Collaborative Engineering in Distance University Master’s Degree

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Abstract

This article explains the results of more than four years working in collaborative engineering learning development, at the master's degree level, in the school of industrial engineers of the Distance University of Spain (UNED). The study is based on three items: the distance methodology and continuous evaluation of the students’ work and periodic reviews. The teamwork aptitude is an implicit requirement and, therefore, there is a specific methodology for the project. The work is supported by data and statistics that show better results than those obtained in other subjects of the same master's where the teamwork option is not applied. The result is satisfactory in the response and participation of the students and it is demonstrated that the new methodology could be transferred to other subjects that do not have a specific teamwork requirement, but could use this methodology to improve the results.

Keywords: Collaborative engineering, teamwork, distance university, concurrent engineering.

1 INTRODUCTION

Concurrent engineering is an integrative subject in the field of engineering, and therefore it is normally given in the last years of a bachelor’s degree or master's degree. There are multiple definitions for concurrent engineering (Winner, 1988; Hartley, 1992; Pawar, 1996; Moges, 2011), although perhaps the one that best describes the objectives of this work is the one proposed by Espinosa et al.: "A work philosophy based on information systems and built on the idea of convergence, simultaneity or concurrence of the information contained in the product's whole life cycle with the product's design phase."

The work philosophy can be approached in three different ways depending on the perspective:

- Perspective of design, where the approach is to merge the information of a product or service with the design phase. In this area, concurrent engineering is usually given the name of "concurrent design".
- Perspective of work planning. Here it is seen that the activities related to a project under a concurrent engineering approach tend towards a parallel structure. For this reason, in this area it is usually called "simultaneous engineering".
- Perspective of communication, which is essential for the project’s development. In this area, concurrent engineering fully relies on the information and communication technology (ICT) tools. When working in this area, concurrent engineering is usually given the name of "collaborative engineering" or "collaboration engineering".

This perspective of communication is the central point of this work. New information and communication technologies open up new perspectives in how to approach this subject matter, and these perspectives should not be ignored when trying to address the subject in an educational, cutting-edge way.

2 MATERIALS AND METHODS

The objective of improving quality resulted in the aforesaid quality circles; the philosophy of continuous improvement of quality (Kaizen is the Japanese word for continuous improvement); the "just-in-time"
production system, whose bases were developed in Toyota in 1947; the 5S methodology (Seiri, Seiton, Seiso, Seiketsu and Shitsuke, which translate as: sorting, systematizing, sweeping, sanitizing, self-discipline), which was the starting point of the current Six Sigma; process reengineering; total productive maintenance; and the foundations of what later was called "robust design".

It was precisely in the area of robust design where the need for integration between the areas of design and manufacturing arose (Whitney, 1990; Domínguez et al., 1991; Bakerjian; 1992; Boothroyd et al., 1994; Mendoza et al., 2003). It soon became obvious that improved communications between these departments could be extrapolated to other areas and that the feedback of information from all a company’s departments into the design area could be used as a tool. Thus concurrent engineering was born.

With the appearance of computer-aided design (CAD), solid modeling and product data management (PDM/PLM), the work methodology was equipped with computational tools and concurrent engineering acquired its current dimensions.

As is known, PDM appeared as a commercial solution in the decade of the eighties and, as to be expected, engineering schools included this technology in the educational content of their different subjects.

In 1994, the engineering school of the UNED began to teach a doctorate course, included in the Construction and Production Engineering doctorate program, which was named precisely: Concurrent Engineering. The research related to this matter led to the first publications (Codina and Espinosa, 1997; Prádanos del Pico et al., 1997), which include the early results that integrate concurrent engineering into CAD environments.

In 2001, a new Industrial Engineering curriculum was implemented in Spain that lasted for five years (the previous ones were six), and concurrent engineering was included as a major subject in engineering education.

However, when four-year engineering degrees (without specialization) and master's degrees (which replaced the former doctoral courses) were implemented in Spain, the subject was reconfigured.

In bachelor's degree programs, the subject is included in the Industrial Design elective, and at the level of master's degree programs, which merge contents of the former second university cycle and those included in the former Diploma of Advanced Studies, the National University of Distance Education in Spain programmed a Master's degree in Design Engineering. This master's includes a series of important subjects in design engineering such as image and solid modelling, and also collaborative engineering as an essential part of concurrent engineering, a core requirement of the engineering master's degree.

The first edition of the master's began in the 2009-10 academic year, so at present four editions of the master's degree have already been completed and the fifth is in progress. Tab. I shows the data on students admitted and enrolled in the master's program during these years. These first editions have already provided important data to analyze the students’ acquisition of skills, particularly in the field of collaborative engineering.

Table I. Historical of admissions and enrollments in the master's.

<table>
<thead>
<tr>
<th>Edition</th>
<th>Applications</th>
<th>Admissions</th>
<th>New Enrollments</th>
<th>Continuing</th>
<th>Total master's students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>103</td>
<td>23</td>
<td>21</td>
<td>-</td>
<td>21</td>
</tr>
<tr>
<td>2010-11</td>
<td>134</td>
<td>21</td>
<td>20</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>2011-12</td>
<td>173</td>
<td>23</td>
<td>21</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>2012-13</td>
<td>181</td>
<td>22</td>
<td>20</td>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>2013-14</td>
<td>185</td>
<td>21</td>
<td>18</td>
<td>21</td>
<td>39</td>
</tr>
</tbody>
</table>

It is important to note that almost all students combine their studies with professional practice and, therefore, they usually take at least two years to finish the master's degree.
On the other hand, in accordance with current legislation, access to the master's degree is open to students from various degree programs and, for this reason, in addition to industrial engineers among the master's students, we can find graduates of other engineering specialties (mechanical, electrical, telecommunications, topography, civil engineering, etc.), as well as architects and graduates in design, among others.

2.1 Teaching-Learning Methodology.

When students reach the concurrent engineering subject after having passed other subjects with complex technological contents, they normally have a sound knowledge of traditional engineering. But in this subject, which is obviously based on teamwork, they are found to be lacking in skills because unfortunately they have not previously acquired them, i.e. "commitment", ability for "teamwork" and "leadership":

When we talk about leadership in collaborative engineering there is no reference to "foreman" or "boss", as these concepts are fortunately obsolete, but rather to "coordinator", "manager" of a sports team or "activator, cheerleader or motivator" in a working group. This role is currently known as "coach".

When we talk about teamwork, concepts like "shared decision-making", "respect for people", "work-sharing" or "delegation" arise. It is not a matter of one person doing everything and the others merely looking on. Nor is there a strict division of work such that each person does only one part and the others know nothing about the project other than their own little area. Teamwork involves active communication between members in such a way that everyone actively does their part, but with knowledge and participation in the work by the other members of the group, as if it was a complex puzzle. Students make the connection between effective teamwork and essential design activities like open mindedness, collaboration, and innovation (Martínez-Mediano and Lord, 2012; Xu et al., 2007; Hirsch and McKenna, 2008).

The aim of commitment is for the engineer to accept and carry out the assigned tasks, to try not to change the rules in the middle of project execution, to not give up at the least little problem or when not in agreement with the team’s proposals, etc. It is a matter of undertaking the project with the aim of reaching the end.

None of these skills, which are so necessary in an engineer, are rigorously developed in preceding subjects. They are considered as inherent traits, like creativity (Aslani et al., 2012), and are at the root of many of the difficulties involved in the development of industrial projects. In the field of concurrent engineering, these qualities play a relevant role since the aim of the subject itself is not to solve a specific problem of design, but rather to acquire a methodology and a set of useful skills to tackle any design problem that may arise – a methodology that relies precisely on commitment, teamwork and leadership.

Concurrent engineering as a subject has a series of special connotations in a university like the UNED, where education is distance-based. In this university, the students acquire their knowledge and skills at home and communicate with their tutors or peers by any available method other than the traditional ones. Therefore, the student must use Internet as a fundamental learning tool and electronic mail as a fundamental tool of communication (ICT tools).

In other subjects, the student can study alone, supported only by his/her efforts and communication with the tutor. However, in this subject the student must necessarily communicate with peers and so must rely on social networks, video conferencing and as many possibilities as currently offered by the world of communication (Senin et al., 2003). Students must share files and working documents, a reason why they should develop special skills to take advantage of the possibilities of the Internet and "cloud" computing to do the exercises assigned to them.

There are not many universities in the world that, like the UNED, have to deal with the problem of having students scattered all over the globe; and who have to work as a team. For example, a group of four students where one is an architect and is in Buenos Aires, another is an industrial designer and lives in Frankfurt, a third is a civil engineer and is in Santa Cruz de Tenerife and the last one is an industrial engineer and lives in Madrid. The collaborative engineering in this case is essential.

Table I shows the worldwide distribution of UNED’s students.
Table I. Worldwide UNED’s students distribution.

<table>
<thead>
<tr>
<th>Country</th>
<th>Degrees</th>
<th>Bachelors</th>
<th>Postgraduates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>110</td>
<td>29</td>
<td>49</td>
<td>188</td>
</tr>
<tr>
<td>Belgium</td>
<td>311</td>
<td>70</td>
<td>46</td>
<td>427</td>
</tr>
<tr>
<td>Brazil</td>
<td>34</td>
<td>16</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>357</td>
<td>141</td>
<td>0</td>
<td>498</td>
</tr>
<tr>
<td>France</td>
<td>268</td>
<td>50</td>
<td>18</td>
<td>336</td>
</tr>
<tr>
<td>Germany</td>
<td>464</td>
<td>143</td>
<td>49</td>
<td>656</td>
</tr>
<tr>
<td>Italy</td>
<td>60</td>
<td>16</td>
<td>17</td>
<td>93</td>
</tr>
<tr>
<td>Mexico</td>
<td>74</td>
<td>18</td>
<td>34</td>
<td>126</td>
</tr>
<tr>
<td>Peru</td>
<td>102</td>
<td>27</td>
<td>40</td>
<td>169</td>
</tr>
<tr>
<td>Spain</td>
<td>151,909</td>
<td>42,534</td>
<td>6,825</td>
<td>201,268</td>
</tr>
<tr>
<td>Switzerland</td>
<td>154</td>
<td>42</td>
<td>4</td>
<td>200</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>555</td>
<td>152</td>
<td>33</td>
<td>740</td>
</tr>
<tr>
<td>USA</td>
<td>99</td>
<td>22</td>
<td>38</td>
<td>159</td>
</tr>
<tr>
<td>Venezuela</td>
<td>75</td>
<td>27</td>
<td>45</td>
<td>147</td>
</tr>
<tr>
<td>TOTAL</td>
<td>154,572</td>
<td>43,287</td>
<td>7,208</td>
<td>205,067</td>
</tr>
</tbody>
</table>

3 RESULTS

Concurrent engineering is a practical subject, and it involves a series of exercises of increasing complexity that the students must complete to acquire the required skills. The exercises proposed for this subject are:

- E1. Brainstorming for alternatives in product design
- E2. Value analysis exercises.
- E4. Ergonomic analysis.
- E5. Manufacturability analysis.
- E7. Analysis of synergies.
- E10. Improvements in design.
- E11. Obsolescence and recyclability studies.

On the other hand, the competencies identified in the subject are:


B. Relating to skills and attitudes: Design and corporate communication. Adaptation of graphic styles to the product and market. Ability to prepare product design strategies. Capability to perform assessments and validations of the design. Ability to elaborate a product design and

In this field, dimensioning, and the use of rapid prototyping as design are effective methodologies to help students to obtain effective results in their engineering projects (Martínez and Félez, 2006; Diegel et al., 2006). There are simple projects that students must accomplish alone; there are also more ambitious projects that need to be dealt with in groups of two or three; and finally there are complex projects, which should be executed by multidisciplinary teams with four or five members.

The methodology has been developed based on the difficulty for the student. The specific strategies for each exercise are introduced and the different alternatives available in each case are analyzed.

Table II shows a list of exercises assigned throughout the course; the number of students who form the team in each exercise; the relative degree of difficulty of each exercise; as well as the results obtained in terms of level of participation and quality of the results.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Number of students</th>
<th>Difficulty of the exercise (1-5)</th>
<th>Level of participation (1-5)</th>
<th>Quality of the results (1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>4-5</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>E2</td>
<td>2-3</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>E3</td>
<td>2-3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>E4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E5</td>
<td>4-5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>E6</td>
<td>2-3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>E7</td>
<td>4-5</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E8</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E9</td>
<td>4-5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>E10</td>
<td>4-5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>E11</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

We can see that, as a rule, the average quality of the results obtained is directly proportional to the number of group members and does not depend on the level of difficulty. In terms of the degree of involvement, we also find a proportional relationship to the number of group members, but here we find a certain dependence on the level of difficulty of the proposed exercise.

As a representative example, figure 1 shows the results obtained by the students in a design improvement exercise (hygrometer and micrometer design). Here we can see the phases of development: Commercial product, modeling the commercial product, detailed drawings and prototyped model.
3.1 Available Technologies.

Of course, when taking this subject, the new technologies serve as a good support for the students. Figure 2 shows a screen display of the Alf platform that the UNED makes available to its students, where they can find the basic course documentation, guidelines and exercises, as well as collaboration forums where they can do part of their work.

The set of indicators that will later enable the analysis and conclusions are:

- Dropout rate. Number of students who, having registered, cancel the enrollment or do not attend the exams.
- Recovery rate. Number of students who, having dropped out, take up the subject again.
- Success rate. Number of students who pass the exams. This is measured in percent versus those who take the exams (those who have not dropped out).

As indicated above, there are data on the first four editions of the master’s which have been completed and on the current edition which ends in September. These data on the indicators mentioned above, which serve as a basis for the analysis, are included in table III. From this table we can see that the number of students who drop out of the studies is high, but it is not as high as the normal dropout rate for undergraduate studies at the UNED.
We can also see that the success rate is high and comparable to any face-to-face University, and quite a bit higher than the average rate of the UNED degree programs.

It should be noted that the results listed here have been obtained from statistics provided by the University and from the tests and surveys carried out by the master’s Coordination Commission, as well as from the contributions of different professors or the specific comments made by students throughout the different courses.

Table III. Enrolled students and success in concurrent engineering.

<table>
<thead>
<tr>
<th>Concurrent Engineering</th>
<th>Enrolled</th>
<th>Early dropout</th>
<th>Recovery</th>
<th>Recovery (%)</th>
<th>Final dropout</th>
<th>Final dropout (%)</th>
<th>Success</th>
<th>Success (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>18</td>
<td>10</td>
<td>3</td>
<td>30.00</td>
<td>7</td>
<td>38.89</td>
<td>8</td>
<td>72.73</td>
</tr>
<tr>
<td>2010-11</td>
<td>21</td>
<td>11</td>
<td>4</td>
<td>36.36</td>
<td>7</td>
<td>33.33</td>
<td>13</td>
<td>92.86</td>
</tr>
<tr>
<td>2011-12</td>
<td>24</td>
<td>11</td>
<td>6</td>
<td>54.55</td>
<td>5</td>
<td>20.83</td>
<td>18</td>
<td>94.74</td>
</tr>
<tr>
<td>2012-13</td>
<td>20</td>
<td>8</td>
<td>4</td>
<td>50.00</td>
<td>4</td>
<td>20.00</td>
<td>15</td>
<td>93.75</td>
</tr>
<tr>
<td>2013-14</td>
<td>18</td>
<td>7</td>
<td>5</td>
<td>71.43</td>
<td>2</td>
<td>11.11</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

3.2 Comparison with related subjects.

The comparison with alternative teaching methodologies is not easy because there are not many published data on results in the face-to-face field in which collaborative engineering is not yet fully developed.

In terms of the distance option, correlated with the subjects that have paved the way to the current situation, there are the subject of concurrent engineering, included in the teaching period of the doctoral program, and the subject of the same name included in the 5th year of Industrial Engineering studies.

Table IV shows the data used for the comparison. It lists the three subjects and indicates the duration (year or semester) of each one. It also includes the number of credits for each course, as well as the average number of students enrolled per year, which enables us to obtain these findings even though the number of students each year has been very low. We can see that when the option of teamwork is not considered, the recovery rate of students who drop out is very low. On the other hand, although the rate of success compared to students who attended the exams is similar in the three alternatives, when combined with the success rate versus the enrolled students, there is a big difference between the subject methodology proposed in this article versus the traditional approach.

Table IV. Comparison of results with other master's subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
<th>Enrolled</th>
<th>Early dropout</th>
<th>Recovery (%)</th>
<th>Final dropout</th>
<th>Success over attendance (%)</th>
<th>Success over Enrollments (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master of Design Engineering</td>
<td>10</td>
<td>18</td>
<td>38.89</td>
<td>71.43</td>
<td>11.11</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Other subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master of Design Engineering</td>
<td>10</td>
<td>20</td>
<td>35</td>
<td>26.71</td>
<td>26</td>
<td>86.75</td>
<td>41.45</td>
</tr>
<tr>
<td>Other subjects in other Eng. Masters</td>
<td>5</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>32</td>
<td>83.96</td>
<td>39.56</td>
</tr>
</tbody>
</table>
As for the comparison of results with those obtained in other subjects of the same master's program or in courses of other master's degrees included in the school of industrial engineering programs, the values are quite similar to those previously obtained as commented above.

As we can see, the success rate over students who attended exams is better, but if we also consider the recovery rate of students, the final success of the students enrolled in the course is much more significant.

3.3 Which are the benefits of the approach?

The starting points for the analysis proposed in this article include:

- A master's degree subject that receives very heterogeneous students e.g. industrial engineers, architects, civil engineers, aeronautical engineers, surveyors, etc.
- Students of very different ages, ranging from 24 or 25 to 50 or 55 years old.
- High degree of equality between males and females, although this has never been proposed as an objective.
- Students who usually must combine studies with professional work. It is a fact that, when a company requires an additional effort, one of the first choices of the student is to abandon the master's program.
- A distance methodology which requires a significantly different mode of work-study for the students.

With this approach, and thanks to the programming methodology, the following results are achieved:

1. When the group is formed in an autonomous way, it works better than when the group is created by tutors, that is, the teams work better if the students organize themselves. Here the "commitment" variable becomes an important value.

2. Contrary to what one might think, the groups were not formed by similarity of qualifications but, rather cleverly, the students themselves tended to form multidisciplinary groups. When forming the groups, there seems to be no distinction by age or sex.

3. The work teams absorb the external workloads of students and cover for each other, trying to prevent the tutors from finding out. When working in a group, the possibility of abandonment is significantly reduced. The group retains the students.

4. Just as there is a natural tendency to help colleagues in trouble, there is also a tendency to shun students who for no obvious reason do not work hard enough and try to take advantage of the work of others.

5. Papers presented by a group are usually of a higher quality. They are more rigorously developed and the presentation tends to be better. This is probably because, when there are more people reviewing a job, detection is better and the details are improved appreciably.

6. Even when, for reasons of methodology, the leadership of the group has to be rotated, no difference is detected in the results of the work. However, it is obvious that some students have more sway over the group than others, regardless of whether or not they are the group coordinators. No doubt they are natural team leaders.

7. Students who acquire a commitment to an exercise usually finish the exercise even when they know that they will leave the master’s program for external reasons. Few students drop out when the teamwork has begun.

8. It is important to note that the success of the methodology depends on two basic elements: on one hand the students assume that teamwork is positive, as they understand that it is the normal way to work in industrial environments, and on the other hand working together reduces the student dropout rate.

9. At the beginning of the course, some students show some reluctance towards teamwork, since their inertia as recent undergraduate students and their interest in controlling all the barriers they must overcome in the subject make them think that teamwork will be an additional difficulty. However, this initial difficulty soon turns into an incentive when they discover that the teamwork results are better than those obtained on working alone.
4 CONCLUSIONS

This paper presents the results related to the need for collaborative engineering in developing of the training exercises of the concurrent engineering subject in the Design Engineering Master’s program of the UNED, where integration of the teamwork, commitment and leadership skills is considered as a fundamental requirement.

The application of concurrent engineering to industrial design tends to require a lot of information, obtained from very different sources, that is capable of boggling the most privileged mind. Thus it is necessary, and essential, to use ICT tools.

The subject stresses the importance that everyone directly or indirectly related to the product be responsible, to the appropriate extent, for the design, from marketing to customer service.

However, for this purpose, classic product development procedures must be reconsidered and adapted to the current technology – information technology - which necessarily involves concurrent engineering.

The success of the data shown in the results section is due to the subject methodology and approach, the contents of which require teamwork.

It is important to note that, at times, it seems that students forget that they are studying for a master’s degree and rather it seems that they are working for their own company. Curiously, students approach the exercises as a game or a challenge, and they perform better.

The results obtained with these methodologies, essential for this subject where teamwork is a requirement, can be transferred to other subjects, because it is clear that good results are obtained. This means that other subjects that are based on individual work, because the subject does not require another work method, would probably yield better results if they used methodologies based on teamwork.

REFERENCES


COLLABORATIVE ENGINEERING IN DISTANCE UNIVERSITY MASTER’S DEGREE

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2Universidad de Comillas (UPV-EHU)

This article explains the results of more than four years working in collaborative engineering learning development, at the master’s degree level, in the school of industrial engineers of the Distance University of Spain (UNED). The study is based on three items: the distance methodology and continuous evaluation of the students’ work and periodic reviews. The teamwork aptitude is an implicit requirement and, therefore, there is a specific methodology for the project. The work is supported by data and statistics that show better results than those obtained in other subjects of the same master’s where the teamwork option is not applied. The result is satisfactory in the response and participation of the students and it is demonstrated that the new methodology could be transferred to other subjects that do not have a specific teamwork requirement, but could use this methodology to improve the results.

Keywords: collaborative engineering, teamwork, distance university, concurrent engineering.
## INTED2015 TABLE OF CONTENTS

### TRAINING EMPATHY IN THE UNIVERSITY FOR THE BUSINESS WORLD
J. Vidal Garcia, M.E. Vidal Garcia

### DIGITAL TECHNOLOGICAL PROFILE OF FUTURE BRAZILIAN TEACHERS
A. Grunewald Nichele, E. Schlemmer

### E-LEARNING IN CLINICAL ENVIRONMENT: A NEW PARADIGM IN THE QUALITY OF HEALTHCARE
V. Henriques

### HIGHER EDUCATION IN THE ECONOMY OF KNOWLEDGE
N. Orloev, H. Beloev, M. Iliev, Y. Vassilev, K. Uzunov, P. Boneva

### FLIPPING THE ONLINE CLASSROOM
L. Carver, E. Omann, C. Todd

### EDUCATIONAL TECHNOLOGY AND ITS IMPACT IN HIGHER EDUCATION
L. Carver, E. Omann, C. Todd

### SEVEN YEARS OF EDUCATIONAL ROBOTICS IN NORTH – EAST OF ITALY: OUTCOMES AND WORKS IN PROGRESS
S. Monfalcon, V. Bisoffi, F. Finotti, N. Fava

### LEARNING STYLES AND USE OF TECHNOLOGIES IN THE TECHNICAL TRAINING. TEACHING EXPERIENCE AND LEARNING ACHIEVEMENT
S. Contreras, J. Torres, L. Lippi

### INTERACTION BETWEEN UNIVERSITY PROFESSORS, STUDENTS AND MUNICIPALITY REPRESENTATIVES FOR IMPROVING ENERGY EFFICIENCY IN REAL ESTATES - NEW PEDAGOGICAL APPROACH
A. Smisko

### SOCIAL STUDENT RELATIONSHIP MANAGEMENT IN HIGHER EDUCATION: EXTENDING EDUCATIONAL AND ORGANISATIONAL COMMUNICATION INTO SOCIAL MEDIA
L. Oliveira

### EMOTIONAL DEVELOPMENT, CREATIVITY AND HAPPINESS IN THE INITIAL TRAINING OF TEACHERS
P. Caballero García, M.J. Carretero Cenjor, P. Fernández Palop

### A FRAMEWORK FOR GLOBALISATION IN EDUCATION TO PROMOTE LIFELONG LEARNING
D. Dabbous

### USING NEW TECHNOLOGIES IN PROBLEM BASED LEARNING EXPERIENCES OF TRAINEE TEACHERS
Z. Gadušová, A. Hašková

### TECHNICAL EDUCATION – CINDERELLA IN A TECHNOLOGY-BASED SOCIETY?
A. Hašková

### DEVELOPMENT OF A WEB-BASED APPLICATION AS A TOOL TOWARDS CONTINUOUS EDUCATION IN NEUROANATOMY
B. Gaimardès, M. Arantes, M. Severo, M.A. Ferreira

### MONETIZATION METHODS FOR EDUCATIONAL GAMES
M.I. Dascalu, R. Bitoleanu, A. Moldoveanu, G. Dragoi

### "COMPARTILHA": A SHARING SOCIAL NETWORK IN SPECIAL NEEDS AIMING TO EMPOWER PARENTS AND EXPERTS
P. Santos, O. Tymoshchuk, T. Sousa, M. Almeida

### CREATING ADVANCED QUIZZES USING MOODLE
I.M. Escobar García, C. Suárez, A. Rojas, S. Maffey, S. Llorens, A. Nájera, E. Arribas García, A. Belendez

### 'TANGLED IN THE NET': SOCIAL AND EMOTIONAL NETWORKS OF LEARNERS
C. Martínez Priego, S. Antropova

### E-SKILLS IP – MASTERING THE 21ST CENTURY SKILLS
A. Loureiro

### THE SYSTEM OF MANAGING ONLINE INTELLIGENCE TESTS IN IDENTIFYING INTELLECTUALLY GIFTED STUDENTS
S.F. Mohd Yassin, N.S. Mohamad, N. Mohd Ishak

### USING ONLINE E-LEARNING TO INVIGORATE UNIVERSITY ENGLISH CLASSES
A. Brasier, S. Cother
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSESSING STRATEGIES USED TO CREATE AND IMPLEMENT COMMUNITIES OF</td>
<td>912</td>
</tr>
<tr>
<td>PRACTICE WITH THEIR HUMAN CAPITAL IN TODAY'S WORKPLACE</td>
<td></td>
</tr>
<tr>
<td>B. Barrett</td>
<td></td>
</tr>
<tr>
<td>ENGLISH AND ANATOMY INTEGRATED LEARNING</td>
<td>913</td>
</tr>
<tr>
<td>A. Angulo Jerez, E. Ausó Montreal, J.V. García Velasco</td>
<td></td>
</tr>
<tr>
<td>TEACHING FINANCE TO FOREIGN STUDENTS: A NEW METHODOLOGICAL APPROACH</td>
<td>920</td>
</tr>
<tr>
<td>S. Bekareva, E. Meltenisova</td>
<td></td>
</tr>
<tr>
<td>THE RELATIONSHIP BETWEEN MOTIVATION AND FLIGHT PERFORMANCE IN</td>
<td>926</td>
</tr>
<tr>
<td>COMBAT PILOT TRAINING AS A PROFESSIONAL-LIFELONG EDUCATION</td>
<td></td>
</tr>
<tr>
<td>I. Dağlı</td>
<td></td>
</tr>
<tr>
<td>A FLIGHT TRAINING METHOD AND A CASE STUDY ON UNMANNED AIRCRAFT VEHICLES’ PILOTS</td>
<td>931</td>
</tr>
<tr>
<td>M.K. Kartal</td>
<td></td>
</tr>
<tr>
<td>DIFFERENTIATED INSTRUCTION IN PRIMARY SCIENCE CLASSES – STUDENT</td>
<td>938</td>
</tr>
<tr>
<td>TEACHERS’ EXPERIENCES</td>
<td></td>
</tr>
<tr>
<td>I. Timoššuk, G. Ennist</td>
<td></td>
</tr>
<tr>
<td>DYNAMIC ACADEMIC EVALUATION THROUGH GAMIFICATION, WITH A NEW IN</td>
<td>945</td>
</tr>
<tr>
<td>CLOUD APPLICATION OF IN CLASSROOM RESPONSE FOR MOBILE DEVICES WITH</td>
<td></td>
</tr>
<tr>
<td>INTERNET ACCESS</td>
<td></td>
</tr>
<tr>
<td>CLICKER SYSTEM OF EVALUATION: NEW METHOD FOR REAL-TIME CONTINUOUS</td>
<td>950</td>
</tr>
<tr>
<td>ASSESSMENT OF LAW DEGREE STUDENTS</td>
<td></td>
</tr>
<tr>
<td>THE UNIVERSITY’S R&amp;D INSTITUTES AS A NEW EDUCATIONAL APPROACH</td>
<td>951</td>
</tr>
<tr>
<td>T. Trencheva, S. Denchev</td>
<td></td>
</tr>
<tr>
<td>COLLABORATIVE ENGINEERING IN DISTANCE UNIVERSITY MASTER’S DEGREE</td>
<td>958</td>
</tr>
<tr>
<td>L. Romero, I. Domínguez, M.M. Espinosa, M. Domínguez, M. Jiménez</td>
<td></td>
</tr>
<tr>
<td>ANALYSIS OF UNIVERSITY SUCCESS DEPENDING ON THE INFRASTRUCTURE OF</td>
<td>968</td>
</tr>
<tr>
<td>THE UNIVERSITY AND THE STUDENT’S DEGREE PREPARATION IN THEIR ACCESS</td>
<td></td>
</tr>
<tr>
<td>L. Romero, M. Romero, M. Jiménez, M.M. Espinosa, M. Domínguez</td>
<td></td>
</tr>
<tr>
<td>THE REPRESENTATION AND THE PUBLIC UNDERSTANDING OF SCIENCE IN</td>
<td>975</td>
</tr>
<tr>
<td>PONTO UFMG ITINERANT MUSEUM</td>
<td></td>
</tr>
<tr>
<td>T. Margarida Lima Costa, L. Mucci Poenaru</td>
<td></td>
</tr>
<tr>
<td>CONTEXTUAL MODEL OF LEARNING IN SCIENCE MUSEUMS – AN EXPERIENCE IN</td>
<td>976</td>
</tr>
<tr>
<td>PONTO UFMG ITINERANT MUSEUM</td>
<td></td>
</tr>
<tr>
<td>T. Margarida Lima Costa, R. Alves Ferreira Almeida</td>
<td></td>
</tr>
<tr>
<td>BRIDGING THE GENDER GAP THROUGH CAPACITY BUILDING AMONG MALE AND</td>
<td>982</td>
</tr>
<tr>
<td>FEMALE TEACHERS IN SECONDARY SCHOOLS FOR QUALITY EDUCATION</td>
<td></td>
</tr>
<tr>
<td>DELIVERY</td>
<td></td>
</tr>
<tr>
<td>C. Madumere-Obike, C. Ukala, A. Nwabueze</td>
<td></td>
</tr>
<tr>
<td>COMPETENCES AND LEARNING OUTCOMES. HOW TO FACE WITH THIS NEW</td>
<td>992</td>
</tr>
<tr>
<td>CHALLENGE</td>
<td></td>
</tr>
<tr>
<td>M.A. Martínez, M. Martínez, E. Ramos, A. Romero, V. Castellanos, I. Ares</td>
<td></td>
</tr>
<tr>
<td>ONLINE SURVEYS FOR EVALUATION AND SATISFACTION IN EXTRACURRICULAR</td>
<td>993</td>
</tr>
<tr>
<td>ACTIVITIES</td>
<td></td>
</tr>
<tr>
<td>M.A. Martínez, M. Martínez, E. Ramos, A. Romero, V. Castellanos, I. Ares</td>
<td></td>
</tr>
<tr>
<td>EMPLOYING ICT FOR PROFESSIONAL DEVELOPMENT OF NEXT GENERATION</td>
<td>994</td>
</tr>
<tr>
<td>TEACHER EDUCATORS: AN INDIAN EXPERIENCE</td>
<td></td>
</tr>
<tr>
<td>R. Khambayat</td>
<td></td>
</tr>
<tr>
<td>ADDRESSING SKILLING &amp; YOUTH EMPLOYABILITY: AN INDIAN PERSPECTIVE</td>
<td>1005</td>
</tr>
<tr>
<td>R. Khambayat</td>
<td></td>
</tr>
<tr>
<td>CAN MOODLE BE USED FOR STRUCTURAL GAMIFICATION?</td>
<td>1014</td>
</tr>
<tr>
<td>H. Pastor, R. Satorre, R. Molina, F.J. Gallego, F. Llorens</td>
<td></td>
</tr>
<tr>
<td>THE RESEARCH POSTER AS AN ACADEMIC TEXT</td>
<td>1023</td>
</tr>
<tr>
<td>A. McNeill</td>
<td></td>
</tr>
<tr>
<td>STUDENTS FREQUENTLY ASK: ‘YES BUT...WHAT IS THE UTILITY OF PHYSICS?’</td>
<td>1024</td>
</tr>
</tbody>
</table>
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Dear INTED2015 participants,

First of all, thank you very much for coming to this 9th edition of INTED. It is an honour to welcome participants from all over the world.

We are living in a constantly changing society where education, technology and research are the key to the world’s development. For this reason, the main aim of INTED is to bring together educational experts under a common objective: to generate innovative ideas to be applied to education and to promote international cooperation and partnership.

INTED is an annual meeting point for educators, researchers, and technology-supported learning professionals. This year, we are delighted to welcome over 600 participants from more than 70 countries world-wide.

We hope that your participation to this conference will provide you with an opportunity to explore different perspectives on education, learn what is currently happening in other countries and share best practices in current educational and research projects.

Madrid, venue of this conference, will give you the opportunity to discover a beautiful city with an impressive architecture, historic monuments and neighbourhoods and a large cultural offer that will make your stay unforgettable.

Thank you very much for coming to INTED2015. We hope you enjoy your time with us!

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CONFERENCE SESSIONS

ORAL SESSIONS, 2nd March 2015.

Blended Learning
Augmented Reality & Virtual Laboratories
m-Learning (1)
Entrepreneurship Education
Meet the Keynote
Student Support in Education
New Technologies in Primary & Secondary Education
Learning Experiences in Arts and Music Education

Technology Enhanced Learning (1)
Intelligent Learning Environments
e-Assessment (1)
International Education & Research Projects
Generic & Transferable Skills
Pre-service Teacher Experiences (1)
Experiences in Primary & Early Childhood Education
Experiences in Maths & Statistics Education

Technology Enhanced Learning (2)
Augmented Reality & Technology-Enhanced Learning
e-Assessment (2)
Work Employability
Links between Education and Research
Pre-service Teacher Experiences (2)
Experiences in Primary & Secondary Education
Experiences in Business Administration Education

Technology Enhanced Learning (3)
e-Learning
Learning Management Systems (LMS)
Workplace Learning
New experiences in STEM Education
In-service Teachers
Experiences in Life & Health Sciences
Experiences in Finance & Economics

POSTER SESSIONS, 2nd March 2015.

Experiences in Education
Challenges in Education and Research
ORAL SESSIONS, 3rd March 2015.

University-Industry Collaboration
Virtual Universities & MOOCs
Apps for Learning
Students & Teachers Attitudes towards ICT
Pedagogical & Didactical Innovations
Inclusive Learning
Curriculum Design in Primary & Secondary Education
Technology-Enhanced Language Learning (1)

Computer Supported Collaborative Learning
Next Generation Classroom
Game-based Learning
e-Portfolios & Assessment
Enhancing Learning and the Undergraduate Experience
Special Education
Curriculum Design in Engineering Education
Technology-Enhanced Language Learning (2)

Collaborative Virtual Environments
Flipped Learning
Gamification
Accreditation & Assessment
New Educational Projects and Innovations
Adult Learning and ICT
New Experiences for Curriculum Design
Experiences in Foreign Languages Education (1)

Collaborative & Problem Based Learning (1)
Flipped & Blended Learning
m-Learning (2)
Quality Assurance in Education
Technology in Life & Health Sciences (1)
Lifelong & Continuous Learning
Experiences in Architecture Education
Foreign Languages in Primary & Secondary Education

Collaborative & Problem Based Learning (2)
Social Media and Social Networking in Education
Organizational and Management issues in Education
Diversity and Multicultural Education
Technology in Life & Health Sciences (2)
Impact of Education on Development
Technology in Engineering Education
Experiences in Foreign Languages Education (2)

POSTER SESSIONS, 3rd March 2015.

New Trends in Education
Emerging Technologies in Teaching and Learning
VIRTUAL SESSIONS

- Apps for education
- Barriers to Learning
- Blended Learning
- Competence Evaluation
- Computer Supported Collaborative Work
- Curriculum Design and Innovation
- E-content Management and Development
- E-Learning
- Education and Globalization
- Education in a multicultural society
- Educational Research Experiences
- Educational Software and Serious Games
- Enhancing learning and the undergraduate experience
- Evaluation and Assessment of Student Learning
- ICT skills and competencies among teachers
- Impact of Education on Development
- Inclusive Learning
- International Projects
- Language Learning Innovations
- Learning and Teaching Methodologies
- Learning Experiences in Primary and Secondary School
- Lifelong Learning
- Links between Education and Research
- Mobile learning
- New projects and innovations
- New Trends in the Higher Education Area
- Pedagogical & Didactical Innovations
- Quality assurance in Education
- Research in Education
- Research on Technology in Education
- Student Support in Education
- Technological Issues in Education
- Technology-Enhanced Learning
- University-Industry Collaboration
- Virtual Universities
- Vocational Training