.052	.649	.002
	PerfilDig	-.110	.340	.012
	Infraestructura	.089	.434	.007
	ActitudTIC	-.143	.213	.020
	FamiliaridadTIC	-.090	.441	.008
	PerfilAcadyProf	-.110	.343	.012



Gráfica 2. Age Regression.

To respond to the objective on the consideration of the teaching staff of the institution concerning teaching and the incentives they perceive on this activity, and how it affects the adoption of ICTs, we requested that the participants give their opinion on the predominance of their research work over teaching: 75.3% asserted that their research activities had predominance over teaching, while only 9.9% disagreed, with a mean of 4.01, median 4.00 and mode 4.

An important variable is materialized in the consideration of the academic personnel of the institution on the economic incentives they perceive as a result of teaching. Along these lines, we asked the participants to give their opinion on whether the National Researchers System contributed to the practice and improvement of teaching; the response was divided: 37% disagreed or strongly disagreed with this statement while 53.1% agreed or strongly agreed which shows a significant polarization of 3.15, median 4.00 and mode 4.

On the other hand, we asked the participants to tell us if the institutional incentives fostered teaching: 49.4% answered no, while 28.4% answered yes. This aspect shows a certain polarization, although to a lesser degree. Here, the percentage of indecision is noteworthy: 22.2%, with a mean of 2.69, media 3.00 and mode 2.

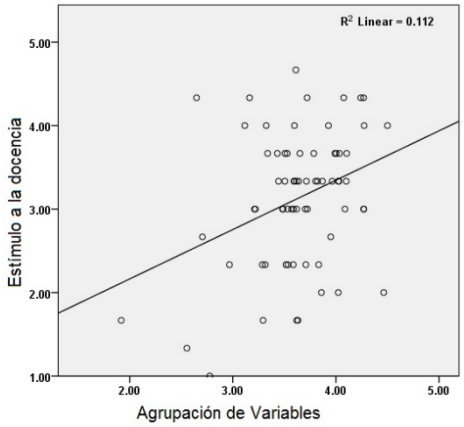
Concerning teaching within the institution, we asked the teachers if their professional practice was considered an additional burden not economically rewarded when they used ICTs: 51.3% disagreed and only 13.7% said the contrary, with a mean of 2.41, they measure 2.00 and mode 3.

The results of the correlation exercise on the incentives they perceive on exercising teaching and how this affects the adoption of ICTs are shown in Table 3 and Graph 3 where the different variables are grouped.

Tabla 3. Incentive to Teaching Correlation

Variable	Variable	Correlación de Pearson	Sig (bilateral)	Coeficiente de determinación (r^2)
Estímulo a la docencia	CompetenciasTIC	.261*	.020	.06
	PerfilDig	.377**	.001	.14
	Infraestructura	.278*	.013	.07
	ActitudTIC	.029	.802	.00
	FamiliaridadTIC	.204	.080	.04
	PerfilAcadyProf	.413**	.000	.17

*The correlation is significant at level 0.05 (bilateral).
** The correlation is significant at level 0.01 (bilateral).



Graph 3. Regression of the incentive to teaching.

In general, there is a positive mean correlation; however, it is relevant to highlight the opinion polarization of teachers on the consideration they have in regard to the influence of the incentives they perceive by teaching and adopting ICTs.

DISCUSSION

The results of our research show that the teachers of the institution have a positive relation toward technology which is shown in the different dimensions revised: familiarization, competence, digital profile, attitude and the consideration of having the proper technological resources. In all these dimensions, we observe a marked positive tendency. The attitude toward technology is highlighted: 90% of the participants' attitude was favorable. Moreover, the positive correlation generated between the aspects of the participants' profile and their professional profile made it possible to recognize a synergy that encourages the teachers' receptivity in adopting ICTs.

The UNESCO (2008)'s consideration on the indicators that a teacher competent in ICTs must cover in a timely manner are met in the professional profile that characterizes CIBNOR teachers, who as scientists, are accustomed to searching and developing knowledge, adopting technology in both their own field of expertise and complementary areas. It is feasible to establish that, by making constant use of technology, ICTs, more specifically in their specific areas of study of professional interest, they can transfer said knowledge to their own students more easily (Ottenbreit *et al*., 2010).

Age is a factor that, in the CIBNOR context, is in line with the findings of other authors (López, 2006; Hammond, Reynolds & Ingram, 2011), since it does not constitute a specific problem. In general, they correlate negatively; however, this correlation is extremely weak and quite negligible. Moreover, we observe a positive correlation with the consideration of possessing the technical resources necessary to exercise their professional activity. It is important to underline that the average age of the CIBNOR teachers is 53.64 years and the differential of said variable in the context of this study is small, which makes it essential to revise this variable in depth from other study perspectives.

Therefore, our study shows that the users make a greater or lesser use of digital resources and they are more deeply involved in their use, not in terms of age but rather of the context, their motivations and interests, in which the attitude factor weighs more than experience or chronology (García, 2014). Hence, it is feasible to assert that, despite the age, training as scientists fosters the preparation necessary to adapt to new technological tools as well as to shape a profile favorable in drawing them closer to using new technologies from different perspectives.

It is clear that age, attitude, familiarization and knowledge related to ICTs do not seem to constitute any obstacle that cannot be overcome to integrate them in the institutional curriculum. None of the participants seemed to be significantly affected by the use and way of using technology. Despite the fairly positive correlation of the teachers' economic incentives and the different aspects on ICTs, the polarization this aspect has shown, is relevant.

The foregoing can be explained by the fact that incentives are granted by institutional as well as governmental policies, and that said policies are not always coherent or accompanied by properly established objectives (Aviram *et al.*, 2005), that take into account the contexts in which technology is to be introduced and the disagreement that can spur between the institution and its members, which, in turn, would lead to pursuing diverging objectives. This situation comes forth in this study through the polarization identified in the opinion of the teachers who have more consideration for their research activities than for teaching. This may well be because public policies have invested in promoting research activities and have neglected giving their support to teaching (Estévez, Martínez & Martínez, 2009).

CONCLUSIONS

CIBNOR personnel coexist in a particular manner with technology since both, their academic and professional profiles generate synergy in using technology, result of each other's activities in which they are mutually involved. They know technology, they are familiar with it, and they even use it on a daily basis. In general, we can consider that the academics of the institution are proficient in the use of ICTs; however, their profile constrains them to activities they value greatly and which motivate and interest them. In the end, they consider these activities as a priority. In the CIBNOR context, research activities prevail over those of teaching, which implies that the inclusion of ICTs in this latter activity is overshadowed.

This assessment is established from the economic benefit each activity offers them, in such a way that this leads the way to dig further into the policies that frame the operation of the institution, more specifically, those that determine the economic benefits of the teaching staff. Likewise, in a broader spectrum, find out if the phenomenon that occurred within CIBNOR is reproduced in the System of Public Research Centers belonging to Conacyt.

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