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CONFERENCE PROCEEDINGS

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Published by
IATED Academy
iated.org

ICERI2021 Proceedings
14th International Conference of Education, Research and Innovation
November 8th-9th, 2021

Edited by
L. Gómez Chova, A. López Martínez, I. Candel Torres
IATED Academy

ISBN: 978-84-09-34549-6
ISSN: 2340-1095
DL: V-3123-2021

Book cover designed by
J.L. Bernat

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EXPERIENCING THE TECHNICAL-SCIENTIFIC PRODUCTION PROCESS WITH MASTER'S STUDENTS

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Abstract

In the current context, much of the information that higher education students need for their academic work is searched on the internet, but they do not always use the proper filtering tools to select it. This aspect, together with the fact that they do not have reading habits of technical-scientific texts, especially when written in English, makes it pertinent in master's courses to challenge students to tasks that allow them to develop these skills. In this sense, within the scope of the Manufacturing Processes course unit (UC) of the master's in industrial engineering, it was proposed to carry out a group work, which, in addition to the laboratory component, involved the writing of a scientific article in English and peer review. In the practical component, students were asked to idealize (1st phase) and create (2nd phase) a piece in aluminium alloy, preferably with some innovative character. In the first phase, considering some restrictions that were imposed in terms of material and maximum dimensions, they had to think and decide with their group colleagues about the characteristics of the part, drawing and dimensioning it in SOLIDWORKS®. In the second phase, the students started by simulating the part's manufacturing process using the CAM (Computer Aiding Manufacturing) module, CNC (Computer Numerical Control) code generation and, finally, they started to manufacture it with numerical control machines. Alongside the practical component, students were encouraged to develop the theoretical component of the work, researching in scientific articles matters related to the design and manufacturing methods of their type of piece or part.

Each group had to produce an article in English that focused on the work carried out, both at a technical and scientific level, and to review an article from another group, in addition to the reformulation of its own based on the suggestions of colleagues. In order to know the student's opinion about the process, a questionnaire was applied, in which, among other aspects, their opinion was asked about this entire writing and revision process. From the students who responded, 94.7% agree or totally agree that the elaboration of the article allowed them to develop skills that may be useful to them in the future and 84.2% agree or totally agree that the work of reviewing the article has improved their critical skills. However, the teacher found that students had difficulty in mobilizing their knowledge and creativity to design an innovative piece, so it is important to continue to promote this type of approach so that students develop research and thinking skills associated with practical aspects. As would also be expected, the fact that the article was written in English made the process of writing (57.9% agree or totally agree) and review (63.2% agree or totally agree) difficult, but they were faced with the need to overcome this barrier can be an important contribution to increasing their English proficiency.

Keywords: Peer review, higher education, writing technical-scientific texts.

1 INTRODUCTION

The world is undergoing significant changes, including the exponential growth of the world population, climate change with global warming, international migration, the loss of biodiversity, digitization and, more recently, the emergence of a global pandemic, among other important changes. These trends present a set of relevant challenges for the training of new graduates, as well as for the requalification of current workers through lifelong learning programs [1]. As Richard Riley (former United States Secretary of Education) mentioned about a decade ago, the ten most wanted jobs in 2010 did not exist in 2004 and 38-year-olds would have changed jobs 10 to 14 times [2]. This perspective, which can still be considered current, requires a reflection on whether the training provided in higher education meets the new demands. There are a significant amount of research works dealing with the ideal set of skills that new graduates must have to be competitive in the labour market, generally concluding that their acquisition depends on the training area in which the students are found [3], [4]. According to Hecklau et al. [5], in addition to technical skills, the other skills required in the future will essentially be at a

methodological, personal and social level [5]. Thus, at a methodological level, professionals must have the ability to solve problems, analyse and critical thinking [6]. On a personal level, skills will have to do with flexibility, the ability to learn new content and work under pressure [7]. Finally, at the social level, good communication skills, teamwork and leadership skills will be important [8].

In order to contribute to the development of some of these skills, and based on teaching experiences already carried out by the authors with course units related to manufacturing processes [9], [10], [11], within the scope of the Manufacturing Processes course unit (UC) of the Master's Degree in Industrial Engineering, from a higher education institution in the north of Portugal, it was proposed to the students to carry out a group work which, in addition to the laboratory component, involved the writing of a scientific article in English and the peer review. As reported by Azevedo, Castro & Gadelha [12], collaborative learning techniques, such as peer review, provide students with the opportunity to exchange experiences that can help them achieve better results, developing critical and self-critical skills during learning.

2 METHODOLOGY

In the following sub-points, it is presented a contextualization of the environment in which the experience described occurred, the characterization of participants and the research methodology adopted, concerning the database collection and analysis.

2.1 Study context

The Manufacturing Processes UC, within which the study was carried out, is common to the two branches of the master's degree in Industrial Engineering: Mechanical Engineering and Electrotechnical Engineering, being taught in the 1st semester of the 1st year. In terms of contents, it covers basic notions of computer-integrated production, computer-aided production planning and control and computer-aided manufacturing. As students come from different scientific areas (mechanics, electrotechnics, renewable energies, among others), in the first three weeks the classes are oriented towards levelling their knowledge about the manufacturing processes. Thus, in the form of seminars, basic concepts of metal machining, casting, cutting, and plastic forming processes are discussed, as well as metal welding processes.

The group work that was proposed to students within the UC, can be considered divided into two components that are interconnected, practical and theoretical. The first, more directly associated with laboratory work, consisted of two phases:

- Choice of the part (piece) and its three-dimensional modelling: Idealization of a part in which the restrictions were linked to the dimensions of the workpiece ($100 \times 50 \times 10 \text{ mm}^3$), material (aluminium alloy) and manufacturing processes (machining processes). There was no limitation as to its function, it was only asked that it have some innovative character. The students had to think and decide with their colleague's group about the characteristics of the part, design and dimension it in the CAD (Computer Aided Design) SOLIDWORKS® software.
- Numerical and manufacturing simulation and part manufacturing: Simulation of the manufacturing process of the part, CNC code generation (Computer Numerical Control) and its execution in machines with numerical control (see details of the steps in Table 1).

The theoretical component "Article writing and peer review" was proposed in parallel with the practical component. Each group had to write an article in English that focused on the practical work carried out, both at a technical and scientific level, and review the article from another group, which was assigned to them in a draw by the professor.

At the beginning of the work, it was suggested that each group start by researching scientific articles on issues related to the design and manufacturing methods of the chosen piece, which allowed, simultaneously, the acquisition of knowledge for the practical component and the literature review to write the manuscript. As support for the writing process, a seminar was held by the UC professor where guidelines for the writing of a technical/scientific article were presented and some bibliography on the subject was suggested [13], [14], [15]. Based on this information, it was defined with the students that the articles would have the following structure: Title, Authors with their affiliations, Abstract, Introduction, Materials and Methods, Results, Discussion, Conclusions and References.

Table 1. Stages of the 2nd phase – Numerical and manufacturing simulation and piece manufacturing

Stage	Purposes	Tools
Checking the strength of the part	Analyse, for the operating limit conditions, what is the stress state of the parts Check if there is a need to change the geometry or dimensions of the drawn parts	Finite element module (Simulation) integrated in SOLIDWORKS®
Definition of the manufacturing processes to be used and their simulation	Choose the most suitable and optimized tools, machining parameters and trajectories Generate the CNC code to be used to manufacture the part	SOLIDWORKS® CAM Module (HSMWorks)
Parts manufacturing	Preparing the aluminium workpieces Manufacturing the parts based on the generated CNC code	Classic machine-tools (milling and lathe machines) Machine-tools with numerical control

Before the review process, the professor held a brief seminar to set out some guidelines for the review of an article, indicating some accredited scientific journal sites that students could consult [16], [17]. It was agreed that each group, after reviewing the article assigned to them, would send their comments directly to their “colleagues”, not being, in this case, a blind review process. The students had a week to discuss with the group members the acceptance or not of the changes proposed by the pairs and to reformulate the article, sending, at the end of the process, the final version to the professor.

2.2 The participants

Participants in the study were the 38 students who, in the 2018/2019 academic year, attending the Manufacturing Processes of the master's degree in Industrial Engineering, carried out the proposed group work and answered a final questionnaire to evaluate the experience fulfilled. The ages of the students ranged from 21 to 35 years old, with their mode being 22 years old.

The Masters is usually attended by Erasmus and Double Diploma students and, therefore, with different nationalities. The class in question was made up of Portuguese (42.1%), Brazilian (42.1%), Spanish (7.9%) and Cape Verdean (7.9%) students.

The students' experience regarding group work habits was similar, as throughout their school career most had already worked in groups many times or always in class (81.6%) and outside class (84.2%). Regarding writing articles, a little more than half of the students (55.3%) said they had already written work in the form of an article, in another UC, for congresses or, in the case of some Brazilian students' double degree, within the scope of the Scientific Initiation Project. However, the majority (76.3%) reported never having performed peer review tasks.

The students' experience regarding group work habits was similar, throughout the Methods of database collection and analysis.

The evaluation of the experience is based on the observations made by the class teacher (condition of participant-observer) throughout the process, on the students' productions, and, with a final questionnaire, asking students for their opinion on several aspects that had to do with the experience developed. More properly, the final questionnaire was divided into two parts. In the first part – General information – general and personal information were requested at academic and personal levels. In the second part – Information related to the course unit – it was intended to know the students' opinions about UC classes; the SolidWorks software, selection and piece manufacturing, article writing and review process, group functioning, aspects that pleased more/less/ to change, among others.

In most closed answers, students expressed their opinion on several items, based on a Likert scale with four levels: 1 – Totally disagree (TD); 2 – Disagree (D); 3 – Agree (A) and 4 - Totally agree (TA).

In the data analysis of the questionnaire, for the case of closed answers, were used descriptive statistics techniques, namely the calculation of frequencies organized in tables as a way to structure and synthesize the information. In the case of open answer questions, were defined categories, posteriorly, from the students' answers.

3 RESULTS

3.1 The parts and their manufacture

The parts developed by the students, although not very innovative, were quite varied, ranging from simple products such as a bottle opener, with a different design than usual, to specific mechanical parts for certain applications: trigger wheel, connecting rod, gear pump, among others. In Fig. 1 it is possible to observe some of the drawings made by the students.



Figure 1. Examples of 3D models design by the students: (a) bottle opener and (b) adjustable camshaft sprocket [Source: articles written by students].

In the opinion of more than 80% of the students, the choice of the piece they carried out was essentially motivated by the final objective of the work – writing an article (81.6% A/TA) and the learning they could achieve (89.5% A/TA), having the teacher's suggestions (73.7% A/TA) and internet research (50% A/TA) also had a significant influence.

The manufacture of the parts was carried out at the institution's Mechanical Technology Laboratory. The manufacturing process was accompanied by specialized technicians and students were alerted to respect all the safety rules underlying the machines to be used. All groups were able to manufacture the products they had designed. In Fig. 2 it is possible to observe some of the final parts manufactured.



Figure 2. Examples of produced pieces by the students: (a) gear pump and (b) adjustable camshaft sprocket [Source: articles written by students].

Regarding the way the part was manufactured, although 50% of the students agree or totally agree that they were afraid/difficult in working with the milling machine and others had some specific difficulties, in general, the students consider that they have learned the basic processes for its execution. It should be noted, however, that 89.5% believe that they would not have been able to execute the part without the support of the technicians so that more experiences of this kind could be useful to acquire the necessary skills to work with the machines.

3.2 Article writing and review

All groups were able to complete the writing of the article within the parameters that were defined. The UC professor found that, given what was to be expected, there were some initial difficulties for students to internalize the scientific writing methodology and the fact that the article was written in English made its elaboration difficult. Note that 57.9% of students agree or totally agree with this opinion. However, the general idea is that the writing process had positive effects on their learning, including the promotion of transversal skills. Note that (see Table 2), more than three-quarters of the students agree or totally

agree that the writing of the article helped them to better structure the ideas (84.2%), to better understand the concepts (84.2%), allowed them to improve the ability to synthesise (94.7%) and develop skills that may be useful to them in the future (94.7%).

Table 2. Opinion on the writing of the article.

	<i>TD/D (%)</i>	<i>A/TA (%)</i>
We had difficulty to select the information that was relevant to include.	57.9	42.1
We had difficulty to express ourselves in writing.	63.2	36.8
We had difficulty to structure the article according to the request.	73.7	26.3
The fact of having to write in English made the writing of the article difficult.	42.1	57.9
I learned more than just doing a report.	23.7	76.3
Writing the article helped me to structure better my ideas.	15.8	84.2
Writing the article helped me to reflect on the concepts involved in the task performed.	7.9	92.1
Writing the article helped me to better understand the concepts.	15.8	84.2
It allowed me to improve my synthesis ability.	5.3	94.7
I developed skills that can be useful to me in the future.	5.3	94.7

The UC professor observed that the students' enthusiasm for writing the article was lower than in the 1st phase – idealization and conception of the piece, probably because this process, in addition to adapting to scientific writing and the need for mobilization of diverse transversal competencies, it demands a theoretical and well-founded understanding of the subjects. This aspect, combined with the lack of habits associated with review processes, can also explain the difficulty of some students in carrying out reviews with objective and scientific criteria, as observed by the professor. In particular, evaluate the originality of the article, identify the strengths and weaknesses of the described method in the manuscript, as well as make specific and useful comments to improve its writing. Although some students recognize difficulties that go against these aspects (see Table 3), how to analyse the scientific correctness of the theoretical component, if the article was following the requested structure, give suggestions on aspects to correct (44.7%, 42.1% and 34.2%, respectively agree or totally agree), most do not consider them to be meaningful. A situation that can be understood if we think that the teacher's criteria will be more demanding than those of the students since they are still making their first contact with the scientific review process.

In general terms, students understand that the review process helped them to improve skills such as critical capacity (84.2% A/TA), the ability to argue (86.8% A/TA) and allowed them to identify flaws in their own work (94.7% A/TA) which, combined with other aspects, helped to improve the group's own article (see Table 3).

Table 3. Opinion on another group's article review process.

	<i>TD/D (%)</i>	<i>A/TA (%)</i>
Reviewing the article helped me to better understand the concepts of UC.	18.4	81.6
I had difficulty to analyse whether the article was following the requested structure.	57.9	42.1
Reviewing others' articles helped me see the flaws in my work.	5.3	94.7
Having to analyse the correctness of the work of colleagues made me research concepts/procedures in which I had difficulties.	21.1	78.9
It was complicated to analyse the scientific correctness of the theoretical component.	55.3	44.7
Reading colleagues' work helped me to improve my group's article.	15.8	84.2
It was difficult to give suggestions on aspects to correct.	63.2	34.2
The review work improved my critical capacity.	13.2	84.2
Explaining to the members of the other group why the suggested corrections improved my ability to argue.	10.5	86.8
The fact of having to read and correct in English made the proofreading work difficult.	34.2	63.2
Reviewing the article was a motivating task.	31.6	65.8

Table 4. Opinion on the article reformulation process.

	TD/D (%)	A/TA (%)
Colleagues' comments are pertinent to improve my work.	18.4	81.6
It was difficult to see corrections and suggestions from colleagues.	65.8	34.2
Rephrasing the article helped me to better understand the concepts involved.	23.7	76.3
The correction of colleagues helped me to detect errors in my group's work.	5.3	94.7
Reviewing others helped me to overcome some difficulties.	39.5	60.5
Redesigning the work was beneficial to my learning.	13.2	86.8
Knowing that I could redesign the work made me feel more motivated to write the article.	26.3	73.7
Rephrasing the work improved the quality of the article.	5.3	94.7
The reformulation of the work helped put me in the role of a reader.	5.3	94.7
Rephrasing the article allowed me to improve my ability to write in English.	18.4	81.6

As for the reformulation of the article, according to the students' opinions (see Table 4), it is clear that it was a strategy that, in addition to fulfilling its objective of helping to detect errors (94.7% A/TA) and improve the quality of the work performed (94.7% A/TA) was also beneficial for learning (86.8%) and for improving the ability to write in English (81.6%).

4 CONCLUSIONS

The fact that students must idealize and design a piece of their own as a group, allowed them to acquire technical skills closer to the reality they will face in the labour market, as well as develop teamwork skills.

About the writing and review component of the article, it is noteworthy that, at the end of the process, students had access to three learning moments: the original writing of the article, the feedback they received from the review group and the implicit feedback when reviewing the peer article. In this way, each group, in addition to being able to use the feedback received by peers to improve their article, could also benefit from the reflection and learning carried out when they themselves reviewed the article of other colleagues [18].

It can thus be concluded that the writing and review of the article by peers, in addition to contributing to better understand of the concepts of UC, allowed the development of various transversal skills such as critical skills, synthesis, structuring of ideas and argumentation, among other aspects, which could be useful skills in the future for any engineer.

REFERENCES

- [1] S. Cesco, V. Zara, A. Toni, P. Lugli, A. Evans and G. Orzes, "The future challenges of scientific and technical higher education," *Tuning Journal for Higher Education*, vol. 8, no. 2, pp. 85–117, 2021.
- [2] O. Erstad, "Educating the digital generation," *Nordic Journal of Digital Literacy*, vol. 5, no. 1, pp. 56–71, 2010.
- [3] F. Suleman, "The employability skills of higher education graduates: insights into conceptual frameworks and methodological options," *Higher Education*, vol. 76, no. 2, pp. 263–278, 2018.
- [4] M. Humburg and R. Velden, "Skills and the graduate recruitment process: evidence from two discrete choice experiments," *Economics of Education Review*, vol. 49, pp. 24–41, 2015.
- [5] F. Hecklau, M. Galeitzke, S. Flachs and H. Kohl, "Holistic approach for human resource management in Industry 4.0," *Procedia CIRP*, vol. 54, pp. 1–6, 2016.
- [6] C. Succi and M. Canovi, "Soft skills to enhance graduate employability: comparing students and employers' perceptions," *Studies in Higher Education*, vol. 45, no. 11, pp. 1–14, 2019.
- [7] L. Liboni, L. Cezarino, C. Jabbour, B. Oliveira and N. Stefanelli, "Smart industry and the pathways to HRM 4.0: implications for SCM," *Supply Chain Management: An International Journal*, vol. 24, no. 1, pp. 124–146, 2019.

- [8] C. Marnewick and A. Marnewick, "The Demands of Industry 4.0 on Project Teams," *IEEE Transactions on Engineering Management*, vol. 67, no. 3, pp. 941–949, 2019.
- [9] J. Ribeiro, P. Barros and F. Silva, "Active methodology in mechanical technology," *EDULEARN Proceedings: 10th International Conference on Education and New Learning Technologies*, pp. 6870-6875, 2018.
- [10] J. Ribeiro, P. Barros and F. Silva, "Promote learning in mechanical technology manufacturing work equipment," *ICERI Proceedings: 11th International Conference of Education, Research and Innovation*, pp. 6278-6283, 2018.
- [11] F. Silva, J. Ribeiro and P. Barros, "Learning exchange: a collaborative work between course units," *IATED Proceedings: 15th International Technology, Education and Development Conference*, pp. 9892-9898, 2021.
- [12] R. Azevedo, A. Castro, B. Gadelha, "Apoiando a revisão por pares no ensino remoto de modelagem de software," *EduComp'21*, pp. 27–30, 2021.
- [13] J. Fisher, J. Jansen, P. Johnson and A. Mikos, "Guidelines for writing a research paper for publication," Mary Ann Liebert, Inc. publishers, 2013.
- [14] A. Lourens, "Scientific Writing Skills: Guidelines for Writing Theses and Dissertations," published by Sun Press, Stellenbosch, 2007.
- [15] V. Booth, "Communicating in Science," 2nd ed., Cambridge University Press, Cambridge, 1993.
- [16] <https://authorservices.wiley.com/Reviewers/journal-reviewers/how-to-perform-a-peer-review/index.html>, consulted on 03/01/2020.
- [17] <https://www.elsevier.com/reviewers/how-to-review>, consulted on 03/01/2020.
- [18] J. M. Zerr and R.J. Zerr, "Learning from their mistakes: using students' incorrect proofs as a pedagogical tool," *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, vol. 21, no. 6, pp. 530-544, 2011.