Digital Competences in Higher Education Teachers: Domain Levels and Training Needs

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Abstract

Based on a previous model of digital teaching competence in higher education, a mixed sequential study (QUAN + QUAL) is carried out. This is based on a multistage design in the study of detection of training needs according to two of the objectives of the study: identify current competences and establish-prioritize training needs. The population of the study is referred to the faculty of higher education institutions of the Metropolitan Zone of the Valley of Mexico. Participates a sample of 20 institutions (11 public, 9 private), with 247 teachers involved. The results indicate a medium-low domain in the digital competences that correspond to the teaching role (planning, development and conduction of learning experiences and evaluation with the support of ICT). Next are the digital competences related to research and professional development with the support of ICT. The digital competences that most dominates the Mexican university teaching staff are those that are linked to the commitment and social responsibility of teachers with the use of ICT. It concludes on the most priority training needs in line with the low average level of competence domain verified.

Keywords:

Teaching digital competence, university professor, continuous training, training needs, and model of digital teaching competence.

Competencias digitales en docentes de Educación Superior: niveles de dominio y necesidades formativas

Resumen

Partiendo de un modelo previo de competencia digital docente en educación superior, se realiza un estudio mixto secuencial (QUAN+QUAL). Se parte de un diseño multietápico en el estudio de detección de necesidades de acuerdo a dos

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de los objetivos del estudio: identificar las competencias actuales y establecer-priorizar las necesidades formativas. La población del estudio está referida al profesorado de instituciones universitarias de la Zona Metropolitana del Valle de México. Participa una muestra de 20 instituciones (11 públicas, 9 privadas), con 247 profesores implicados. Los resultados indican un dominio medio-bajo en las competencias digitales que corresponden con el rol de docencia (planificación, el desarrollo y conducción de experiencias de aprendizaje y la evaluación con apoyo de las TIC). Seguidamente se encuentran las competencias digitales relacionadas con la investigación y el desarrollo profesional con apoyo de las TIC. Las competencias digitales que más domina el profesorado universitario mexicano son las que están vinculadas al compromiso y la responsabilidad social de los docentes con el uso de las TIC. Se concluye sobre las necesidades de formación más prioritarias en consonancia con el nivel medio bajo de dominio competencial verificado.

Palabras clave:

Competencia digital docente, profesor universitario, formación continua, necesidades formativas, modelo competencia digital docente.

Competências de ensino digital no educaçao superior: níveis de domínio e necessidades de formação

Resumo

Partindo de um modelo prévio de competência digital docente em educação superior, realiza-se um estudo misto sequencial (QUAN+QUAL). Parte-se de um desenho multietápico para a detecção de necessidades de acordo com dois dos objetivos do estudo: identificar as competências atuais e estabelecer-priorizar as necessidades formativas. A população do estudo está referida ao corpo de professores de instituições universitárias da Zona Metropolitana do Valle de México. Consiste em uma amostra de 20 instituições (11 públicas, 9 privadas) que envolve 247 professores. Os resultados indicam um domínio médio-baixo das competências digitais condizentes com a função do professor (planejamento, desenvolvimento e condução de experiências de aprendizagem e avaliação com apoio das TIC). Seguidamente, abordam-se as competências digitais relacionadas com a pesquisa e o desenvolvimento profissional com apoio das TIC. As competências digitais que os professores universitários mexicanos dominam mais são aquelas vinculadas com o compromisso e à responsabilidade social no uso das TIC. Conclui-se sobre as necessidades prioritárias de formação cona competência que registra um domínio médio-baixo por parte dos docentes.

Palavras-chave:

Competência digital docente, professor universitário, formação contínua, necessidades formativas, modelo competência digital docente.

Introduction

The concern about the competence structure is not new, but it is in higher education. It has been since the past decade, and particularly since 2008 (ISTE, 2008, although it has a previous background; UNESCO, 2008), as the first exponents of the emergency to make efforts to evaluate teachers' ICT competence, generating many other standards around it. While there is no common agreement on the particular matter, we believe this concern is important in view of the digital outline which is a key and reference for a meaningful training, exceeding certain technological—more than pedagogic—dissemination and literacy, especially in higher education.

The fact that ICTs are gaining significance for the creation of new scenarios makes the "digital competence" necessary for citizens to manage themselves in the current and future society. Such digital competence must be understood not as a simple instrumental mastery, but as the construction, production, evaluation, and selec-

tion of media messages.

Without a doubt, technology is a key factor, not only for the setup of professional scenarios, but also for the transformation that it entails in the professional performance (Adams Becker, Cummins, Davis, Freeman, Hall Giesinger & Ananthanarayanan, 2017; Barroso, Cabero & Vázquez, 2012; Cabero, 2009 and 2013; Cabero & Marín, 2012; Castañeda & Adell, 2013; Cebrián, 2013; Del Moral & Villaustre, 2012; Fandos, 2013; González Soto, 2009; Johnson, Adams Becker, Estrada & Freeman, 2015; Urbina & Salinas, 2014), in this case of teachers' performance, giving rise both to modify existing competences, and create new roles and new professional competences.

Clearly, digital competence has gained a strong relevance in recent times in different educational levels (Almerich, Suárez, Jornet & Orellana, 2011; Álvarez Rojo, et al., 2009; Cabero, 2014; Carrera & Coiduras, 2012; Domínguez, Bárcenas, Ruiz-Velasco, &. Tolosa, 2014; Fernández de la Iglesia, 2013; Ferrari, 2012; Gallego, Gámiz & Gutiérrez, 2010; Gutiérrez, 2014; Mayorga & Núñez, 2011; Medina-Talavera, 2014; Mengual & Roig, 2012; Prendes, Castañeda & Gutiérrez, 2010; Prendes & Gutierrez, 2013; Ramírez, 2012; Roig & Pascual, 2012; Suárez-Rodríguez, Almerich, Gargallo & Aliaga, 2013; Tejedor & García-Valcárcel, 2006) to the extent that it has been considered by the European Parliament as one of the eight key competences for lifelong learning (2006).

Digital competence not only provides the capacity to take advantage of the wealth of new possibilities related to digital technology, and the challenges they raise, but it is increasingly necessary being able to participate systematically in this new knowledge-based society and economy of the 21st century (INTEF, 2013, p. 3).

In this context is where we have focused the objectives for this study, centered mainly on analyzing and identifying university professors' profile and competences, building a model of Digital Competence integration into teachers' professional development, in a way it serves as a guide and a future baseline for the diagnostic self-assessment of continuous training needs regarding this competence, as well as identifying university teachers' continuous training needs regarding their Digital Competence, based on the proposed model and the competence reference developed.

Digital Teaching Competence: Towards a Model for the Digital Competence Integration into the University Teacher's Professional Development

The digital teaching competence, under our conceptual reference for professional competence, owes a debt to a socio-professional context, together with the performance regarding *professional problem-solving*. Therefore, it is not enough to have resources (knowledge), but it is also necessary to efficiently *solve problems* to be competent. This stance originates from our own concept of competence in its double dimension: social and personal (Tejada, 2009, 2012, 2013). In the first case, there is the *social dimension*, within professional scenarios, we refer to the responsibilities in the key of functions that are developed and are distinctive to a specific professional; in the second case, the *personal dimension* of this competence, refers to the set of knowledge (personal resources) to act competently.

At this moment, we want to show the importance of the scenario, since it is conditioned by a *technology, an organization, and regulations*, which will significantly limit the functions to be undertaken and the resources to be activated. Today, nobody disagrees with the relevance of these three constituents, and the need to take them into consideration when preparing not only any kind of profile, but also what is the most genuine for making reference to professionals' training, which is the source of content selection (conceptual, procedural, and attitudinal). It should not be forgotten that these constituents are subject to change and in continuous evolution. They have a strong presence in everything related to the continuing training of professionals, since they are finally and ultimately the highest suppliers of the needs to update the professional qualification.

While designing and planning this model, we have tried to reflect, both the integration of the advancements and successes achieved in the references, and previous models of digital teaching competences (Adell, 2008; Ala-Mutka (2011); Gutiérrez Porlán, 2011; INTEF, 2013; ISTE, 2008; MEN, 2013; Newrly & Veugelers, 2009; Prendes, 2010;

Prendes & Gutiérrez; 2013; Unesco, 2008), as well as the personal effort for the *conceptual and reflective advancements* on the technologies and the university professors—depicted in the model's aims and orientations—and the *practical advancements*—reflected in the concretions of the model and in the development of the matrix of competences for each of the competences (Pozos, 2011, 2015, 2016; Tejada & Pozos 2018).

The main purpose of the model is to provide the university faculty with a tool for professional development and growth on their digital competences that must be developed and integrated in order to perform adequately in any of their related roles and functions.

The model is intended to integrate the main roles of the university professor's current profile (Mas & Tejada, 2013), through the Digital Competencies, as well as to provide a clear framework on the professional teacher development to serve as a reference to guide their decisions on training and updating permanent.

The following are the basic dimensions that structure and constitute this model:

a. *Digital Competence Units*, as the baseline and foundation that give meaning to the model (the professionalism of the university faculty; the professional commitment, the personal and social impact).

b. *Digital Competence Integration Phases*, that give the development nature and ongoing continuity (training purpose).

c. *Level of Command and Degree of Complexity of the Digital Competence* that gives account of the evolutionary nature and depth by development levels. This aspect will be very useful in the detection studies of continuous training needs of Digital Competence of the faculty, and its subsequent prioritization to constitute or plan the training proposals.

A whole series of Digital Competences has been identified for this profile, which we believe the faculty should assume, emphasizing that such competence must be integrated into the framework of each of these roles, given its transversal nature and impact, in greater or lesser degree, in each of the teacher's functions and activities. This will allow him to lay aside the purely instrumental approach of the technologies, which we consider to be only part of the competences approach and that will be considered equally along with those methodological, personal and participatory competencies that make up all types of knowledge of a competence (Tejada, 2007). This will also open the way to prioritize the person from the professional, so that it will be the teacher who, based on a critical reflection, properly uses and integrates ICT, not only in the classroom, which would correspond only to the role of teaching, but incorporates them in each of their roles and professional functions and their corresponding contexts, according to their criteria and professional expertise. Thus, the focus will not be on the technology, but on the power of reflection and decision of the human being to strategically use said technology.

The option to have a model of digital competences based on functions and roles comes from our professional scenario (context), and the functions that are of its (Pozos, 2011, 2013; Tejada, 2009).

Therefore, in accordance with the theories on teacher professional development, it has been defined that the integration of the Digital Competence of the teacher must be structured in three major phases (basic skills, deepening, and knowledge creation) (UNESCO, 2008, 2011), conceived as a complex process in which teachers deepen their knowledge and the use of ICT, and gradually and significantly integrated into their teaching activity through critical reflection, as an essential element in this whole process.

Conceiving the integration of digital competence in professional teacher development as a continuous, recurrent and gradual process (lifelong learning), also implies defining the degree or extent to which each of the competences can be developed and deepened, both in its understanding as well as in its use and meaningful integration; that is, the degree of domain or mastery of digital competence. Thus, we have defined five levels that start from the consideration that a competence has not been developed so far, but that, however, is latent to be learnt and developed, until reaching an ideal or maximum level of competence development, as an expert.

In Appendix A, we provide a matrix for the deployment of competences with their descriptions.
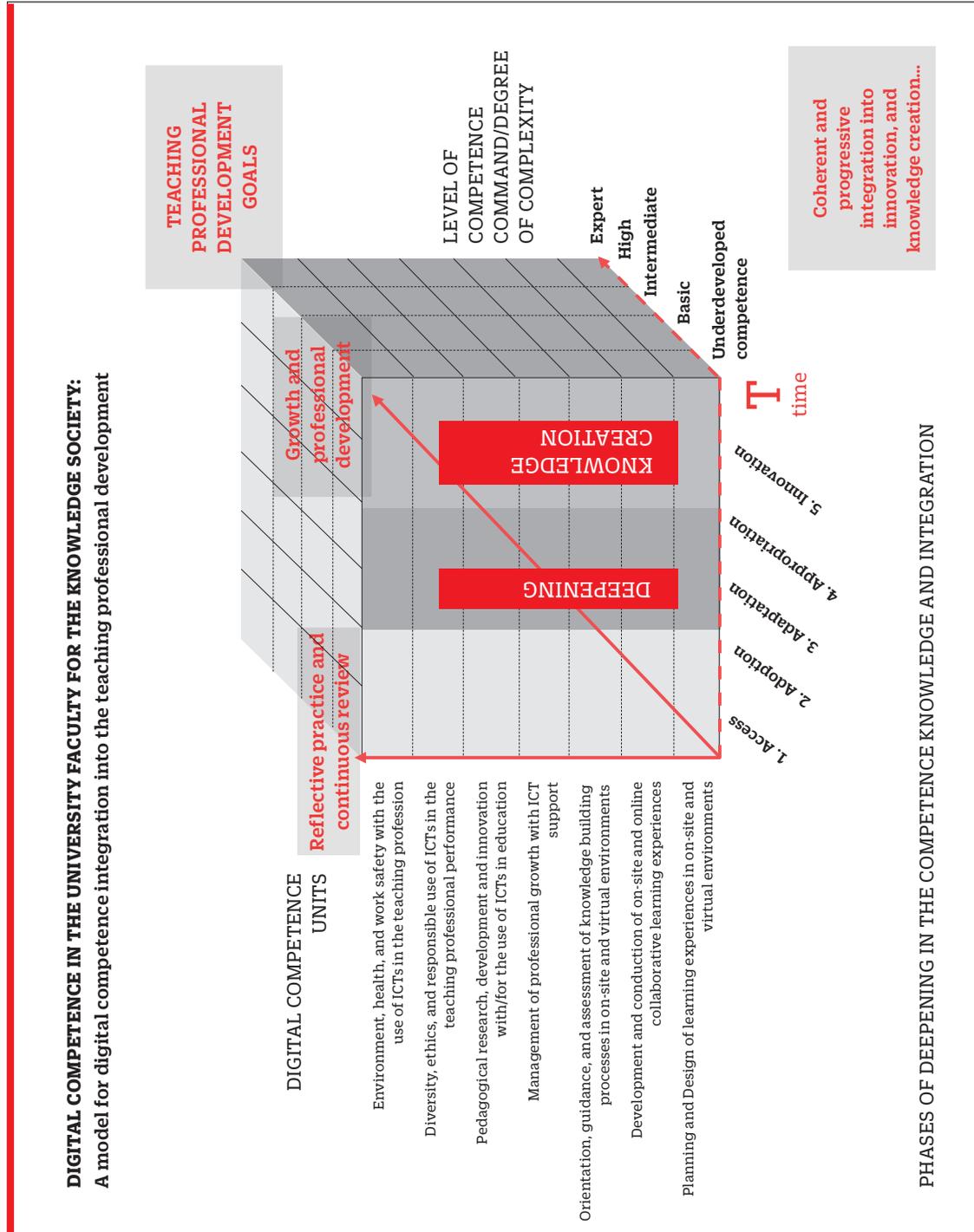
DIGITAL COMPETENCE IN THE UNIVERSITY FACULTY FOR THE KNOWLEDGE SOCIETY:
A model for digital competence integration into the teaching professional development

Figure 1. Model for the Digital Competence integration into the teaching professional development (Pozos, 2010, p.155)

Method

Design

A mixed descriptive, concurrent transformative exploratory study (QUA + QUAL) has been carried out. Here, both methodological approaches are given the same relevance, and the data collection is simultaneous (Hernández Sampieri, Fernández Collado & Baptista 2014). It starts with a multi-stage design in the study of needs detection in the framework of the formulation of training plans and programs (Tejada & Giménez, 2007), considering one of the research objectives (to identify and analyze current competencies) in the context of field study—current competencies—and establish-prioritize needs—training needs.

Participants

The study population is referred to higher education institutions faculty members of the Metropolitan Zone of the Valley of Mexico. A sample of 20 institutions (11 public, 9 private), with 247 teachers, participates. The faculty sample characteristics are of an average age of 45,47 years old; 49% male y 51% female; from the knowledge fields of social sciences (30%), computer, natural, and exact sciences, (24%); arts and humanities (18%); and 15 % of educational sciences; mostly full time (55%), with continuous training in areas related to education and technology in 76%; most of them (72,47%) from private universities, and to a lesser extent (27,53 %), from public universities.

Data collection instruments

Given the nature of the object of study, different techniques and research instruments were chosen, both quantitative and qualitative, from a triangulation perspective to provide truthfulness or authenticity to the collected information (Tójar, 2006). In the triangulation process, different perspectives and sources of inquiry were used (teachers, students, colleagues, managers, researchers) that were combined with various research techniques and instruments (questionnaires -247-, in-depth interviews -30- and focus groups -4-).

To design each of the techniques and instruments of the information collection device, a deep process of reflection and analysis of the matter status at a national and international level was started, in order to set up the theoretical-methodological basis for the conceptualization and construction, of both the integration model of digital competence in teacher professional development, which is the main focus on this research, and the matrix of digital competences derived from the model.

In this document, we will only address everything that is related to the questionnaire, from its construction and validation to the results obtained from the perspective of the level of command and digital teaching competence.

The matrix was finally conformed by 78 units of competences organized in the 7 digital competences of the model and in the 3 levels of deepening developed. Based on these competences, the entire data collection device of the research was built (Appendix A).

The scale of numerical-descriptive measurement has been doubled, considering the current competence *command level* (1 = not developed, 2 = basic command, 3 = intermediate command, 4 = high command, 5 = total command), as well as to the *need of command* (1 = none, 2 = little, 3 = regular, 4 = high, 5 = essential).

Procedure

The development of the questionnaire started from the matrix of competences derived from the proposed model, and the usual steps for its design were followed (preparation, first draft, validation by experts, and pilot application, and final draft) (Mateo & Martínez, 2008). In our case, two of the key processes in the elaboration were, on one side, the validation of the questionnaire by expert judges; and on the other, the application of a pilot test in the Mexican university context. For both processes, statistical analyses and relevant tests were carried out, which allowed us to obtain significant evidence about the validity and high reliability of the instrument (Cronbach's alpha = 0.989), concluding that it is a reliable instrument, with a scale of measurement that includes solid and consistent measurements (Pozos, 2013).

The statistical processing of the data obtained through the questionnaire was carried out with the statistical software SPSS v19.0, the graphic representation for the analysis of the discrepancies found in the digital competences was made

Table 1
Training decision criteria

CRITERIA (scale points)	RATING	TRAINING DECISION
(1,2) (3,5)	Low-Level Commands High Needs	= HIGH PRIORITY
(1,2) (2, 2.99)	Low-Level Commands Intermediate Needs	= MEDIUM PRIORITY
(2,1, 3) (3,5)	Intermediate Commands Intermediate Needs	= LOW PRIORITY
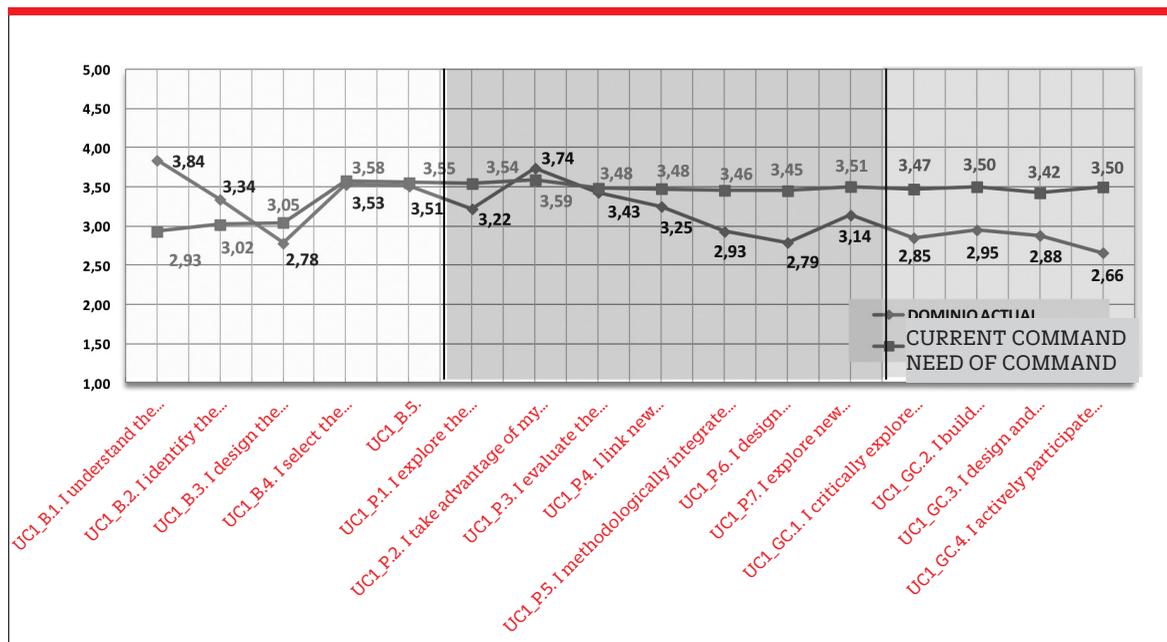
Figure 2. C1_PLANNING AND DESIGN of learning experiences in on-site and virtual environments -

in Excel v2007, from the medians and standard deviations obtained.

Results

As we have already pointed out, in this document we only show the results related to the questionnaire and more concretely, the specific items of the teaching digital competence units considered in our model.

The results are organized in two large sections: the first one, to provide an analysis of the data specifically on the command and the needs in digital competence, and the second one, for the inferential analysis of these data.

To identify if there was a discrepancy or need, it

was considered that the median of the Need would have to be statistically higher than the mean of the Command (*Student's T test* for related samples).

When there is a Training Necessity, it is necessary to assess if this is significant, meaning, to identify and prioritize each of them to guide the training decisions. According to the questionnaire's scale, when necessary, we determined the following criteria:

Analysis of CURRENT COMMAND vs. NEED

In the following graph, a global panorama of the current command is shown compared to the needs expressed in the UC1, PLANNING AND DESIGN OF LEARNING EXPERIENCES, integrating all the units in its three levels (Basic, Deepening, and Knowledge Creation).
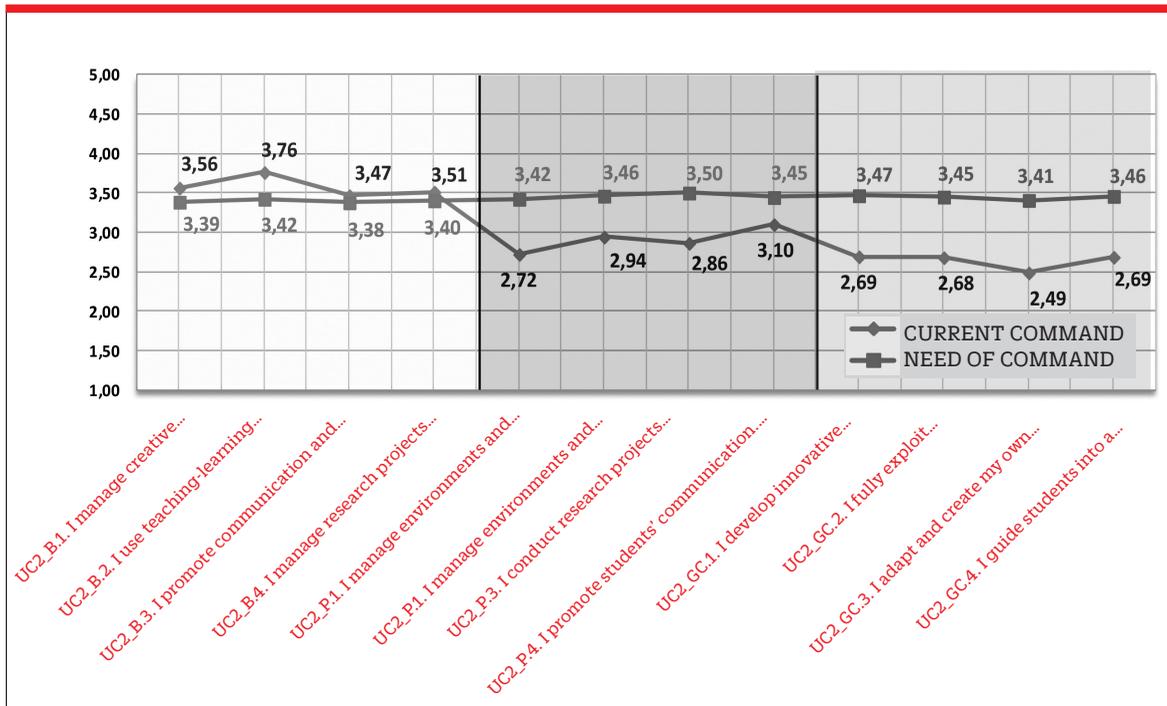
Figure 3. C2_Global. DEVELOPMENT AND CONDUCTION of collaborative on-site and online learning experiences
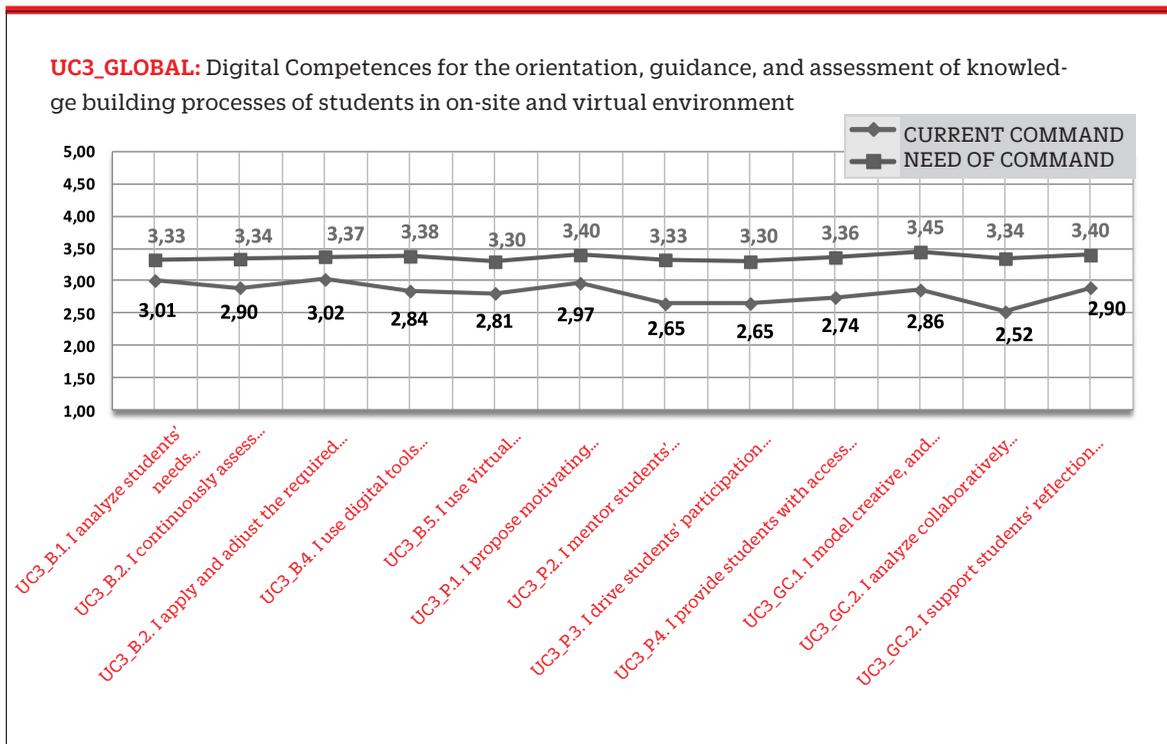

Figure 4. C3_Global. ORIENTATION, GUIDANCE, AND ASSESSMENT of knowledge building processes of students in on-site and virtual environments.
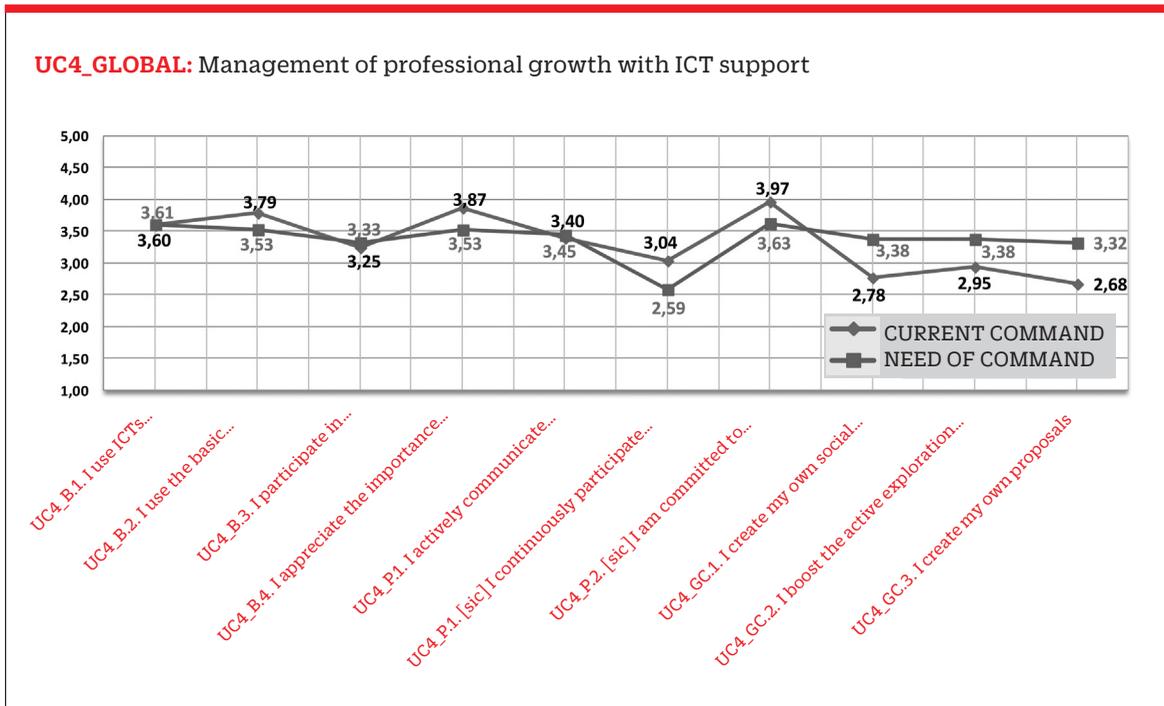
Figure 5. *C4_Global. MANAGEMENT of professional growth with ICT support -*

Taking the theoretical mean of our scale **x** = 3 (average command) as a reference, it tells us that in this profile, 56.25% of the units of this competence (9/16) are above the theoretical average and that the remaining 43.75% (7/12) is below, but very close to it (between 2.66 and 2.95); this means, according to our scale, that the current command of these competences is mainly between a basic level and an intermediate level of development, leading to training needs related to the levels of deepening and knowledge creation.

We notice that in this profile of UC2 DEVE-LOPMENT AND DRIVING OF COLLABORATIVE LEARNING EXPERIENCES, 58% of teachers' digital competences (7/12) are below the theoretical average, which means according to our scale, that the Mexican faculty currently masters these competences at a basic level. The 42% of digital competences remaining in this competence (5/12), have means over the theoretical average, therefore, it represents that the faculty has a current mid-level command.

In short, the current command of these competences is mainly between a basic and an intermediate level of development, resulting also in the

training needs that run through in most of the units (8/12).

In the case of Competence 3. ORIENTATION, GUIDE, AND ASSESMENT REGARDING THE PRO-CESSES OF STUDENT'S KNOWLEDGE CREATION, again taking the theoretical mean as a reference, we see that almost all the units of competence are below the average, that is to say, that 83.3% of these digital competences (10/12) feature a basic current command or little developed by the teachers. The remaining 16.7% of digital competences (2/12), barely reach the average (UC3_B.1, UC3_B.3) and; therefore, they master them at an interme-diate level.

The global picture of this competence is shown again where we can observe that the training needs gradually become a little broader in the level of Knowledge Creation.

Following the same procedure as set before for C4. MANAGEMENT OF PROFESSIONAL GROWTH WITH ICT SUPPORT, we observe that in this profi-le, 70% of the teachers' digital competences (7/10) are above it [3.04, 3.97], which means that the cu-rrent command of these competences is an inter-mediate level tending towards a high level, since
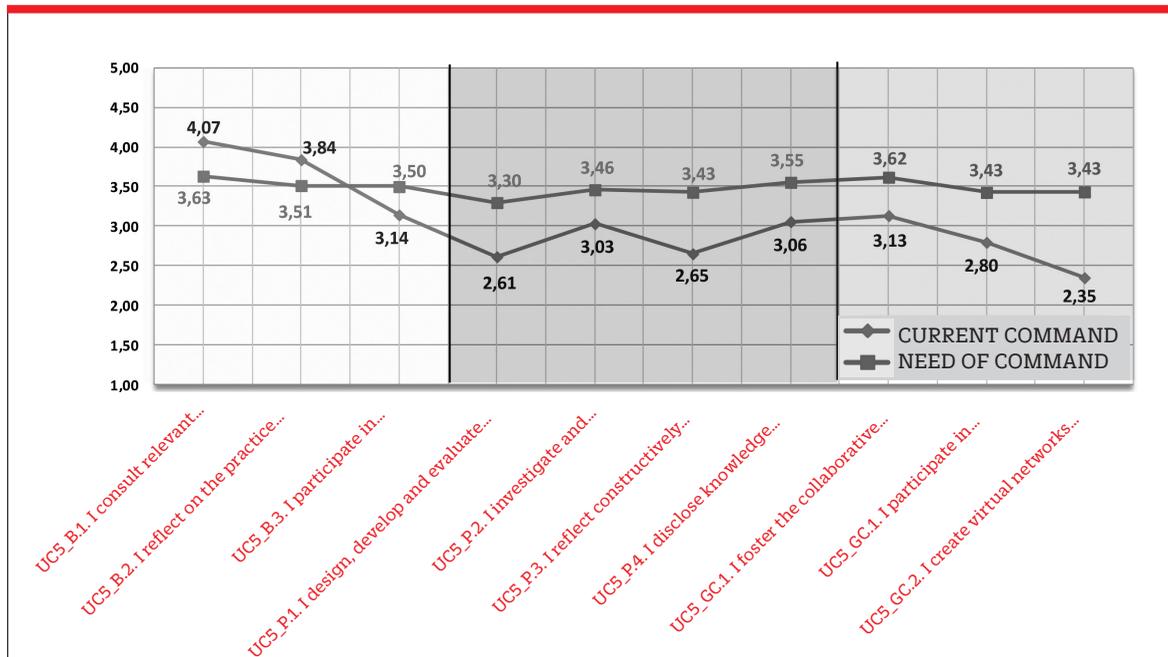
Figure 6. *C5_Global. PEDAGOGICAL RESEARCH, DEVELOPMENT, AND INNOVATION with/for the use of ICT*

there are also competences that are closer to 4 and that are of high command.

To a lesser extent, the other 30% of the remaining competences (3/10), are with low scores below the theoretical mean, therefore, they are in a current basic command over these (UC4_GC.1, UC4_GC.2 and UC4_GC .3) but tending towards an intermediate level.

As we see, the training needs increase more in those related to knowledge creation.

In the case of C5. PEDAGOGICAL RESEARCH, DEVELOPMENT, AND INNOVATION WITH ICT, we observe in this profile, that 60% of the teachers' digital competences (6/10) are above the theoretical mean, which shows, according to our scale, that the current command of these competences is an intermediate-to-high level, since there is also a competence (UC5_B1) that has a value greater than 4 that corresponds to a high command. This refers to the search and inquiry of relevant information through the Internet and technologies to develop activities for teaching, research, and management. 40% of digital competences (4/10) have means lower than the theoretical mean [2.35, 2.80], therefore, it represents that the faculty has a current level of basic or underdeveloped level on

these competences (UC2_P.1, UC2_P.3, UC2_GC.2, UC2_GC.3).

In most of the competence units for this competence, training needs are observed (8/10) given that the level of need expressed is greater than the level of current competence command.

The profile that shows the C6 competence. MANAGEMENT OF THE DIVERSITY, ETHICS, AND RESPONSIBLE USE OF ICTs indicates a greater command than what has been seen in all the previous competences, since it is not only observed that all are above the mean (11/11), but that 27% of them (3/11) are within the high command level (UC6_B2, UC6_P5 and UC6_GC2), and the rest are in a high intermediate command.

In this sense, we can conceive from the current command that training needs are not taken into account, given that the discrepancies are associated with a greater command vs. the need—except in some of them.

Finally, in the C7 competence: ENVIRONMENT, HEALTH, AND WORK SAFETY WITH THE USE OF ICTs, it is demonstrated that 100% of teachers' digital competences (7/7) are above the average, which results in a current intermediate or considerably-important command of these competen-
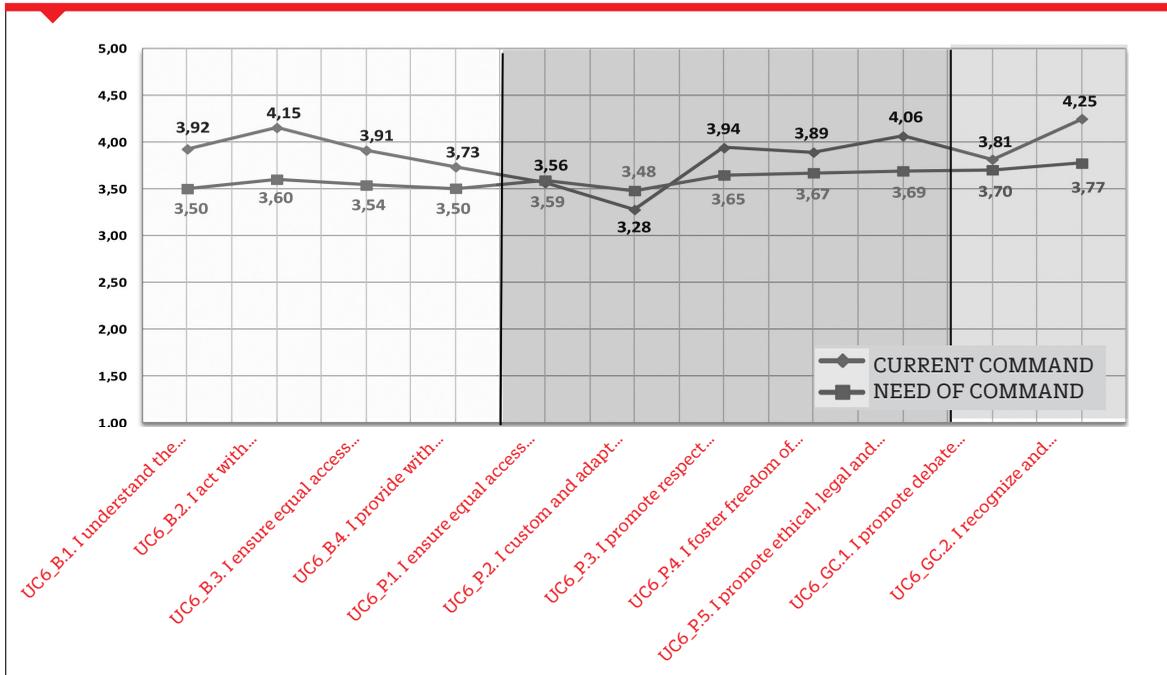
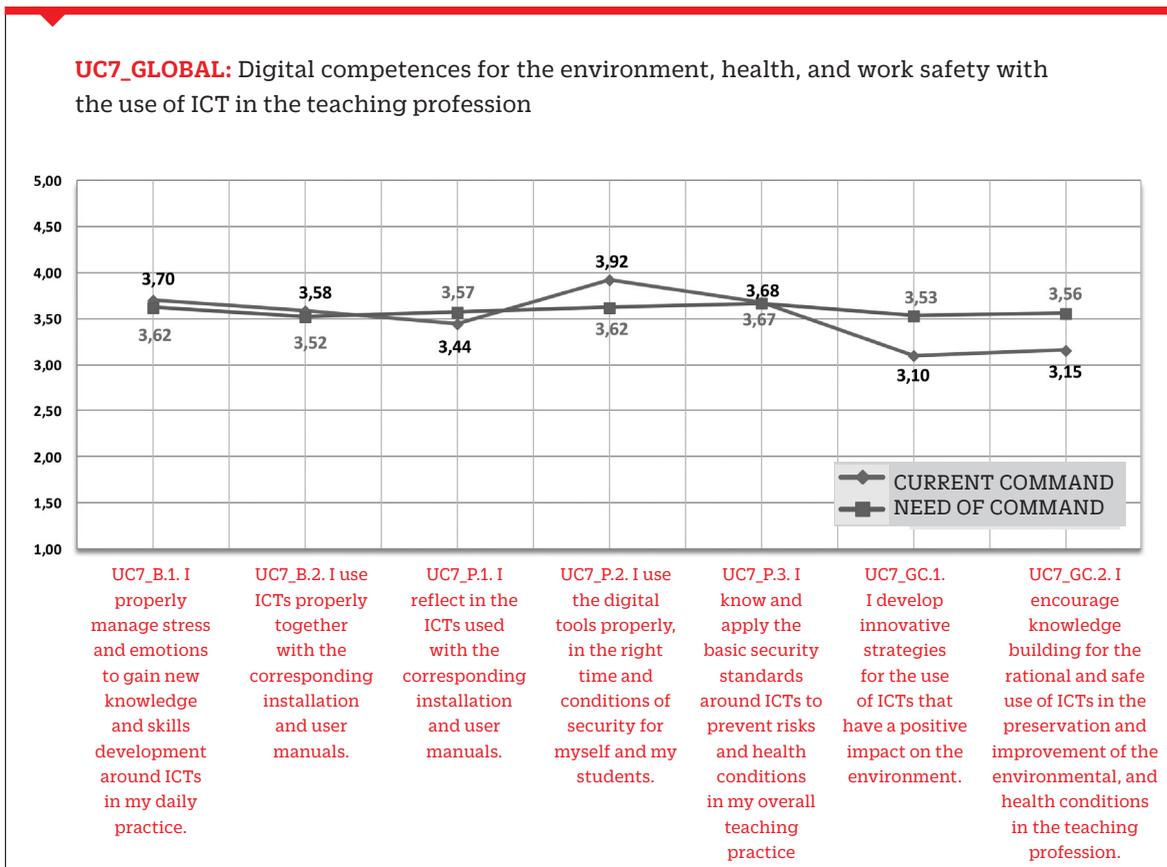*Figure 7.* C6_Global. DIVERSITY, ETHICS AND RESPONSIBLE USE OF ICTs

Figure 8. C7_Global. ENVIRONMENT, HEALTH, AND WORK SAFETY with the use of ICTs
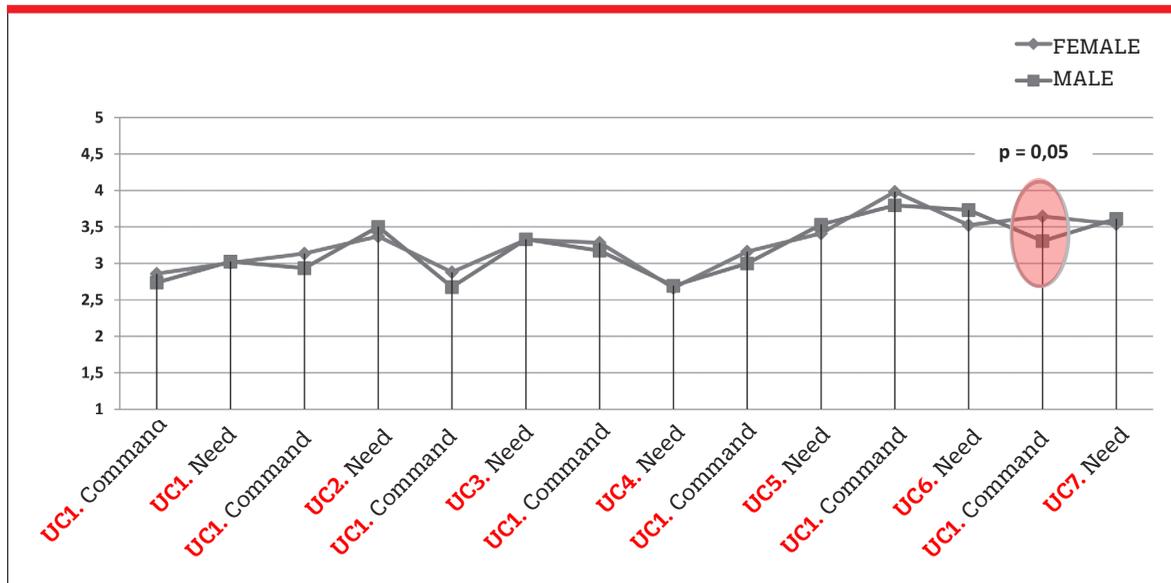
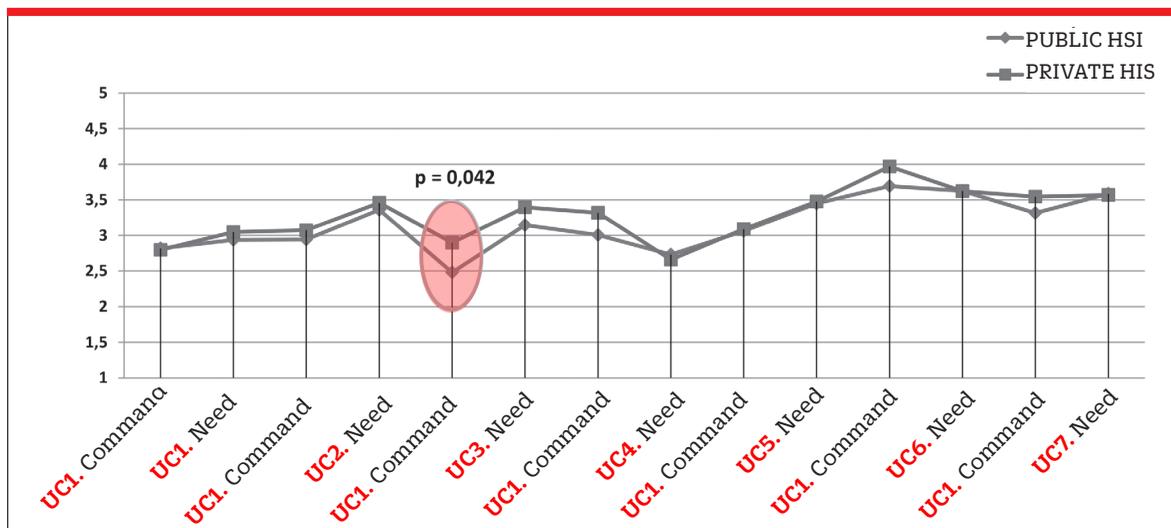*Figure 9.* Differences between the command and need by gender

Figure 10. Differences between public HSI faculty and private HSI faculty

ces. Even 57% of them (UC7_B1, UC7_B2, UC7_B1, UC7_P2 and UC7_P3), are closer to a higher rating score on the command.

In short, only in three competence units (UC7_P1, UC7_GC1 and UC7_GC2) a discrepancy is observed, where the need expressed is greater than the command and; therefore, only there is where training needs distinguished.

Inferential Analysis

Now, considering the 7 digital competences globally, both as in command and in need, we also see similar results between men and women, that is, there are no significant differences by gender, except in competence 7, where women show a greater command than men (p <0.05).

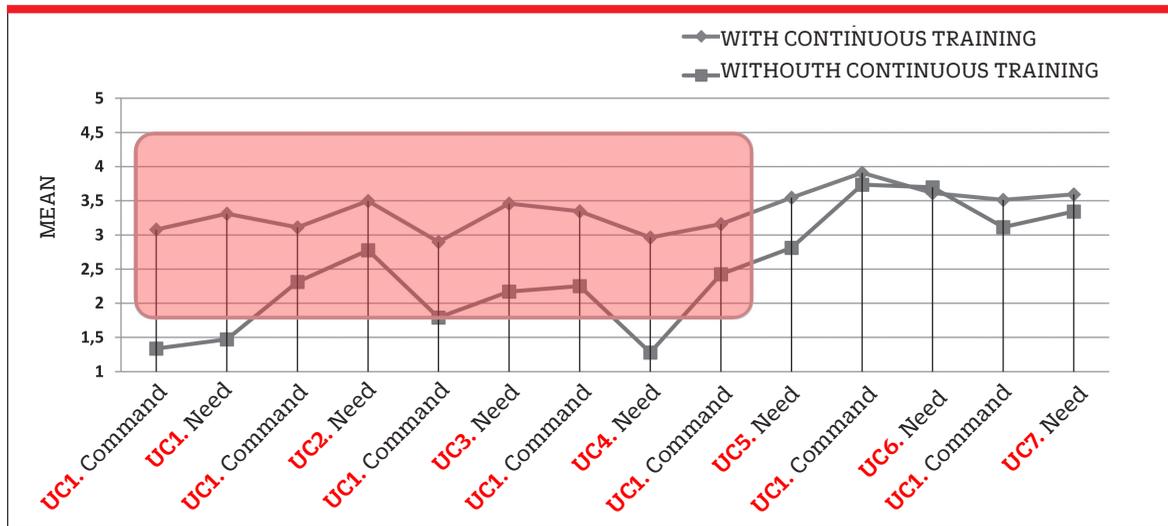If we consider the competences globally, both

Figure 11. Difference in command based on the continuous training

in command and in need, we also observe a similar rating between public and private institutions, except in competence 3, where the faculty of private high school institutions (HSI) show a significantly higher proficiency than that of public ones (p <0.05). This refers to the orientation, guidance and evaluation of knowledge building processes in on-site and virtual learning environments.

Comparing again the command and the need of the faculty that does have continuous training and the one that does not, we observe different results. That is to say, that with respect to the continuous training, there are significant differences mainly in the competences related to the on-site, virtual and mixed teaching, and to management, research and pedagogical innovation with ICTs (in the latter only in the command).

It should be mentioned that there are no significant differences in the need of competence 5 (which is the one referring to pedagogical research and innovation with ICTs), and in competences 6 and 7, which are those that are most related to the faculty's social responsibility in their teaching profession.

Discussion

By identifying the problems of professional qualification in the current university faculty, the ICT variable was integrated, trying to find out in which aspects or roles, in what way and to what extent, the ICTs have impacted on the profile of teachers, their functions and performance contexts. We identified that the University Teacher has to develop seven digital competences for the Knowledge Society:

1) Planning and design of learning experiences in on-site and virtual environments.
2) Development and conduction of collaborative on-site and online learning experiences.
3) Orientation, guidance, and assessment of knowledge building processes in on-site and virtual environments.
4) Management of professional growth with ICT support.
5) Pedagogical research, development and innovation with/for the use of ICTs in education.
6) Diversity, ethics, and responsible use of ICTs in the teaching professional performance.
7) Environment, health, and work safety with the use of ICTs in the teaching profession.

The formulation specific to each of the competences was carried out mainly considering a conceptualization of the competences, influenced by a holistic, integral and complex perspective, as well as some of the most important reflections on the teaching competences (Ala- Mutka, 2011, Mas
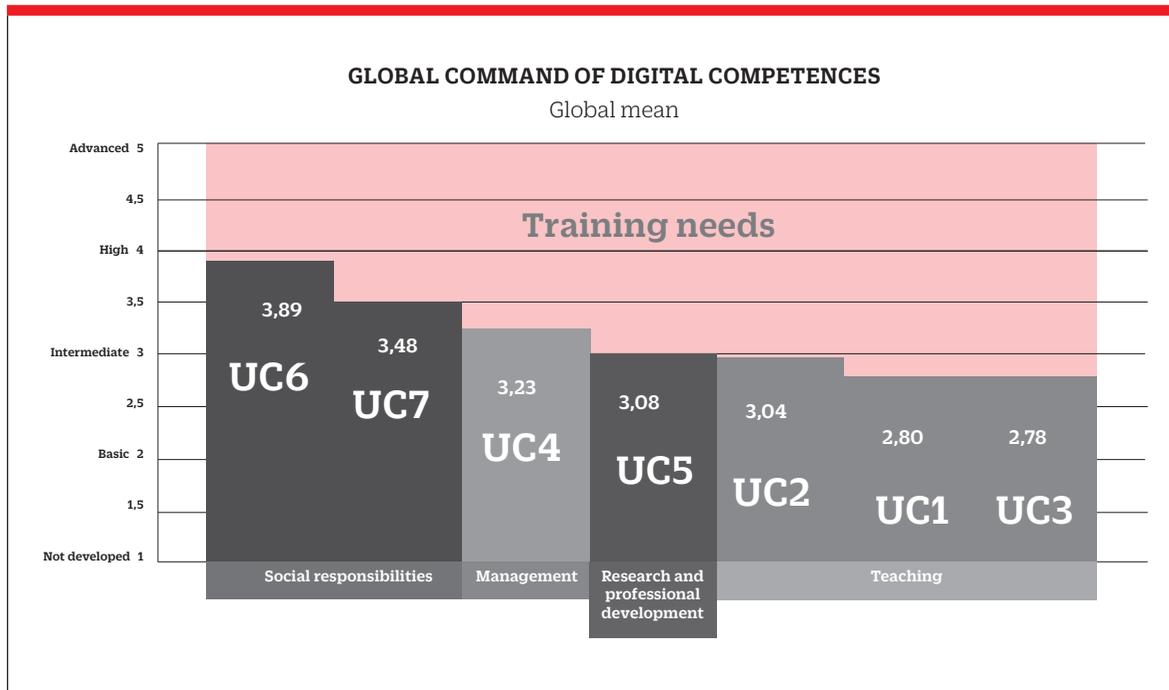
GLOBAL COMMAND OF DIGITAL COMPETENCES

Global mean

Figure 12. Level of command and training needs in digital teaching competences

& Tejada, 2013, Navío, 2005, Prendes, 2010, Tejada, 2009, UNESCO, 2008). With this, it was possible to develop a Digital Competence Integration Model, and once its command was determined, it was possible to later identify their own needs for continuous training (Pozos, 2011, 2015, 2016; Tejada & Pozos 2018).

As we can see, the graph below shows the synthesis of the *global command of the sample teachers' digital competences*, sorted from the highest to the lowest level of development. Here we realize that competences 1, 2 and 3 are the least developed (essentially below the theoretical mean), and, therefore, they show greater training needs; these digital competences are actually linked to the teaching role, and from these, the weakest are the digital competences related to planning, as well as the development and conduction of on-site learning experiences with ICTs, or, mixed or totally virtual experiences, and followed by those related to assessment with the support of ICTs or the evaluation and monitoring of learning in virtual environments. Then, and above the theoretical mean, but without reaching a considerably advanced level, there are digital competences related to research and professional development with the

support of ICTs, as well as those related to the management of professional growth and development supported by technologies. In this group of competences, the faculty has an intermediate or regular level of proficiency that surpasses slightly above the theoretical mean.

The digital competences that most dominates the Mexican university faculty in this study are those that are linked to the commitment and social responsibility of teachers with the use of ICTs, such as, for example, developing and providing digital materials and learning experiences enriched with ICTs, considering the linguistic and cultural diversity of the students; or, to promote the ethical, legal, and responsible use of ICTs in students through critical analysis of the implications and consequences of their inappropriate use.

The weight of the *training needs* found can be seen in the graph that shows the level of current command, and where we can visualize the area that remains to be developed for an optimal development of digital skills. For example, given that digital competences for teaching were the ones where teachers have less control, that is where we highlight more needs and, therefore, the training priorities would be mainly in this area.

Thus, as we pointed out in the results section, we found a total of 42 training needs distributed in 6 of the 7 competences, from which, 33 were of high priority and 9 of low priority. The training needs with high priority correspond basically to the competences linked to teaching, research and management in on-site, mixed and virtual environments. These high needs are observed especially in the levels of deepening and knowledge creation, so we verified that the current command of digital teaching competence is, in general, at a low-intermediate level and that has a lot to do with what is expressed by the teachers in the interviews and focus groups, especially when they said that, even when they have the technology, they do not know how to take advantage of everything that could be learned and taught. The training needs with low priority are related mainly to competence 5 which refers to those digital competences necessary for pedagogical research, development and innovation with ICTs and for the use of ICTs in university education and which also corresponds to what is pointed out by the faculty, since they expresses that more research is needed on the real uses and benefits of technologies in learning.

For all that, we must also conclude that the foregoing applies to both to female and male professors, and to public and private institutions equally. Although, we have verified that the level of command is directly related to the fact of having received continuous training—or not—on the subject, especially in those competences associated with teaching and research.

This demonstrate the repeated need for urgent pedagogical training demanded by teachers, as well as the need for continuous support and accompaniment for the adequate integration of ICTs in university teaching (Cabero, 2014; Duran, Gutiérrez & Prendes, 2016; Jakstiene, 2011, Prendes, Gutiérrez & Martínez, 2018, Sangrà & González Sanmamed, 2004, Tejada, 2014, Urbina & Salinas, 2014).

At the same time, we consider that digital competence involves a complex, gradual and recurrent learning process, which includes the ability to properly use digital tools and resources to search, manage, analyze and transform information into knowledge in a critical manner, as well as the ability to work as a team and share this knowledge

with ethics and social responsibility (Area, Gros & García-Quismondo, 2008, Dominguez et al 2014, Tannenbaum, and Katz, 2008, Vivancos, 2008, UNESCO, 2008 and 2011). Therefore, we consider it is extremely important that teachers think deeply and investigate about it, within the practice and for the practice, and at the same time, take the necessary measures to rethink and redesign the teacher's training towards continuous learning, with learning experiences focused on the daily problems of higher education and in significantly integrating technologies to help solve them.

Hence, in line with Moser (2014), it is crucial that the university institution establishes a framework of relevant conditions for teachers to properly use technology. This not only includes formal structures of incentives, professional careers, but also technological and resource structures, accompanied by teaching-pedagogical training, basic conditions for the integration of ICTs, and the development of digital competence previously discussed (Mercader y Pozos, 2015; Prendes, 2010; Robbins and Judge, 2013).

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APPENDIX A. *Matrix of Faculty Digital Competences for the Knowledge Society (Pozos Pérez, 2013)*

1. Regarding planning and design of learning experiences in on-site and/or virtual environments...	
UC1_B.1.	I understand the characteristics, languages and basic functioning of the most common digital tools to integrate them in on-site learning situations supported by ICTs.
UC1_B.2.	I identify the educational possibilities of basic digital tools and existing educational materials.
UC1_B.3.	I design mechanisms to identify the learning needs of my students using digital tools and materials.
UC1_B.4.	I select the most appropriate digital tools for their strategic integration in the design of on-site learning experiences, in accordance with the student's learning goals.
UC1_B.5.	I design the on-site learning experiences enriched with ICTs. I look for the most suitable educational methodologies to guide students' learning.
UC1_P.1.	I explore the characteristics, languages and functioning of new digital tools to integrate them in the on-site and remote learning experiences.
UC1_P.2.	I take advantage of my teaching experience and the deep knowledge I have of the subject to apply ICTs flexibly in the design of different learning situations.
UC1_P.3.	I evaluate the educational potentials of new tools and digital teaching materials.
UC1_P.4.	I link new digital tools with the possible learnings or competences they promote, pointing out the most appropriate moments and contexts for their use
UC1_P.5.	I methodologically integrate more advanced digital tools in the design of online and remote learning experiences.
UC1_P.6.	I design more complex digital learning materials for both, on-site environment, as well for mixed and virtual environments.
UC1_P.7.	I explore new methodologies and educational strategies to apply digital tools in on-site and/or virtual learning experiences.
UC1_GC.1.	I critically explore new technological systems and networks of collaboration and knowledge management, to contribute to the enhancement of learning and creativity in students aiming knowledge creation.
UC1_GC.2.	I build innovative learning experiences by incorporating pertinent resources and complex technological systems for the creation and cooperative dissemination of knowledge.
UC1_GC.3.	I design and develop innovative learning materials with students' participation.
UC1_GC.4.	I actively participate with my students and other network experts in the planning and design of learning experiences that contribute to the improvement of people and society.

2. Regarding the development and conduction of collaborative on-site and/or online collaborative learning experiences ...	
UC2_B.1.	I manage creative learning experiences in on-site environments with the support of basic digital tools to motivate and guide students' learning.
UC2_B.2.	I use teaching-learning methodologies I know so far, to integrate the basic digital tools in the appropriate moments of educational performance.
UC2_B.3.	I promote communication and collaborative work through the basic digital tools of communication and digital collaboration.
UC2_B.4.	I manage research projects and student's work with the support of basic digital tools.
UC2_P.1.	I manage environments and online learning platforms to develop new collaborative learning experiences that allow students to solve complex situations whether simulated or reality.
UC2_P.2.	I strategically and methodologically adapt digital tools and more complex learning materials to be used in appropriate moments of the educational performance.
UC2_P.3.	I conduct research projects and students' experience through simulated or real cases or problems with the support of advanced digital tools and collaborative networking.

2. Regarding the development and conduction of collaborative on-site and/or online collaborative learning experiences ...	
UC2_P.4.	I promote students' communication, critical thinking and leadership using communication tools and collaborative work in the network.
UC2_GC.1.	I develop innovative teaching methodologies with more advanced digital tools to build, manage and disseminate knowledge with students and with other people through different networks.
UC2_GC.2.	I fully exploit the possibilities of learning platforms and network knowledge management to enhance individual and especially collaborative knowledge of students.
UC2_GC.3.	I adapt and create my own learning and knowledge management platforms according to students' specific needs.
UC2_GC.4.	I guide students in a series of varied experiences and real and simulated scenarios through the network. This facilitates their own knowledge creation and the generation and conduction of their own learning and research projects.

3. Regarding the orientation, guidance, and assessment of the knowledge building processes of students in on-site and/or virtual environments...	
UC3_B.1.	I analyze students' learning needs, previous knowledge and motivations with the support of tools or digital materials.
UC3_B.2.	I continually assess students' learning and knowledge building processes in on-site learning environments mediated by ICT
UC3_B.3.	I apply and adjust the required support to guide learning with the support of rating of students' learning.
UC3_B.4.	I use digital tools to create instruments for the evaluation and rating of students' learning.
UC3_B.5.	I use virtual academic connect management platforms if the institution to administer the course evaluation system and follow up on the students' learning.
UC3_P.1.	I propose motivating and complex learning activities and experiences with the use of digital tools to assess and promote students' level of understanding, creativity, critical analysis and practical thinking.
UC3_P.2.	I mentor students' learning and communication processes in virtual learning environments, giving control to students when they are able to assume it and recovering the role of guidance when they need it.
UC3_P.3.	I drive students' participation and interactions with contents, learning materials, peers, other people and experts from the network.
UC3_P.4.	I provide students with access to multiple perspectives and contents, as well as various ways to evaluate and give feedback through ICT.
UC3_GC.1.	I model creative and innovative thinking, encouraging students to participate and be actively involved in the planning, development and resolution of social situations or problems with the support of ICTs.
UC3_GC.2.	I analyze collaboratively with students and experts through the network, the current social contexts and its specific problems to guide reflections and knowledge building processes.
UC3_GC.3.	I support the students' reflection process. When they address the external evaluation from their participation in social-reality projects.

4. Regarding the management of professional growth and development with the support of ICTs...	
UC4_B.1.	I use ICTs, especially to gain complementary knowledge about the subjects and the pedagogy-teaching, which contribute to my own professional development.
UC4_B.2.	I use the basic academic management technological tools in the common professional fields to support my professional performance.
UC4_B.3.	I participate in basic training proposals in/with ICTs to improve my regular professional activities.

4. Regarding the management of professional growth and development with the support of ICTs...	
UC4_B.4.	I appreciate the importance and the need of lifelong learning in different fields, and in ICT to improve my professional development.
UC4_P.1.	I actively communicate and share knowledge with my students and other experts or people through the network.
UC4_P.2.	I continuously participate in various proposals and training ways in/with ICTs tailored to the needs and personal plan for my professional development.
UC4_P.3.	I am committed to learning through my life for the constant improvement of my professional and personal development, trying to integrate the latest scientific and technological advances.
UC4_GC.1.	I create my own social, learning, work, and personal networks through the network and I foster it in my students.
UC4_GC.2.	I boost the active exploration of new ways of professional growth and development with other people through social and professional networks.
UC4_GC.3.	I create my own proposals and training modes for the professional development and growth of other professionals through the network and ICTs.

5. Regarding pedagogical research, development, and innovation with ICT and for the use of ICT in education...	
UC5_B.1.	I consult relevant information through the basic digital tools to develop my daily professional activities of teaching, research and management.
UC5_B.2.	I reflect on the practice, about the benefits of using basic digital tools in on-site educational experiences.
UC5_B.3.	I participate in research projects with the support of basic digital tools.
UC5_P.1.	I design, develop and evaluate research and innovation projects with/for ICTs aiming to improve the professional practice.
UC5_P.2.	I investigate and thoughtfully apply—on and in practice—the actual possibilities and benefits of ICTs in the on-site teaching and learning processes.
UC5_P.3.	I reflect constructively through the networks with other professors or expert professionals, to share and debate about the didactic-pedagogical knowledge, the professional knowledge and local and global social context where we perform.
UC5_P.4.	I disclose knowledge through my participation in seminars, congresses, discussion forums, and different on-site and virtual activities through the network.
UC5_GC.1.	I foster the collaborative knowledge building, committing myself to learn with students, colleagues and other professionals in on-site and virtual environments.
UC5_GC.2.	I participate in the building of pedagogical knowledge, curricular policy, and decision-making regarding educational processes with the support of digital tools.
UC5_GC.3.	I create virtual networks to encourage innovation and quality through reflection and mutual exchange.

6. Regarding diversity, ethics and responsible use of ICT in the teaching professional performance...	
UC6_B.1.	I understand the implications and potential risks of digital tools in segregation and social exclusion.
UC6_B.2.	I act with ethical criteria to responsibly integrate ICTs in the curriculum and in students' learning activities.
UC6_B.3.	I ensure equal access to students so they can use ICTs during on-site learning experiences, especially in collaborative activities.
UC6_B.4.	I provide with digital learning experiences and materials considering students' cultural and linguistic diversity.

6. Regarding diversity, ethics and responsible use of ICT in the teaching professional performance...	
UC6_P.1.	I ensure equal access to students so they can use ICTs during virtual learning experiences, especially in collaborative activities.
UC6_P.2.	I custom and adapt the design of virtual learning activities to meet the diversity of students.
UC6_P.3.	I promote respect for cultural diversity and different ways of thinking during collaborative learning and communication experiences in virtual learning environments and in the use of social networks.
UC6_P.4.	I foster freedom of speech in the communicative processes on virtual learning environments.
UC6_P.5.	I promote ethical, legal and responsible use of ICT in students through critical analysis of the implications and consequences of their inappropriate use for the society.
UC6_GC.1.	I promote debate and critical analysis in the ethical use and responsible application of ICTs and new knowledge built.
UC6_GC.2.	I recognize and respect intellectual rights and copyrights over new knowledge generated through ICTs.

7. Regarding the environment, health, and work safety with the use of ICT in the teaching profession...	
UC7_B.1.	I properly manage stress and emotions to gain new knowledge and skills development around ICTs in my daily practice.
UC7_B.2.	I use ICTs properly together with the corresponding installation and user manuals.
UC7_P.1.	I reflect in the UCTs used with the corresponding installation and user manuals.
UC7_P.2.	I use the digital tools properly, in the right time and conditions of security for myself and my students.
UC7_P.3.	I know and apply the basic security standards around ICT to prevent risks and health conditions in my overall teaching practice.
UC7_GC.1.	I develop innovative strategies for the use of ICT that have a positive impact on the environment.
UC7_GC.2.	I encourage knowledge building for the rational and safe use of ICTs in the preservation and improvement of the environmental, and health conditions in the teaching profession.