EVALUATION OF DIGITAL TEACHING SKILLS

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Abstract

In the Master in Secondary Education Teaching, Vocational Training and Language Teaching (MasterProf) at Miguel Hernandez University in Elche (Alicante/Spain), students take an “ICT for learning and teaching” course, in which they discover ICT resources and how they can be integrated into a class at Secondary levels of education. Measuring the impact of this course in developing digital skills in our students is an issue of special relevance. During this course 2016 -17 we have made a study to investigate initial digital skills and motivation in our students and their evolution throughout the course. We considered different sources to define the critical needs for a XXIst century teacher; then we designed a questionnaire to record useful information to evaluate five critical competences. Survey was carried out at the beginning and at the end of the course. Conclusions from the study will serve us to detect strong and weak points in our course to develop digital competences in our students. Some results from this survey are presented in this paper.

Keywords: ICT, competency, teachers, digital skills, XXIst century teacher.

1 INTRODUCTION

Different organizations and administrations are involved in defining competency standards to be achieved by teachers in our decades. UNESCO provides a complete guide on ICT Competency Standards for Teachers [1]. The National Institute of Educational Technologies and Teachers Training in Spain, also published a complete guide refering the issue “Digital Competency of Teachers” [2]. The idea of getting better education achievements by integrating computers and ICT within a methodological learning framework is gaining relevance (see Horizon [3] and PISA Reports [4]). So the need to develop efficient instructional frameworks to guarantee digital and methodological competencies on our teachers. Moreover, a special interest is perceived related to define efficient evaluation instruments of digital skills of teachers [5], [6], [7].

Nowadays ICT training is an indispensable course in the curricula of every training teachers programme. This course in MasterProf is due to all students, it is 4.5ECTS long (1ECTS is equivalent to 25 hours of study), and it is scheduled for the first semester of the academic year, throughout eight on-site sessions and also online additional work and interaction with students. The eight sessions are structured in eight content blocks covering communication, interaction, collaborative resources, LMS, rubrics, web content, presentations, mind maps, OER, educational licences, mobile learning, gamification and multimedia content creation. Evaluation essentially consists on developing digital content and using diverse digital resources (that contributes 60% to the final mark). A final exam is due, consisting on questions about resources and didactical uses, that contributes 30% to the final mark. The remaining 10% is obtained from seminars.

2 METHODOLOGY

This study is based on a survey. To create the questionnaire for evaluating digital skills, we inspired in different sources, like those mentioned in ([1] and [2]), and some less formal texts as [8]. To guarantee enough response from students we decided to create not a very long questionnaire, avoiding any reference to concrete resources or brands, and asking skills through active verbs followed by the skill (example: “Create and edit audio through digital resources”). We motivated student response by providing the respondents with an individual report, both with the initial and final evaluation on the considered competences to become XXIst century professors.

The questionnaire consisted on 21 items, requiring the students to answer in a scale from 1 (I’ve never done it) to 4 (I’m a specialist) to different digital skills. These 21 items were grouped into five
competences, all of them referring to the use of different technological resources for learning and teaching, say:


2. C2. Use of social media, social bookmarking and content curation tools (3 items). Also including the use of social media to find and share educational contents.

3. C3. Learning management and online evaluation (4 items). Use of LMS, online questionnaires, evaluation tools based on rubrics and good practices on the evaluation of digital content.

4. C4. Online interaction and collaboration (5 items). Use of interactive resources for learning as blogs or wikis, online boards, online planning tools and digital portfolios.

5. C5. Knowledge on legal issues on digital content (3 items). Plagiarism detection, identification of relevant and valid digital content, and correct use of digital content from other authors.

A final mark between 0 and 100 was obtained by averaging and normalizing individual responses to items within each criteria. Then, a categorization in five levels was made, by categorizing the responses in intervals (0,20), (20,40), (40,60), (60,80) and (80,100), with labels E, D, C, B and A respectively, to grade the level of competence attained. The best achievement on a digital competences is identified with A level, and the lowest with E level.

Personal features about the respondents were also recorded in order to characterize our students and identify possible patterns on their digital competence development. These variables included sex, age, opinion about the need for new methodologies and integration of ICT at the Secondary education level, and perception about daily and specific digital skills. Age was categorized in two categories, identifying those born before 1990 and born from 1990 on, so distinguishing —perhaps— more analogical or less digital people from the most digital ones.

The survey was carried out at the beginning of the course (during October 2016; the responses from November were discarded) and at the end, after the final exam (during February 2017). A total of 174 students responded the questionnaire at the beginning of the course, and 71 repeated it at the end of the course.

A descriptive analysis, numeric and graphical, has been used to provide relevant facts relative to the initial evaluation on digital competencies referring education. Mann-Whitney tests are used to compare two independent groups in non-normal data (responses on integer scale 0-10). The R package [9] was used for the statistical analysis, with the libraries ggplot2, dplyr and pander.

### 3 RESULTS

We present our results divided in two parts, each one with different goals:

1. For the initial database (based on 174 responses provided at the beginning of the course), the goal is to describe the digital skills perceived by the students (future teachers) when they start the course and also evaluated from the test, relative to their initial motivation.

2. For the pre-post database (based on 71 responses with the evaluation at the beginning and at the end of the course), the goal is to evaluate the gaining in digital skills provided by the test.

Results on these goals are presented next.

#### 3.1 Initial evaluation

##### 3.1.1 Initial opinion about changes on education

Digital skills development could be linked to the opinion of the respondents about the necessity to change methodologies in classes at the Secondary level, or the necessity to integrate ICT as meaningful resources for learning. Knowledge of the opinion of our students referred to these issues is of interest in order to justify posterior improvements on digital competencies.

About the necessity to use new methodologies in classes, the global opinion, also differentiated by sex and age, is shown -in percentages- in Table 1. 71,3% of the students think of the necessity to incorporate new methodologies into the teaching practice at Secondary level education. Around 30% of them don’t have a clear opinion on the issue.
Table 1. Opinion about the necessity to change methodologies in Secondary classes. Percentages: global, differentiated by sex and by age (born before and from 1990).

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Global Opinion</th>
<th>Female</th>
<th>Male</th>
<th>Born before 1990</th>
<th>Born from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t Know</td>
<td>4.0%</td>
<td>1.2%</td>
<td>2.9%</td>
<td>3.5%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Perhaps</td>
<td>24.7%</td>
<td>14.9%</td>
<td>9.8%</td>
<td>10.3%</td>
<td>14.4%</td>
</tr>
<tr>
<td>Necessary</td>
<td>71.3%</td>
<td>43.1%</td>
<td>28.2%</td>
<td>36.8%</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

About the necessity to integrate ICTs as educational resources in classes, Table 2 shows theglobal opinion in percentages, also differentiated by sex and age. 62.6% of the students say it is necessary to integrate ICT resources in secondary level classes, and around 37% haven’t a clear opinion on the necessity to use them. Percentage of students that judge ICT are not necessary at all in classes, is irrelevant (just a 0.6%).

Table 2. Opinion about the necessity to integrate ICT as educational resources in Secondary classes. Percentages: global, differentiated by sex and by age (born before and from 1990).

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Global opinion</th>
<th>Female</th>
<th>Male</th>
<th>Born before 1990</th>
<th>Born from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not necessary</td>
<td>0.6%</td>
<td>0</td>
<td>0.57</td>
<td>0.57</td>
<td>0</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>2.3%</td>
<td>1.72</td>
<td>0.57</td>
<td>2.3</td>
<td>0</td>
</tr>
<tr>
<td>Perhaps</td>
<td>34.48</td>
<td>22.41</td>
<td>12.07</td>
<td>14.94</td>
<td>19.54</td>
</tr>
<tr>
<td>Necessary</td>
<td>62.6%</td>
<td>35.06</td>
<td>27.59</td>
<td>32.76</td>
<td>29.89</td>
</tr>
</tbody>
</table>

Concluding from Tables 1 and 2, the majority of students perceive the necessity to integrate both new methodologies and ICT resources in classes at the Secondary level. This fact inclines us to anticipate good levels of initial motivation on the “ICT for teaching and learning” course in the master, and so to expect significant learning and improvement on digital competence.

3.1.2 Perception on personal skills on daily and specific technology

The perception of each student on his/her digital achievement referred to daily technologies and also specific technologies were asked through the questions:

- “How do you consider yourself, in a 0-10 scale, referred to your abilities using daily technologies?”
- “How do you consider yourself, in a 0-10 scale, referred to your abilities using specific technologies (recording and video edition, audio, blogs management and creation of digital resources)?”

These issues provide us a global vision of digital features of our students at the beginning of the course. Tables 3 and 4 illustrate the results obtained, with means and standard deviations assessed from individual 0-10 scores: globally and differentiated by sex and age.

Table 3. Perception on personal skills on the use of daily technology. Means and standard deviations (in parenthesis) from 0-10 scale scores. Global and differentiated by sex and by age.

<table>
<thead>
<tr>
<th>Mean (sd)</th>
<th>Global opinion</th>
<th>Female</th>
<th>Male</th>
<th>Born before 1990</th>
<th>Born from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.9 (1.8)</td>
<td>6.7 (1.7)</td>
<td>7.3 (1.9)</td>
<td>6.7 (2.0)</td>
<td>7.2 (1.5)</td>
</tr>
</tbody>
</table>

Significant differences were encountered between female and male students, referred to perceived skills on digital daily technologies (a p-value of 0.04 for the Mann-Whitney test). However, no significant differences were encountered between those students born before and from 1990 (a p-value of 0.18 for the Mann-Whitney test).
Table 4. Perception on personal skills on the use of specific technology. Means and standard deviations (in parenthesis) from 0-10 scale scores. Global and differentiated by sex and by age.

<table>
<thead>
<tr>
<th></th>
<th>Global opinion</th>
<th>Female</th>
<th>Male</th>
<th>Born before 1990</th>
<th>Born from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean (sd)</strong></td>
<td>4.4 (2.5)</td>
<td>4.0 (2.4)</td>
<td>5.1 (2.5)</td>
<td>4.1 (2.8)</td>
<td>4.8 (2.1)</td>
</tr>
</tbody>
</table>

Significant differences were encountered between Female and Male students, referred to perceived skills on digital specific technologies (p-value of 0.003 for the Mann-Whitney test). However, no significant differences were encountered between those students born before and from 1990 (p-value of 0.09 for the Mann-Whitney test).

Concluding from Table 3, students recognize themselves positioned on moderate levels of achievement on the use of daily technologies, always above 6 points on a 0-10 scale, however the age or sex. However, when asking about the use of specific technology, Table 4 shows some lacks perceived, with scores than only get over the 5 (on a 0-10 scale) for the group of male students (though with a high standard deviation of 2.5).

From Tables 3 and 4, great differences between global daily and specific scores are evident: 6.9 in mean for the use of daily technologies and 4.4 for the use of specific technologies. The Mann-Whitney test provides a p-value less than 2.2e-16 in favour of a significant difference between the initial perception on the use of daily and specific technologies.

Our students, though they consider themselves in a moderate-good level of achievement in the use of daily technologies, they perceive important lacks for using more specific technologies referred to the creation of multimedia digital content.

3.1.3 Initial evaluation on digital competencies

Once the initial motivational issues and features of our students have been described, we present the initial evaluation on the five competences used, say C1 to C5, presented in Section 2. Figure 1 shows the distribution of students among marks A to E, being A the best level of achievement (scores between 80 and 100 on a 0-100 scale), and E the lowest one (scores between 0 and 20 on a 0-100 scale). Table 5 gives the numerical information displayed in Figure 1.

![Figure 1. Initial evaluation on the five digital competencies considered, with levels A to E describing the range from high competency level (A) to low competency level (E).](image-url)
The less developed competencies among our students at the beginning of the course are C1, C3 and C4, with percentages of 71.8%, 80.4% and 85.6% respectively, of students classified in the lowest levels of achievement D or E. The result on C1 bears out the initial scores on the use of specific technologies related to creation of digital content, shown in Section 3.1.2 and Table 4. C3 refers to the use of learning management and online evaluation tools, which are less usual in our students as most of them have not worked as professors before. C4 refers to the use of online interaction and online collaboration tools for learning; the low competency level in this issue could be a consequence of the spread of conventional and traditional non-digital learning scenarios along their academic life.

On the other hand, C2, referred to the use of social media and other resources related to the publication and organization of information, a 49.4% of the students are classified in low levels of achievement D or E, so giving more weight to upper levels of competency. Behaviour for C5 criteria is quite similar to C2, with a 53% of students in levels D or E, though the issues related to knowledge of licensing of digital content and its use as resources for learning generally involve a surprising discovering in our classes in the master. Possibly this result is a consequence of the popular and extended opinion that everything is allowed in the Internet, and no attention to licensing is due.

3.2 Final evaluation and comparison

Next we consider the data from the 71 students that repeated the test at the end of the course about "ICT for learning and teaching". Final scores were assessed for the five competences. Then, differences are assessed by subtracting initial scores to final ones. Negative values for differences, which could come from misunderstandings of the abilities asked in the questionnaire, were set to zero, in order to avoid inconsistences.

These differences on pre-post scores are represented in Figure 2 (vertical axis), versus the initial grading in the five levels from A to E (horizontal axis), for each competence. Improvement on the digital skills of our students whatever the competences is clear from the figure. The best prepared students at the beginning, those classified in A or B levels, couldn't improve so much: just those in B level could improve to A level. So, the fewer the initial level of competency, the higher the improvement and viceversa. Moreover, the relation between differences in final and initial scores is quite linear on the initial classification, for every competence. This could justify a linear model to predict improvement in our students depending on their initial score, and it will be used for future research.

From Figure 2 we can conclude on a clear evidence on the effectiveness of the ICT course: our students considerably improve their digital skills by studying the course.
Figure 2. Improvement -vertical axis- on the five digital competencies considered, versus initial evaluation – horizontal axis- in levels A to E describing the range from high competency level (A=mark between 80 and 100) to lo competency level (E=mark between 0 and 20).

4 CONCLUSIONS

The basic conclusions from this study, related to the students during this course 2016-17, are:

- The majority of students in the master perceive the necessity to integrate both new methodologies and ICT resources in classes at the Secondary level. Motivation for learning ICT resources is high.

- They perceive themselves as quite able to make a good use of daily technologies, but not so much to use specific technologies related to the generation of digital content. Differences between male and female students are significant, but they aren’t between students born before 1990 and those born from 1990 on.

- The less developed competencies among our students at the beginning of the course are C1, C3 and C4, referred to creation and publication of digital content, use of LMS and online evaluation resources, and online and interactive resources to collaborate.

- Differences obtained in pre-post scores are higher for those students who revealed fewer digital skills at the beginning of the course. The fewer the initial level of competency, the higher the improvement and viceversa.

- Our students considerably improve their digital skills by studying the course on ICT for learning and teaching, however their initial level on digital skills.

- More relationships will be studied in future research, to use all information recorded from the survey and predict improvement on digital skills.

REFERENCES


[9] R project statistical software. Available at https://www.r-project.org/about.html