Learning Content Development With Social Tools: Learning Generated Content in Engineering

Ana María López Torres and Cristóbal Nico Suárez Guerrero

Abstract— **The activities associated with learner generated content are supposed to enhance the learning process, facilitating the construction of knowledge. In this paper, the description of the process of creation of learning content is addressed. A group of students in the first year of an engineering degree collaboratively constructs a blog that covers the real-life applications of the physical concepts that are studied. We identify the characteristics that define meaningful learning during the development of the task and analyze the advantages and problems related to the use of Web 2.0 applications and Internet as learning tools.**

Index Terms— **Active learning, Engineering education, web 2.0 learning tools.**

I. INTRODUCTION

BY USING the information and communication technologies, ICT, in learning processes of any modality (presently, blended or virtual) the context that helps to introduce a new methodological approach is enhanced. The main difference between this new approach and the traditional practice is the strong change in the role of the main agents of the learning process: students and teachers [1], [2]. Learners must play an active role in order to reach meaningful learning. They leave their passive role as mere receivers of the information provided by teachers and create their own knowledge from their personal and social experiences. Teachers assume a guiding role in the process. In this way, students increase their responsibility level. This new approach, which is based on a constructivist view of the learning activity [3], does not essentially require the use of the new technologies. Moreover, the use of ICT itself does not guarantee the development of authentic learning.

These changes in the learning agents' roles also affect the type and use of didactic materials [4]. From a traditional point of view, learning materials were static products, developed in different formats, created by an authoritative source. All students within the same level worked with these contents in the same way, following a closed learning itinerary. They were discipline-centred materials. The evolution to learner-centred methodologies implies working with a new kind of learning materials that let the learners choose their own pace and itinerary through the construction of their knowledge. The hypertextuality that characterizes multimedia materials

supports this kind of interaction, provided that the didactic materials are properly conceptualized. By the use of different formats it is possible to adapt to different learning styles and to reach a degree of personalization in the learning process. This instructional strategy enables students to use higher order thinking skills. A step beyond is taken when students create their own learning materials, and they reach the highest cognitive levels of complexity of Bloom's Taxonomy [5] (synthesis and evaluation), while the use of traditional didactic contents entails working at the lowest levels (knowledge and comprehension). Students not only discover the materials guided by the teacher, but they generate and personalize these contents as well. This shift in the conceptualization of learning contents is closely related to the use of ICT in the learning environment.

Learning materials have been always generated by students during the learning process but they have been mainly used by teachers just to assess their progress, in order to provide feedback to them (formative evaluation) or to grade the knowledge achieved (summative evaluation). These contents can also have an intrinsic value as a new teaching methodology or as lasting products that can be used by other learners [6]. The teaching approach based on empowering students to create their own contents is known as Learner Generated Content (LGC). In this paper, a LGC activity developed in a specific context is described. First year students of engineering at the University of Zaragoza, Spain, must generate digital content using Web 2.0 tools.

LGC is a relatively new concept that is being explored by educational researchers as a learning tool/methodology that enhances meaningful learning. But also, the tangible result of this process has been analysed. The materials product of the learning experience of a group of students can be re-used in a different formative situation [7]. Therefore LGC can be, on the one hand, described as a process that facilitates students acquiring new knowledge and skills. In this case, it is necessary to understand which features characterize knowledge building in order to identify them in the LGC activities. If, on the other hand, the products of LGC processes are studied, the definition and application of quality criteria is required. The main aim of this work is to describe LGC as a process, not as a product. However, the analysis of the generated digital contents will help us to understand the process.

The tools used by students to generate their own contents can belong or not to the new technologies. Our work focuses on the use of Web 2.0 tools, specifically a web log (blog), to generate students' learning materials. Web 2.0 tools stand

for a new philosophy of internet use. Web 2.0 allows people to get actively involved in creating content in a collaborative way. User communities emerge that generate and share knowledge. Though the emergence of Web 2.0 is linked to an evolution of internet technologies, the true revolution is based on the social use of the new software applications [8], [9].

As it will be explained below, we have addressed in a special way how the students manage the information when they perform a LGC activity. Nowadays, the information that the students gather to elaborate learning contents comes mainly from internet sources. The internet provides information in different formats that may give rise to a great variety of high quality educational materials. However, the fact that these sources can be easily replicated may be the origin of valueless products whose generation does not imply a personalized, active approach to learning. Plagiarism among higher education students has been widely documented as a common practice [10], [11]. It is a real problem that can be boosted by the ease of access and copy of the information in digital format. In this way, what could be a good learning experience may turn into a worthless, mechanical task. Besides, it should not be forgotten the inherent risks of using ICTs. For example, problems may arise when students search information in the internet without the proper guideline or when they face the challenge of using software tools with an inadequate digital literacy [12].

II. LEARNER GENERATED CONTENT CONCEPT

The concept of Learner Generated Content encloses all the materials generated in a spontaneous and dynamic way by students within the educational process [4], [6], [7]. It may include the deliverables resulted from the formal assignments as well as any material (drafts, synopsis, discussions…) that evidences the advances in the process of learning. Most of the research work about this concept, as will be summarized below, is developed by the analysis of one or several concrete experiences where the learning benefits are identified together with the challenges that must be faced when this kind of didactical practice takes place.

The concept of LGC was clearly described by Sener in 2007 [6]. In this paper, the author not only describes the benefits of this educational methodology, but also their risks and the obstacles that a teacher has to overcome when he wants to put into practice this learning technique. Sener affirms that the creation of contents enhances the student's engagement, which increases the quality and effectiveness of the learning process. LGC can go beyond an assessment tool and become the origin of end-products with intrinsic educational value. LGC promotes the emergence of professionals with initiative and self-learning skills. However, Sener states that good examples of LGC are hard to find. The main reason is that the traditional educational model considers that students lack proficiency and experience to assume responsibility in their own learning. Though it is widely believed that Web 2.0 technologies and active learning methodologies are supposed to make a difference, this kind of activities is still the exception. They are performed as innovative, pilot experiences

that are not fully integrated in the daily teaching practice. The lack of LGC strategies is associated with the resistance that the teaching community offers to the change from a teacher-centred paradigm to a student-centred one. Besides, it is necessary to admit that the students are in some cases reluctant to change the educational model, as they do not desire to increment their work load even though it implies losing the opportunity of reaching meaningful learning. The new role as content generators that must be assumed by learners is known as **prosumer**. This concept, born in the Web 2.0 context, describes students as producers and consumers of their own outputs.

Most of the work devoted to study LGC focuses on the associated learning experience that enables students to take control of the process and attaches less value to the reuse of the generated material [4]. The student-content interaction changes as the learning methodology evolves from a teacher-centred model to a student-centred one. As the student's engagement grows, their interaction with the learning materials heightens. The pre-packaged authoritative content stands for the lowest degree of interaction. They come from a qualified authority (teacher, textbook) that controls the way to work with the material. This kind of materials accomplishes the mission of transmitting knowledge (acquisition metaphor of learning). A step beyond, guided learning materials still come mainly from teachers but are adapted to a specific learning group and offers alternative itineraries. In this way the student's participation is enhanced (participation metaphor of learning). Finally, learner performance contents are dynamically and spontaneously generated by students in the process of learning. They allow a total commitment in the process of creating new knowledge structures (knowledge creation metaphor of learning). The last type of materials should grow in importance over the pre-packaged contents [13] as they also guarantee a greater adaptation to different learning profiles. Any materialization of the learning development is interesting and can be considered LGC: formal assignments, drafts, planning, discussions… The web-portfolio is considered the most appropriate tool to collect all these learning products.

Most authors remark that Web 2.0 tools are adequate to the generation of contents in constructive learning environments. These web applications [14] enable the development of the three P's of pedagogy for the networked society (Personalization, Participation, and Productivity), and make it easy to contribute ideas and content in order to create individual or collective LGC. Many case studies about LGC experiences based on the use of Web 2.0 tools have been reported [15]–[18]. Our work follows this approach, and is focused on the description of a concrete learning situation.

As it has been mentioned, though LGC is mainly analysed as a learning process and assessed in virtue of its pedagogical benefits, some authors also evaluate the output products of the process. These learning materials created by students within their learning activity are useful not only for the students that have created it in an authentic learning experience or for the teacher that uses them in his or her assessment role. They may have an intrinsic educational value that can be re-used in different learning situations [7]. If the LGC are going to

be used in different learning processes it is also necessary to guarantee the quality and validity of the materials [4]. Therefore, this approach has developed a quality framework for LGC. Quality issues regarding LGC should pay attention to both the process of material creation and the contents and format of the output products.

One of the most important challenges that must be faced when students are supposed to create their own learning contents is the development of the skills required to properly manage the enormous amount of information students can access. The problem of the initial confusion associated with the use of a new technological tool must also be taken into account. Besides, as the users access the web application in a concurrent way, these tools can collapse and the users may feel frustrated because they cannot advance in the task. Another alarming aspect is the creation of didactic materials as a result of the mere juxtaposition of paragraphs proceeding form different web pages, lacking any personal contribution [18]. Therefore, it is important to guide and help students during the process. When this control is performed together with students, they get more involved in the LGC process. The degree of understanding and maturity increases and so do the learning benefits.

The use of blogs in teaching-learning processes has been already documented. This kind of experiences in Higher Education is described in [19]. Blog use has evolved in a natural way from a mere fore to share learning experiences to a student controlled space where collaborative learning takes place. Teachers have also taken advantage of this tool and have used it to expose learning contents in a static way. Blogs have been used in relevant experiences in Higher Education and have enhanced the start of constructivism strategies in agreement with the aims of the new European Higher Education Area (EHEA). Blogs, as the rest of Web 2.0 tools, are one more tool and it is not recommended to base all the learning experience on them. Web 2.0 tools may be valid for a group of students or for specific tasks but it is possible that the use of blogs does not adapt to all learning profiles. So, it is interesting to establish a matrix of blog learning uses which collects all the benefits that teachers and students may obtain from reading and creating blogs [20].

III. RESEARCH DESIGN

A. Objectives and Research Questions

The purpose of this research work is the systematic description of the process of Learner Generated Content carried out by higher education students attending the first year of an engineering degree. Special interest has been taken in analyzing the management of the information obtained from digital sources.

The research questions that are going to be answered are:

Q1. What activities do first year students carry out when they generate educational digital materials using the Web 2.0 tool named blog?

If the actions performed by students are described it will be possible to detect if this learning strategy can be identified with effective knowledge construction. Do students really play an active role, assume the responsibility and reflect on the learning process?

Q2. How does their previous knowledge about Web 2.0 tools affect the process?

The use of a new tool may require a learning effort that could mask the main objective of the learning task. It is also possible that the excitement associated with the learning of a new software application makes students spend most of the time testing all its possibilities instead of creating quality contents.

Q3. What activities are related to the management of the digital information?

The documented plagiarism in assignments' result deliverables (above all when these deliverables have influence on the quantitative assessment) makes it necessary to trace the origin and management of the information sources. Besides, it is interesting to know how the students face the challenge of arranging the huge amount of information they can get from the internet. We want to confirm if the information sources have been corroborated, if the contents from different sources are combined to create an original, personalized final product or if just a replication of web content is performed.

B. Methodological Approach

Our concrete object under study was the process of creation of digital learning materials by first year students of the degree of Electronic and Automatic Engineering. These high studies take place in the University of Zaragoza in Spain. This LGC example was integrated in the curriculum of the subject Physics II. Students must explain industrial applications of the studied physical concepts and give actual examples. They worked in pairs. Each couple created a blog entry about a practical application of electromagnetism. In this way, the whole group participated collaboratively in creating learning materials that are suitable for any first year student of an engineering degree. The assessment of this activity contributed to the summative evaluation of the subject. Students were expected to approximately dedicate seven hours to complete the task. The final product is public [21].

We have tackled the research questions with a mixed methodological approach. Quantitative and qualitative methodologies have been integrated in a complementary way. Related to research questions 1 and 3 a qualitative approach is addressed as the aim was to describe the process. No variable had to be defined and no causal relationship definition was aimed. We have followed the case study methodology, as it will be explained below. However, the formulation of question 2 implies to establish a relationship between two variables: students' previous knowledge about Web 2.0 tools, and degree of difficulty of the task. So, a quantitative approach is necessary to clearly define these two variables. An ex-post facto analysis has been carried out.

The pursued objective (description of a process) and the object under study (a specific group of students) in a particular context who must carry out a specific task, justify the use of a qualitative approach that fits within the typology of case study. The researcher observes how the event takes place and explains

the reality she has observed. In this case, the researcher plays a clear role in the group under study as she is the teacher in charge of the subject. She is not an external observer, so her personal feelings can be an important factor in the process. At the same time, the students' behaviour is less affected by the observation process because the researcher is not considered a stranger. In this way it is easier to complement the researcher's explanation with the students' own interpretation.

A triangulation strategy has been used to collect information about the process in order to ensure the internal validity of the research work. Three different tools have been designed to collect information: direct observation, open-question questionnaires and personal interviews. To gather more information about the management of the digital information sources (Q3) researchers carried out the indirect observation of the deliverables created by the students. A tool designed to localize web content, *Plagium* [22], was used. This web application enables teachers to analyse in a simple way the degree of originality of the work or how many different information sources have been consulted to write up the blog entry and the way these sources were combined. The final aim was to define a relationship between the actions executed on the information sources and the personalization of the generated materials. This analysis was completed by classifying the kind of sources referenced by the learners.

Descriptive statistic techniques have been used to establish a direct relationship between the previous experience with Web 2.0 tools and the problems faced when learning materials are generated with these software applications. Students answered the items of a multiple choice questionnaire before the activity began. With this information, the independent variable "previous experience with Web 2.0 tools" was defined and measured. The researcher/teacher had no chance to influence on the value of this variable, which was measured in a single group formed by students that had received the same information from the teacher. No comparison between groups could be done. A second closed-question questionnaire was the tool, at the end of the activity, used to define and measure the dependent variable "degree of difficulty of the task".

IV. FIELD WORK DEVELOPMENT

Field work took place in May 2012 and lasted three weeks. The task the students must fulfill was part of the compulsory activities of the subject named Physics II. The task was developed through three presential sessions (lasting two hours each), where the teacher plays only an orientation role. During these sessions, the teacher/researcher performed an observation work taking special interest in the following aspects:

- Observation context description.
- Recording of the students' public participation: complaints, doubts, jokes, ideas.
- Recording of some of the oral interactions among students.
- Recording of the communicative interaction between teacher and students.
- Description of nonverbal communicative elements.

The researcher carried out three different interviews, one each week, to three of the work groups in order to get information about how the task was developing.

These interviews were partially structured. Starting form a pre-established group of questions that were focused on the content generation task, the interviews sometimes evolved to informal talks. The familiarity between researcher and learners enhanced a relaxed atmosphere.

Finally, all the students could answer two closed questions forms (to get information about previous Web 2.0 tools knowledge and to detect, at the end of the task, the problems related to the use of these tools), and a third one consisting of open questions. The items included in this open questionnaire were intended to detect if the studied process could be identified as a true knowledge creation process. Students had access to the questionnaires in the Moodle virtual environment that supports the subject.

In the next section, we explain how the information collected through these tools has been analyzed.

V. INFORMATION ANALYSIS

As it has been mentioned in previous sections, two information sources have been used to give an answer to the research questions: the research subjects, students, and the materials resulted from the activity.

Using this data, the LGC process has been described, the actions related to the management of information have been detected and a relationship between previous experience in blog-use and difficulties in the task has been established.

A. Knowledge Construction Identification

The constructivist paradigm applied to the teaching-learning process identifies true learning with learners that create their own meanings [23]. Students learn when they add the new concepts and skills to their previous knowledge network. Teachers must provide the tools that help students to modify their knowledge structure, but the learners must take the main responsibility by playing an active role. Therefore, instructional design in general and, in particular, each of the activities that are part of it, must follow a set of guidelines to guarantee authentic learning [24]:

- Student's active participation. Learners must do things and engage in the process.
- Reflection on the learning process. Learners must think about what they are doing.
- Responsibility on the learning process. Learners must have the opportunity of making decisions.
- If knowledge construction is strongly related to the previous experience and the social context of each learner, instructional design must provide different itineraries that adapt to different learning profiles.
- Continuous orientation. Teachers are not the unique origin of knowledge but they play a crucial role in the learning situation. They facilitate this personalized building process providing students with the proper scaffolding.
- Authentic activities. In order to increase the students' degree of compromise it is important to propose tasks directly related to the real world (situated learning).

The constructivist paradigm includes also a social aspect [25]. Every learning process takes place in a concrete social context that has a determinant influence on the way each person builds knowledge. The new meanings are not independent of the social context and so social interaction is indispensable for authentic learning. Therefore collaboration and communication among students must be present in the instructional design [26] if meaningful learning is addressed. These are the features to search in a LGC activity in order to identify it with an authentic knowledge construction process.

The content analysis of the documentary material resulted from the observation sessions, the interviews and the open-question form, let us identify the semantic categories that signal true knowledge creation. This kind of processes is strongly associated with meaningful learning. We look for students' assertions and attitudes that stood for the semantic categories shown on Table I: learners' active participation, learners' responsibility on their own learning, reflection about the formative process and personalization of the knowledge construction.

Once these units of meaning were localized, we have carried out the description of the students' work identifying phases and actions. After this description was fulfilled, it is possible to determine which elements of the proposed activity were compatible with the idea of content generation. In other words, this research work detected what students make and feel when they are really constructing learning content in the case studied.

B. Relationship Between Previous Knowledge on Web 2.0 Tools and Problems Faced in Performing the Task

The information necessary to answer this question was collected by means of two multiple choice questionnaires. They were completed by the students in two different moments of the activity. The first one was answered just before the task began and the second one after its conclusion. Students could access both questionnaires in the virtual learning environment of the subject.

The first questionnaire was designed to quantitatively evaluate two variables:

a) Previous knowledge/experience with Web 2.0 tools.
b) Specific knowledge about blog use.

The information was analysed with descriptive statistic tools and visualized by means of histograms that show the percentage distribution of the answers.

The second questionnaire aimed to measure two new variables related to the degree of difficulty associated with blog use:

a) General issues: technical difficulties, time spent on learning how to use the software tool and reluctance to make the generated material public.
b) Degree of difficulty in comparison to working with a text processor (Microsoft Word, OpenOffice Writer…). Word processors are the tools mainly used so far to create digital deliverables.

TABLE I
FEATURES OF MEANINGFUL LEARNING AND HOW TO DETECT THEM IN THE LGC ACTIVITY

Active participation	- Actions performed by students.
Responsibility on learning process	- Actions performed by students that have not been explicitly specified by teachers. - Planning actions. - Selection of information sources.
Reflection about learning	- Relationship with the contents of the subject. - Assessment of one's own work and other students' work. - Value given to the activity related to the rest of the subject programme.
Personalization	- Elements that differentiate one group work. - Personal valuation of the activity.

C. Analysis of the Digital Information Management

The information obtained from the students (observation, interviews and questionnaires) was analyzed again to determine if the students had taken into account, when they assessed web sources, the basic guidelines provided by the teacher [27]. These guidelines advise to identify the authors and their credentials, to check if the information is correctly updated, to detect if the authors' opinion can be biased, to analyze the links included on the web site or to search for citations of that web page.

The materials created by the students have been also analysed to identify the actions carried out on information sources. The aspects taken into account are shown on Table II.

VI. RESEARCH RESULTS

A. Description of the Process of Content Generation

At a first phase, students had to face the confusion associated with the novelty of the task. They had to use a software tool, not completely new for them, but never contextualized in the academic work. Besides, the proposed assignment had a degree of freedom greater than the previous proposed tasks.

Though students declared in the interviews that they had not felt surprised by the proposed task, the degree of excitement and restlessness was higher than in similar activities. Most of students was quickly aware of the simplicity of the software tool and began to concern about how to select the information to include in the blog entry. The fact that the task could be solved following different paths and had many possible solutions somehow disturbed them.

TABLE II
ASPECTS TO BE CONSIDERED WHEN THE GENERATED CONTENTS ARE
ANALYZED

Number of sources used to create each blog entry - How many citations the students affirm to have used. - How many citations were really used to create the blog entry
Kind of sources used to create each blog entry - Digital sources versus books or notes. - Sources from educational or technical institutions versos informal forums.
Degree of combination of different sources: - Detect if more than a 50% of the content of a blog entry was taken from the same source.
Existence of completely original elements.

In a second phase, once the students were really centred on the task, a set of common actions have been detected. We use cursive text to literally cite students' assertions.

- Actions related to information management: *search, read, chose, summarize.*
- Actions related to the edition of the blog entry: *write text, link Youtube videos, insert images, add multimedia elements.*
- Actions related to work planning: *think about how we are going to carry out the work, develop a draft in Word.*

These actions reveal that the students participate in an active way in the process and make decisions since they select which information will appear in the final product and why. Besides, not all the groups carry out the task in the same way:

- In some cases, students consulted books and class notes and in others only digital sources were used.
- Some students first wrote a draft using a text processor (mainly Microsoft Word) and then replicated it in the blog, and others worked directly on the web application.
- Some of them finished the search of all the required information (there were several sections that must be fulfilled) before writing the final product and others preferred to search for information and create the digital material at the same time.

However, though the process was characterized by an active participation and decision making, creativity was limited to combining pre-existent materials of different formats: texts, images or videos. Only two blog entries contained completely original material: one group recorded a video and another pair of students wrote a text from scratch. One of the sections that should appear in the generated content was the explanation of the physical basis of the industrial application. This explanation should be related to the concepts studied in the subject. These concepts were supposed to be known by all the students; therefore they had to be able to write them up without using an external reference. This fact reveals that the theoretical concepts have not been thoroughly understood,

so students could not use their own words to explain them. But also, one of the interviewed students clearly revealed a less obvious reason: *one of the difficulties was not to find exactly the physical explanation that I was looking for.* That is, he knew which information he should include but, instead of writing it up by himself, he expected to find it on the web in order to add it up to his work. He relied more on the web material than on the contents he could create.

One of the questionnaires contained issues aimed to get information about how the students reflected on the learning process. These questions, designed as information collection tools, have been useful to stimulate this reflection skill. To propose this kind of questions to the students has an intrinsic value that goes beyond the aim of collecting information about the studied case. On answering, students thought about how their situation had changed after completing the task and realized what they had achieved with the learning activity. Though most of them answered to an initial question that they had learned nothing, after several questions about the process they were aware that something had changed. As a positive fact, all the students affirmed to be able to explain the functioning of the application they had worked with. Though this assertion could not be completely true, it helped them to realize what the result of the work should have been and to reflect on the degree of success in achieving this result.

As the students had to work in pairs, the knowledge building was collaborative. Most of the groups planned a task division. Collaboration between different groups was not important. Some students thought that sharing information was not allowed.

The global outcome was a digital learning content created by all the students in a collaborative way and that can be used by them and by learners of future years.

B. Treatment of the Information Found on the Web

As it has been mentioned before, the activities of searching, selecting and putting together pieces of information taken from different sources, mainly digital ones, involved that students played an active role, made decisions during the process and personalized their learning. The task of selecting and synthetizing, as they claim, forced them to read and understand the information in order to identify what was really important to structure the material.

Though all of them knew that they must apply quality criteria to the web pages they used as information source (and so appears in their answers), only the ones that consulted textbooks justified why they had worked with these sources.

Many groups used literal information from user-forums. These communities were not linked to any technical or educational organization. We think that learners need to go in depth more on the validity and quality of web sources. The LGC activity would improve, for example, if students had to fulfill a specific set of questions about each of the cited digital source. These questions would cover such aspects as authorship, relevance or validity and would help learners to reflect on their decisions and to

interiorize a set of good practices in selecting information sources.

The Spanish version of the Wikipedia web-page [28] was the most used digital source. This is a source of proven validity that covers multiple knowledge areas. Besides, it is always one of the first results when using any web search engine.

The information collected by means of questionnaires reveals that, before the LGC activity began, students were used to working with web search engines and that a notable percentage of them used the advance search tools to find information. The analysis of the final blog entries showed that, on average, 3–4 information sources were used on their creation. Information was chosen and just juxtaposed following the structures defined in the task instructions. Students thought about what they needed and looked for it. Rarely were new contents created from scratch. This fact reveals what several students commented:

- Everything is on the internet. One just needs to find it.
- Anything on the web is going to be better than what I am able to create.

Finally, students have not hidden the origin of the information they have used to create their blog entries.

C. Relationship Between Previous Knowledge on Web 2.0 Tools and the Problems Found During the Task

The statistical descriptive analysis of the multiple-choice question forms revealed that, though most of the students had never edited a blog before the activity took place, the process of learning and handling this tool was not especially problematic. Most of the time spent on the activity was dedicated to looking for information and to composing the blog entry.

However, 12.5% of students declared to have spent a 75% of the task time to learn how to use a blog. This fact makes indispensable the development of support technical sessions that prevent that some of the students fall back due to lack of digital literacy.

VII. CONCLUSION

The process of generation of digital learning materials by means of the Web 2.0 tool named blog has enhanced that students take part actively in their learning process. They have created a blog entry following the proposed topics and structure. In most cases, they have required to learn how to work with a new software application. They have also searched for information in different formats. They have read, summarized and combined this information to obtain a result that is different from the material they have worked with. The generation process, however, has been limited to the combination of different information sources. The final product is really new, as a result of a collection and synthesis work and it has enhanced the participant students' learning. But it must be remarked that the students have not generated their own content entirely. The main reason can be that the concepts required to develop these materials had not been properly interiorized. Other important factors are that it is easier to replicate pre-existent materials and the trust students place on web content.

Students have made decisions during the process about how to plan the task, how the work should be shared or which information sources were to be cited. They took responsibility for their learning process. As the proposed task was short and quite structured, most of the students have carried out the same activities. However, clear signs of personalization in the execution have been detected.

Working in pairs helps students to construct their learning in a collaborative way. In some cases students have worked together the whole time. Other students have looked for information individually and they have had to negotiate which data should appear in the final product. Collaboration out of the working group has been limited to the resolution of technical difficulties.

In order to increase the reflection on the learning development students should answer a set of questions about the content generation process. In our work, these questionnaires were intended to collect information about the case study but they have turned out to be the appropriate means to make learners analyse their learning evolution. It would be necessary to set similar questionnaires about the quality of the information sources in order to promote good practices the search for information. LGC activities should not be reduced to the creation of a deliverable but they must be complemented with different actions specially designed to promote the student's reflection.

Given the above, we conclude that activities like the one described in this paper give as a result the generation of digital contents that enhances an authentic construction of learning. Web 2.0 tools are simple and intuitive enough to let High Education students generate learning materials without the need of a long and complex learning process. So it does not imply a remarkable increase of their work load. However, there is always a group of learners that needs technical support as these tools are completely new for them. The use of Web 2.0 tools makes the task more exciting and helps to interact with contents in different formats. Care must be taken, however, because students are used to working with these tools in their leisure activities and they can spend their time playing instead of working. Finally, the use of audio-visual materials clarifies the explanation of the physical concepts as it has been positively valued by the students.

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Ana María López Torres received the Degree in physics from the University of Zaragoza, Zaragoza, Spain, and the Ph.D. degree in physics with the same university in 2001. Since 2000, she teaches with the Polytechnic School of Teruel, Teruel, Spain, belonging to the same university, in the Department of Electronics and Communications Engineering. She is collaborating in research projects associated with acoustic signal processing and is in charge of projects in the area of automatic identification technologies.

In June 2012, she completed the Master studies in education and ICT from the Open University of Catalonia, Catalonia, Spain, focusing her final project on the concept of Learner Generated Content.

Cristóbal Nico Suárez Guerrero received the Degree in education, specializing in philosophy and social sciences from the Universidad Nacional Mayor de San Marcos, San Marcos, Spain, and the Doctorate degree in education, training processes in virtual spaces from the University of Salamanca, Salamanca, Spain. He teaches at the Department of Didàctica i Organització Escolar, University of Valencia, Valencia, Spain. He develops a research activity on the development of education in the Network Society.

He is a member of the Network of Experts Virtual School for Latin America and the Caribbean, UNDP and the Advisory Council of Latin America from 2012 to 2017 Horizon Report. He is the author of the blog *Education and Virtuality*.