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# Collaborative Construction of a Project as a Methodology for Acquiring Digital Competences

La construcción colaborativa de proyectos como metodología para adquirir  
competencias digitales

## ABSTRACT

As a result of the emergence of Information and Communication Technologies (ICT) we are currently experiencing a period of major changes. Higher education plays a key role in helping students to acquire the competences which enable them to be autonomous in both academic and professional environments, where ICT literacy and collaborative processes are considered crucial. This study analyzes students' perceptions about how the collaborative construction of an online project facilitates the acquisition of digital competences. It examines the methodological approach, within the context of the Open University of Catalonia, of the subject: «ICT Competences». This subject is conducted fully online at the UOC, and learners are required to engage in a collaborative project organized in 4 phases: starting, structuring, developing and concluding. Based on an evaluation research approach, quantitative and qualitative data from a survey have been triangulated. The results support the pedagogical methodology which forms the basis of this subject and indicates that collaborative projects facilitate the acquisition of digital competences, highlighting those linked to digital teamwork and digital attitude. The conclusions reinforce the importance of Computer Supported Collaborative Learning (CSCL) processes, the need to put forward pedagogical proposals for the acquisition of both digital and collaborative competences and the relevant role of the teacher in this process.

## RESUMEN

Actualmente presenciamos una etapa de importantes cambios como consecuencia de la emergencia de las tecnologías de la información y la comunicación (TIC). La educación superior ejerce un papel clave para ayudar a los estudiantes a adquirir las competencias que les permitan desenvolverse en los entornos académico y profesional. Entre éstas, las vinculadas a las TIC y los procesos de colaboración se consideran claves. La finalidad del presente estudio es analizar la percepción de los estudiantes a fin de evidenciar cómo la construcción colaborativa de un proyecto digital facilita la adquisición de las competencias digitales. Para ello, se aborda el planteamiento metodológico de la asignatura «Competencias TIC» de la Universitat Oberta de Catalunya, la cual se desarrolla a través de un proyecto colaborativo en red organizado en cuatro fases: inicio, estructuración, desarrollo y conclusión y cierre. Mediante una investigación evaluativa se triangulan datos de naturaleza cuantitativa y cualitativa provenientes de un cuestionario. Los resultados muestran la evolución en la propuesta metodológica de la asignatura a la vez que ponen de manifiesto cómo el proyecto digital en equipo facilita la adquisición de las competencias digitales, destacando concretamente las vinculadas al trabajo en equipo en red y la actitud digital. Las conclusiones refuerzan la importancia de los procesos CSCL, la necesidad de trabajar propuestas pedagógicas para la adquisición de competencias digitales.

## KEYWORDS / DESCRIPTORES

Collaborative learning, virtual learning, digital literacy, competences, virtual environment, teaching practice, social web. Aprendizaje colaborativo, aprendizaje virtual, alfabetización digital, competencias, percepción crítica, práctica docente, web social, wikis.

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## 1. Introduction

The Parliament and the Council of Europe (2006) have laid down eight key competences for lifelong learning, and among these, digital competences are included. Given its rapid expansion, ICT are understood to be one of the most effective agents of social change (Domingo & Marquès, 2011). Digital competences are at the same time considered to be transversal in that they facilitate the acquisition of others (Punie, 2012).

In accordance with the European Commission, we will adopt in our case the term digital competence to refer to the «set of knowledge, skills, attitudes, strategies and awareness which are required when ICT and digital media are used to perform tasks, resolve problems, communicate, manage information, collaborate, create and share content, and build knowledge in an effective, efficient and adequate way, in a critical, creative, autonomous, flexible, ethical and a sensible form for work, entertainment, participation, learning, socialization, consumption and empowerment» (Ferrari, 2012: 3).

As this definition reflects, digital competences have been attributed with a set of skills that go beyond the use of ICT as an instrument (Pérez & Delgado, 2012). At the same time, the European Higher Education Area acknowledges the importance of the carrying out of collaborative activities to be developed in today's society, defining teamwork as a generic competence (González & Waangebar, 2003). The processes of collaboration are even contemplated as one of the key characteristics of online learning (Garrison, 2006; Harasim & al., 2000). Experts have referred to this educational paradigm as Computer Supported Collaborative Learning (CSCL). CSCL focuses on the use of technology as a mediation tool among the collaborative methods of instruction (Koschmann, 1996). In accordance with Kirschner (2002), CSCL is regarded as a tool which permits educators to hold on to current constructivist approaches in order to develop the processes of teaching and learning, involving dialogue and social interaction among the group members, students and geographically dispersed teachers.

The advance and integration of digital technologies are making a great impact on education, changing the methods of teaching-learning, curriculum, learning objectives and the role of students and teachers (Wen & Shih, 2008). ICT promote this change of role insofar as they facilitate opportunities for active learning (Williams & Chann, 2009), changing the role the student and teacher play.

The changes in the role of the students and their

active participation in the creation of educational content have been strengthened by the so-called Web 2.0 (O'Reilly, 2005). Web 2.0 incorporates technology, knowledge and users as essential aspects and is characterised by the collective creation of content, the establishment of shared resources and collaborative quality control between users (Ribes, 2007), adopting an active role, of reader and/or editor.

The tools associated with Web 2.0 increase and reinforce the possibilities for collaboration, communication and production of knowledge (Rhoades, Friedel & Morgan, 2009; Dimitriadis, 2012). The wiki stands out as one of the Web 2.0 tools in that it facilitates processes of collaboration. Bruns and Humphreys (2005) propose the use of wikis in education as spaces of communication where some of the skills are developed and, fundamentally, attitudes towards a new type of technological literacy which is «critical, collaborative and creative» and goes beyond the mere instrumental mastery of the tools and communication environments which ICT offer.

Supported by the literature in this field (Dillenbourg, 2003; Martínez & al., 2003), a group of researchers from the Open University of Catalonia (UOC) began in 1998 a new line of work in collaborative learning in virtual environments based on student activity through the use of ICT. In recent years, our analysis has shown that the student must acquire digital competences in order to optimise the process of learning in a virtual environment (Guitert & al., 2008) following a collaborative methodology (Guitert, Romeu & Romero, 2012). Afterwards, we focus on project work in terms of a collaborative methodology for the acquisition of digital competences. In a complementary manner, different studies linked to online collaboration have been carried out (Pérez-Mateo, 2010; Romeu, 2011, among others). This present study takes a greater look at collaborative methodology between students.

## 2. Materials and methods

The objective of the present paper is to analyse the perception of students to demonstrate how the collaborative construction of a digital project facilitates the acquisition of digital competences. The study will address the following research questions: To what extent have they perceived that they acquired digital competences following the use of a collaborative methodology? How do they rate the methodology for the collaborative construction of knowledge?, How do the value the wiki as a tool for developing a project in a collaborative manner?

## 2.1. Scenario

This present research falls within the context of the UOC, in which the process of teaching-learning takes place entirely online. In particular, we focus on the analysis of a case from the perspective of Stake (2005): a transversal subject which is ICT Competences (ICTC) that is part of a block of basic training in the degrees at the UOC. ICTC are obligatory for most degrees and recommended in the first term of the university. Its objective is that students begin in a gradual and integrated way with the acquisition of transversal competences at the UOC, «Use and application of ICT in an academic and professional environment» and «Online team work». These competences are outlined as: Search and selection of information online, Processing and development of digital information, Presentation and dissemination of digital information, Basic notions of digital technology, Work planning in a virtual environment, Management of a digital project, Communication strategies in the Net, Teamwork in an online environment and Digital attitude.

The methodological approach is project-based learning (Railsback, 2002); concretely, developing a collaborative digital project is contemplated. To develop it, students form groups of 4 participants, having their own group space which integrates different tools. Among these, the wiki stands out as the tool that links all the process of creation of the project. The development of the project is planned in 4 phases (Starting,

Structuring, Development, Concluding), each of which puts forward a set of interrelated activities (figure 1).

The starting phase provides an environment for creating working teams and perform the initial searches. This assists the students in setting out the theme of the project. The second phase involves making a deeper search for information to structure the project. Subsequently, the project is developed: the processing and the development of the information gathered are carried out. Through this step, the first version of the project is achieved. Finally, the closing and dissemination of the project are done; sharing and discussing the final version of the project.

The approach to be carried out is not only oriented to the use of technological instruments but also to the putting into practice of key methodologies and skills for working in a virtual environment. The teacher orients and facilitates this process of construction in an ongoing way. This assessment is based on continuous evaluation (group and individual), thereby assuring the progressive acquisition of competences in each phase.

The resource «Collaborative Digital Project»<sup>1</sup> (<http://389658.uoc.wikispaces.net/?ajax=true>) involves the implementing of a consistent methodological proposal with respect to project work, being applicable to groups of students of varying profiles. Such a resource represents a methodological advance for the completion of the subject. Its objective is to introduce students to a methodology for project work and provi-

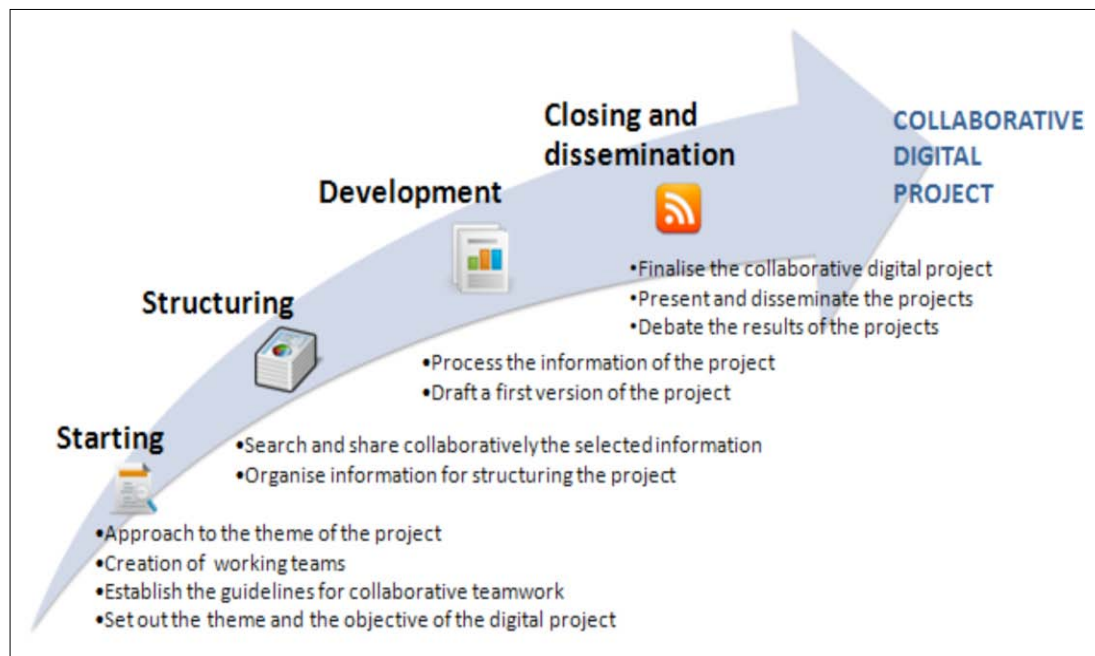


Figure 1: Phases and activities of the Collaborative Digital Project.

de guidelines to develop the project in a collaborative way.

## 2.2. Research design

Responding to this process of applied research, the design of the present study aims to analyse a collaborative digital project as a methodology for online collaboration. Given the transversal character of this subject, a large number of students have been involved: an average of 5,500 annual enrolment. In this study, a sample of 1,887 students participated from 12 different degrees of the UOC.

In the framework of this evaluative research the aim of which is to favour the improvement of educational practice in ICTC, the perception of students is gathered in a systematic way by means of a questionnaire. For this present research, two questionnaires were taken into account, which constitute the instruments for the gathering of the data and at the same time revealing the process of development and soundness of the proposed learning methodology. The first questionnaire sets forth a rethinking of the subject bearing in mind the changes in the proposed methodology (teamwork, incorporation of web 2.0 tools, changes in the platform for the development of the project, etc.) and the second questionnaire responds to a consolidated vision of the methodology. Both questionnaires combine data of a quantitative and qualitative nature.

The first questionnaire (2009-2010 cohort) was oriented towards analysing the perception of the students with respect to the degree of acquisition of the competences of the subject and also to procedural aspects for the development of the project (resources, tools, perception of each one of the activities, role of teacher, etc.). The questionnaire consisted of 20 questions: 16 of Likert-type rating scale and 4 open. It was sent to a population of 1,922 students (second term) and completed by 37.4%, so having a sample of 720 which can be considered significant (sampling error of 2.95%).

The second questionnaire (2011-2012 cohort) focused on the learning resources and the methodology for online project work based on a concrete resource «Collaborative Digital Project» and the analysis of the base tool; the wiki for the carrying out of the project. The questionnaire combined 3 questions of Likert-type rating scale and 2 open ones. It was sent to a population of 3,183 students (second term) and was responded by 36.6% so there was a sample of 1,167 which can be considered significant (sampling error 2.32%).

Both questionnaires were of voluntary character, anonymous and not assessable and were distributed

digitally through the Netquest tool at the end of the course. The reliability of the quantitative questions was checked using the Cronbach's alpha coefficient of internal consistency obtaining a general value of 0.938 in the first questionnaire and 0.874 in the second; both are considered to be highly reliable following Cohen & al. (2011). Both the qualitative questions and the structure and items of both questionnaires were validated by experts in the area. The institutional evaluation surveys of the corresponding courses were also taken into account, which focus on the satisfaction with the subject, the teacher, the resources and its evaluation, and there was a response from 942 students. Academic performance data was also considered. The processing of the information gathered involved the analysis of quantitative and qualitative data. The statistical analysis was based on frequencies. The analysis of the qualitative data from the open questions was done from the identification of categories. All the data of a quantitative and qualitative nature was triangulated to have an in-depth understanding of the experience.

## 3. Analysis of results and discussion

The purpose of the methodology developed in ICTC is to provoke situations that will drive students to acquire digital competences. From the first edition of the subject in 1998, ICTC have adapted methodologically to professional and academic contexts. The result of this analysis and the scope for constant improvement has caused a greater adaptation and advance in the methodology for project work to respond to this objective: facilitate the gradual acquisition of digital competences. This trend is summarised in:

- Gradual incorporation of the methodology for online group work in all of the degrees at the UOC.
- Changes in the format of the project to be developed.
- Development of digital competences.

In the scope of the present investigation, students are requested to evaluate the degree of usefulness of the proposed methodology for the acquisition of digital competences. The objective is to determine if there are significant differences in the methodological approaches. This comparative analysis allows us to observe a marked difference and confirm that the development of the methodology has favoured a greater acquisition of the competences of the students (figure 2): the students perceive that the changes in the methodological approach of the subject adapts to a great extent to their needs, favouring the acquisition of digital competences in a much more effective way.

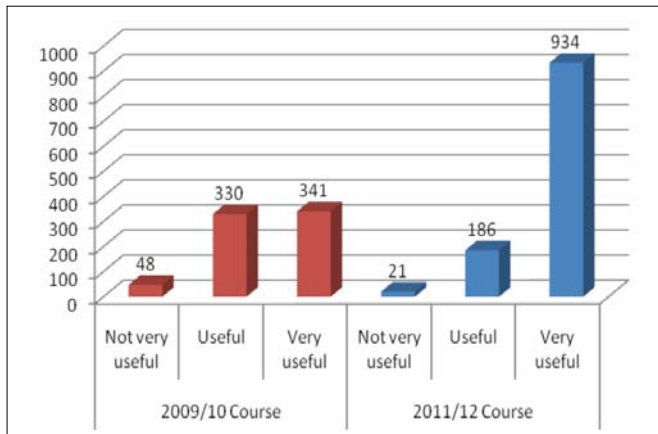


Figure 2: Comparative analysis of the perception of students regarding the usefulness of the methodology of the subject in the acquisition of digital competences (frequencies).

As we have already expressed, the evolution of the subject is shaped through the «Collaborative Digital Project» resource, which strengthens both the strategies and guidelines for developing the processes of online collaboration as well as the use of Web 2.0 tools in order to favour the acquisition of digital competences. The student evaluation regarding this resource is positive. In the words of the students:

- «Due to the lack of experience of working in a group online, many times throughout the term I consulted a set of resources which the subject provides; especially the resource which provides the methodology on how to carry out team work in a virtual way».
- «I particularly liked the body of the subject but especially the resource on how to accomplish a collaborative digital project and the advice and guidelines of the tutor».

From the interpretation of both questionnaires, a common element emerges and is therefore independent of the evolution of the methodology: the role which the teacher plays in guiding the learning process and help the students to acquire digital competences. While it is true that the questionnaires used did not make any reference to the teacher, this role appears repeatedly in the responses of the students, thus demonstrating the importance of being accompanied throughout the process. It is for this reason why we tackle the following sections in a transversal way.

### 3.1. From the individual project to collaborative project work

In accordance with the literature in the field, the preparation of the project in ICTC evolves from a model of individual work (Guitert, Romeu & Fuentes,

2005) towards a collaborative one based on teamwork.

It is worth highlighting that this fact has major repercussions in the approach to the methodology. Indeed, teamwork does not just become exclusively a change in terms of the willingness of the students to work in a team but also implies a set of actions and strategies oriented to help students to manage their work in a team both at the beginning of the process (through the establishment of an internal regulation and a group work plan) as well as during its development, fostering reflection and constructive criticism related to its dynamics. The students have found how the subject provides opportunities to learn to work collaboratively online. The following are some of

the opinions of the students on this issue:

- «One of the strengths which would stand out is the experience acquired with teamwork in an asynchronous and virtual way; an experience that I had not known before».
- «I had no knowledge of group work using the Internet. It has been very useful for me. I think it will be a very useful tool in the future for professional needs»
- [The teamwork] «has been a key element that will facilitate taking up other subjects that require team working and quite a lot of knowledge of the tools and how interaction with our colleagues achieves the best learning results».

In a collaborative learning scenario, the teacher exerts a specific and differential role from other learning methodologies, considering it one of the key elements in the process of learning (Urhahne & al., 2009). Reinforcing these studies, the students reflect in the following way:

- «Have an external vision has been very useful to improve the project and group work».
- «Having made the effort to follow the guidelines and advice for the completion of the project. We think that these instructions were very appropriate and constructive».
- «The different evaluations have helped us in building the group, and these have been enriching to correct situations, improve...».

### 3.2. From the textual account to the wiki

The inclusion and the progressive use of different Web 2.0 tools for the making of the project is another key element in the approach of ICTC: it develops

from a textual project prepared in a local hard disk from file versioning to a project that is fully constructed using online tools in a hypermedia format.

Since 2007, the project has begun to develop collaboratively by means of a wiki. The wiki stands out among the Web 2.0 tools as the one that facilitates processes of collaboration. The research in this field states that the wikis have the potential to improve the collective construction of knowledge in academic contexts (Elgort, 2007; Raman, Ryan & Olfman, 2005) and in the results (Robles & al., 2009). The data demonstrates a favourable progression in the use of the wiki as a tool to develop a collaborative digital project. Figure 3 illustrates the students' perception with respect to the degree of perceived difficulty, and we can see that 85.3% of students from the cohort do not perceive difficulties in the use of the tool, in contrast to 81% from the 2009/10 cohort. This perception can be due to the fact that the wiki and its use have spread to a greater extent and its technological development is more intuitive and with less requirements of HTML language.

The students affirm its usefulness very explicitly when they state that «the use of the wiki has been really useful in carrying out collaborative work, and that it is a tool that could be used in other learning situations in the UOC and outside it». Another student comments: «we were all a little lost at the beginning but between us we learned how to use it although it required practice, especially if one has never worked with it before». The teacher plays an important role in guiding how to use the tool. As one student has affirmed: «it is interesting that the tutor encourages us to use the comments of the wiki as a means of communication and it encourages us to change format by

default. The final result of our wiki was very personal».

### 3.3. Develop digital competences through a collaborative online project

From the beginning of the subject until now, the concept of ICT has evolved through progressively including emerging technologies. This is why the subject is currently evolving towards the concept of digital competence. The analysis of the student perception with respect to the degree of acquisition of digital competences points to a positive evaluation. The means of these items points to the evaluation of these (taking into account a scale of 1 to 3) stand above 2.6 with a standard deviation inferior to 0.4. Figure 4 shows in greater detail the student evaluation on the basis of digital competences worked in ICTC and linked to the process of learning.

As is evident from figure 4, students perceived that they have acquired a high level of digital competences, highlighting two as being key in relation to collaboration: civil attitude and teamwork as a collaborative strategy.

#### Acquiring a civil digital attitude

On the one hand, 98.75% of the students (a total of 711) perceived to have developed to a higher or medium degree of the competence related to the acquisition of a civil digital attitude. These results coincide with the studies performed in the field of online teamwork. Authors like Guitert and Romeu (2006) emphasise that for the preparation of any collaborative activity, the attitude adopted by the members is key for its success. In particular, among the set of values that stand out: commitment, transparency in the interchange of information and the expression of ideas, persistence and respect as basic attitudes in a virtual collaborative environment. The fact of working collaboratively online leads to the development of these attitudes in accordance with the perception of the students: «I have had the opportunity to share in a group project and interact and personally meet other classmates that I had not previously known. Our positive attitude, undoubtedly, has contributed to this» (Pérez-Mateo, 2010).

#### Acquire teamworking skills online

On the other hand, 97.2% of the students (a total of 700) value the fact that they have developed skills linked to team-

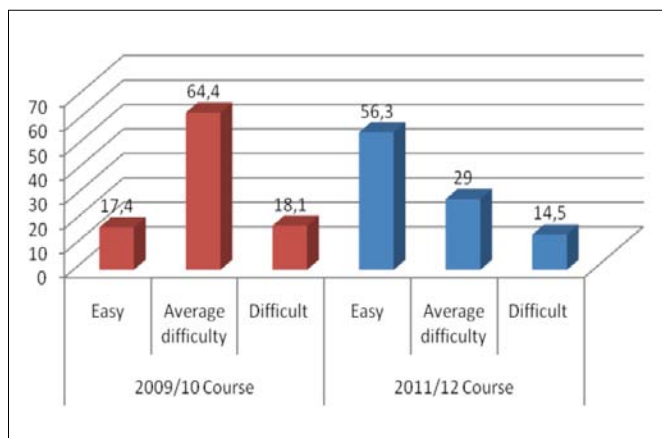


Figure 3. Perception of the students regarding the degree of difficulty of the wiki as a tool to develop a collaborative digital project.

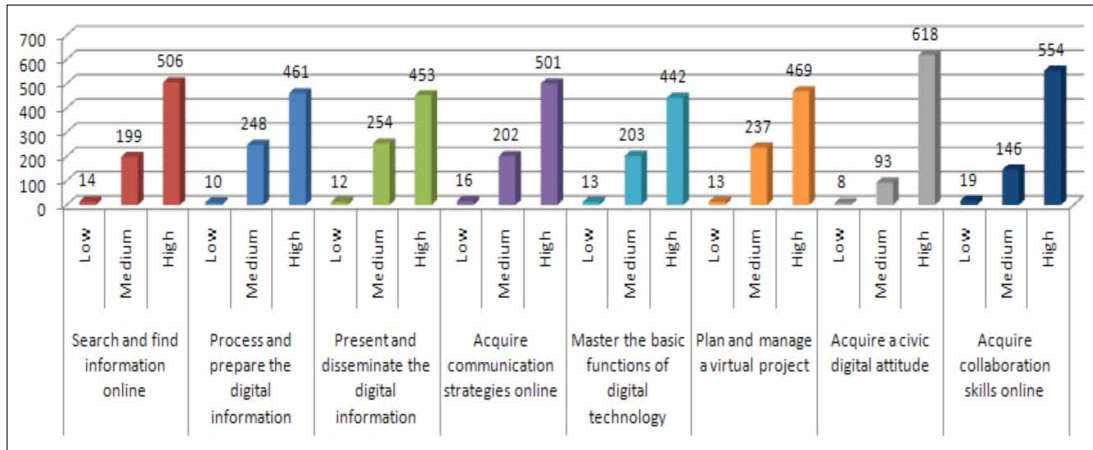


Figura 4. Evaluation of the grade of acquisition of digital competences in the subject (frequencies).

working online to a high or medium degree. A student made a point concerning this line: «Although I initially had some reticence since I did not know my companions, I value as one the strengths the virtual dynamic aspect of the subject that I obtained through team-working». Another student states to be currently: «becoming more familiar and prepared for group work. I have learnt a lot from my team-mates, to respect the way things are done and communication».

We consider that the high valuation of the students with respect to the acquisition of these competences to be the due the relationship that exists between the two. Concerning this, Guitert and Romeu (2006) highlight the relevance of the attitudes adopted by the members in the configuration of collaborative dynamics. The high rating of the students with regard to the acquisition of digital competences coincides with the higher number who passed the subject which, according to institutional data, stands at 73% for the 2009/10 cohort and 77.2% for 2012/13 cohort, increasing the positive impact that the evolution of the subject has had on the students.

Likewise, the effectiveness of the proposed methodology for the acquisition of competences is reflected when making reference to the application or transfer of skills that are put into practice. 94.5% of the students value positively the degree of usefulness of such competences for the completion of other subjects at the UOC. In the words of a student: «I will now be able to apply this knowledge to other subjects in online team work». Another student affirms to have: «learnt to use the tool and work in a team. I am going to use all of this in the next term's subjects». In accordance with the rating of the students, generally speaking, the competences acquired in the subject have been found

to be very useful for the carrying out of collaborative activities.

The changes in the methodological proposal which ICT have witnessed in recent years has led us to redefine digital competences, strengthening those related to collaborative work and the use of ICT; fundamentally oriented to managing group processes and the importance of the publication and dissemination of its contents by means of 2.0 tools. To analyze the perception of students regarding these competences, students were asked to what extent the methodology of the collaborative digital Project had helped them in acquiring them overall. Figure 5 illustrates how the majority (865) have shown to agree with this aspect.

The intervention of the teacher emerges once again as a key element in the perception of students in the acquisition of digital competences. In the words of the students:

- «The guidelines offered by the teacher have helped me to acquire the digital competences; his/her communication and immediate, clear and efficient dialogue with us has created an accessible and personalized contact».

- «I especially value the function of the guide and advisor that the teacher has demonstrated throughout all the process and indicating whenever possible which resources to work with in order to gradually acquire those competences».

- «I stress the importance of the tutor's attitude with us».

#### 4. Conclusions and prospects

In a social context influenced by the emergence and availability of applications and functionalities that provide support to learning processes, pedagogical

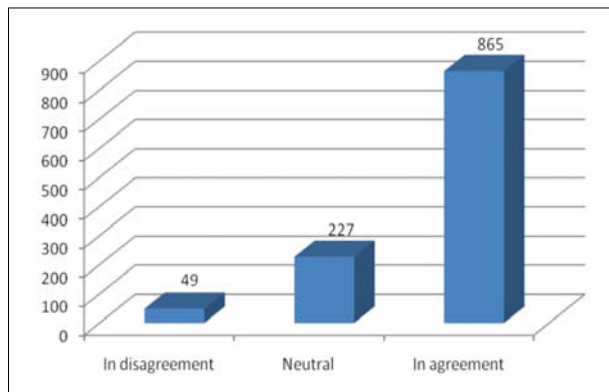


Figure 5: Perception of the students towards this finding: «The method of a collaborative digital Project has helped me to acquire digital competences» (frequencies).

processes are in a moment of change and development.

Being conscious of the importance for students to acquire digital competences for use in academic and professional fields, we have developed a methodological proposal which integrates collaborative learning and the use of ICT. The data gathered brings to light the positive perception of students with respect to the acquisition of digital competences by means of the drawing up of a collaborative digital Project using a wiki; among these competences which specifically stand out are those linked to the acquisition of a civic digital attitude and team working skills online (collaboration). This perception is reinforced by the high level of satisfaction of the students towards the subject, standing at an average of 82%.

The results described are evidence that the methodology for collaborative team work is valid, confirming at the same time the positive development of the subject methodology. It involves, therefore, a coherent and effective proposal, in which the attainment of the phases and associated actions leads students to acquire digital competences.

The intervention of the teacher has been identified as a key element to reinforce the process of the acquisition of competences through the follow-up of groups in an active, accessible and personalised way. The institutional data support this fact, given that it deals with that part of the subject that is best rated in all cases, with an average score of 91%. These results reinforce the necessity of having a teacher whose function is to guide and dynamise the learning process (Guitert & Romeu, 2011).

The following students' comments emphasise the three key aspects in the approach to ICTC: the impor-

tance of the processes of CSCL; the methodology in the acquisition of digital competences and the role of the teacher.

- «I feel that teamwork is really interesting. The subject has been really great in order to gain greater confidence in new technological tools. It has also been really interesting and appropriate to learn to work in an asynchronous way which is each time more valued».

- «I was delighted with the work methodology and the organisation of the subject».

- «I have had the impression throughout the subject I had the feeling that the working guidelines came at the right moment for me, something which has permitted me to feel guided at all times. I find that it has been a subject that has been really well drawn-up, planned and managed».

The results that have been obtained encourage us to continue in the direction of research initiated at the very beginning and at the same time to tackle those new questions raised in order to improve the methodological approach of the subject. Some lines of future work are: to validate the proposal of the current digital competences of the subject from the perception of students and teachers; to carry out a study of longitudinal cases with students that have passed the subject satisfactorily; to determine the level of the transfer of digital competences at the end of the degree; to systematise the process of research through posing comparable questions throughout the different stages of the research which is an aspect that constitutes the principal limitation of the present work; to analyse the possible differences and similarities according to the profiles of students (according to of the course they are doing); to boost the reuse of student projects in the direction of open education; etc. In short, the outlined research endeavours to provide students with the essential skills and techniques to perform better in a digital society.

## Notes

<sup>1</sup> The resource outlines the key aspects of the methodology to be used: phases, objectives and expected products, resources to be used, etc.

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