

An Integrated Approach to Teaching Digital Competences in Higher Education

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ABSTRACT

Teaching at higher education levels traditionally meant for the students to acquire professional skills that would enable them to achieve success in the workplace. Nowadays this has proven to be insufficient in a world that is undergoing a digital transformation. Such a digital transformation means that interactions with people that do not speak the same language have become nearly unavoidable. In this context we proposed an integrated teaching approach that provides the student with the necessary Professional Competences, Digital Competences and Language Competences to be able to undergo their job at a high level of achievement. The key advantage of the proposed approach is that undergoing the acquisition of each competence individually will be far less efficient than having a comprehensive learning process that blends them into a single set of skills.

Keywords: Teaching methodologies, Digital competences, Professional abilities, Language competences.

1. INTRODUCTION

Teaching at higher education levels traditionally meant for the students to acquire professional skills that would enable them to achieve success in their workplace. Such professional skills usually include the specific ones for each degree but also include more general skills like applying for a position, organizing a project, understanding the underlying risks due to the planning of a project, and presenting the progress of a project to different audiences. In order for a student to be able to develop their professional duties effectively in the current context they need to learn to use the digital tools that will organize and increase their performance. It can be clearly seen that professional and digital competences need to evolve. However, teaching digital tools on their own without teaching how they behave and need to be used within the professional requirements of a task is ineffective.

As suggested before, teaching will greatly benefit from knowing how to use digital tools to learning digital competences. The only way to achieve the learning of competences is by learning professional competences and digital competencies together; so digital competences can effectively support the professional competences. But this goes even further, the digital transformation that we are undergoing implies that interactions with people that do not speak the same language have become nearly unavoidable. It is for this reason that the teaching of English as a vehicle for digital interaction needs to evolve. Classically English in higher education levels has been taught as a language to be used in a very broad spectrum of contexts. From this general knowledge of English, it is expected that enough language competences will be acquired to allow a functional professional interaction. This is no longer the case when the amount of interactions, due to the digital transformation, that an employee must undergo goes from occasional trips to another country to daily oral and written interactions and exchange of documents.

As consequence of the above, acquiring the three levels of competencies (Professional, Digital and Language) is paramount in a digital society. It is because of this that we propose an integrated approach that teaches all of them together to enable the student with a more comprehensive set of skills. By addressing how the three different kinds of competence interact, it is easier to identify what precise aspects of each competence are required for a successful professional development of the students. In this work we will show the case a methodology that works all three competences through instruction but specially through guided activities that aim to simulate real case scenarios the student might encounter in the workplace. In just a few words, we want to stop teaching separately Professional skills,

English and Digital tools, and instead teach them together, so as to have a set of capabilities that will enable them to thrive.

2. DESCRIPTION OF SCOPE

To understand the benefits of the proposed approach of teaching all three competences together we must first dissect and describe what those competences entail. We will first provide a formal definition of what such competences are, so afterwards we can describe how such competences were classically taught.

2.1 Professional Competence

In general terms the set of skills that create a good professional is inherent to each domain and is generally well understood. The skills required by an architect or a computer scientist will differ substantially, but the application of the notions described in this work still apply. At the higher levels of education this set of skills is usually described through its curriculum. As students will undergo jobs specific to their studies on which they will be the future experts a level of proficiency of **C1** or **C2** will be established from this point forward. We define this level for completion sake as we will define the level of proficiency for Digital and Language competences using the same scale (A1-2 to C1-2).

2.2 Digital Competence

Digital competence is described and measured within the EU in the DIGGCOMP 2.0 framework¹. It establishes the skills that students need to learn to be able to successfully develop their work. Traditionally at the higher levels of education Digital competence was given through the teaching of how to use specific software and hardware tools. By shifting from learning tools to learning skills the students are more capable to adapt to the changing landscape of their work. It focuses on different aspects of Digital competence by identifying five main areas. To facilitate mentions of such areas in the rest of the paper we will use the following acronym (DigComp Area X = DCA1).

- 1) **(DCA1)** Information and data literacy: It involves being capable of finding digital information, identifying its relevance and the trustworthiness of the source and the content, and finally, to be able to store and organize information in a reliable and efficient manner.
- 2) **(DCA2)** Communication and collaboration: Being capable of collaborating with others through digital mediums while being capable of understanding how technology affects different cultural and generational groups in different ways. Being capable of participating in different forums, both public and private. The ability to understand one's digital image and reputation.
- 3) **(DCA3)** Digital content creation: The ability to create and improve digital elements with additional information and understanding the copyright and licenses involved in doing so. The ability to create functional instructions about a computer system.
- 4) **(DCA4)** Safety: Understanding the risks that concern electronic devices and personal or private data in digital mediums. Being capable of putting security measures in place to protect said data. Understanding the risks involved in the use of digital mediums and how it can affect physically and psychologically those involved.
- 5) **(DCA5)** Problem solving: Being capable of identifying the needs and problems of digital solutions. Being capable to be self-sufficient in learning and keeping up with digital systems. To know how to apply digital solutions to innovate processes and products.

Within the scope of higher education, the level of proficiency required will be on average quite high. As an example, we will discuss two examples that have been researched within the IKANOS project², taking into account the definitions established in the "DIGCOMP at Work"³ directive of the European Commission. We will describe the digital competencies required for four specific professional profiles intended for higher education graduates.

The first professional profile is intended for a technician in digital transformation for small to medium size businesses⁴, the second professional profile is for a 3D designer for additive fabrication⁵. The third professional profile is that of a technician in mechanization and numerical control programmer⁶. And the final profile is that of a technician in mechatronics⁷. These examples aim to paint a picture of the minimum level of digital competence in each area a student might require after they finish their degree.

Table 1. Required minimum digital competence for 4 specific professional profiles. These professional profiles give insight on the requirements a professional with degree in higher education requires.

Area	Technician in Digital Transformation	3D Designer for Additive Fabrication	Technician in Mechanization and Numerical Control Programmer	Technician in Mechatronics
Information and data literacy	C1	C1	B1	C1
Communication and collaboration	C1	B1	B1	B1
Digital content creation	B2	C1	B2	B2
Safety	B1	B2	B2	B2
Problem solving	C1	C2	C1	C1

As seen in Table 1, students will usually require a minimum level of C1 or B2 in most of digital competence areas. As the future employment of a student cannot be set in stone and it is the teachers duty to provide them with the versatility to adjust their professional careers, we will assume from this point forward that students will require at least a **C1** competence level in all DIGCOMP areas.

2.3 Language Competence

As described in Bjorkman (2008, p.36)⁸, **students need to have at least a level of B2** in English to accomplish the goals set in their higher degree studies. The problem with this is, as pointed out by Gómez López et al. (2014)⁹, is that many students do not achieve this level of proficiency in the language. How can we then bridge this reality to still get as close as possible to the levels of comprehensive professional skills a student needs? we believe the answer is shifting the acquisition of the Language skills from an **ESP** (English for Specific Purposes) to and **EMI** (English as a Medium of Instruction).

Teaching within an **ESP** model involves language teachers to teach to technical students about the vocabulary and uses of the language they might encounter. This is clearly an ill posed situation, as language teachers are experts in English but not on the specific profession. The other model, **EMI**, involves professionals to teach the language skills but instead of teaching grammar and vocabulary they use English as a way to teach their specific subjects. By doing so the students learn to describe and use their professional skills in English in a more natural scenario. The main problem of applying an EMI model is that it requires teachers with a very high level of proficiency at higher degree education that in the past was not present. This however is being addressed by several programs to bring back talent from abroad that through their work abroad have acquired a high proficiency in professional English.

If a teacher with high levels of language skills is available there are great advantages to shift from an ESP to an EMI model. The first and foremost is that there is no longer a need to devote space for specific language learning in the higher degree curriculum. Learning how to use English in a professional context changes from being a subject that due to learning constraints has a very small number of credits to a background skill that is acquired while learning the professional skills required by the degree. Another advantage is that now the language skills will be taught by an expert

that knows the domain and can focus and correct more precisely the learning of such skills. In the proposed methodology we have opted for an EMI model and will suppose the teacher has at least a C1 level of English, as agreed by Spanish universities in (Bazo & González, 2017)¹⁰.

Within the Common European Framework of Reference for Languages¹¹ (CEFR) it classifies three types of skills to be acquired at each level: comprehension (listening and reading), speaking skills (oral interaction and oral expression) and writing skills. To reference such specific types of skills we will use the following acronyms: listening comprehension (LCA1), reading comprehension (LCA2), oral interaction (LCA3), oral expression (LCA4) and writing skills (LCA5).

3. METHODOLOGY

Now that we have defined each type of competence and established that we require a level of **at least** C1 for professional competence, a level of C1 for digital competence and a level of B2 for language competence (English), we can show how we propose to integrate the acquisition of the three into one methodology. We believe that the most efficient way of achieving a comprehensive acquisition of all three competences, is by means of presenting them together so as to understand how they interact in real scenarios. We propose to remove teaching digital competences and language competencies on their own from the curriculum, and rather, teach courses that tackle professional competences in a classical manner while incorporating how to more efficiently undergo such competences by using digital tools while using English as the vehicular language of the course.

In essence, we believe that shifting from a few specific subjects on digital and language competences to a teaching methodology where those two competencies are worked and reinforced constantly will enhance the learning of the students and produce better professionals. It is well established that in order to incorporate and learn new skills, repetition is one of the most successful strategies as established in Logan G.D. (1988 and 1989)^{11,12}. The main drawback is that repetition tends to be boring and tedious for the learner. By adding such repetitive tasks to the background, the tediousness of it is highly mitigated.

3.1 Overall strategy

As commented before, we will work all three competences together. The curriculum will be driven by the professional competences inherent to each course/degree while digital and language competences will be constantly present in the background. The key concept that we propose is the creation of activities that will take several weeks to develop in small groups by the students. It is ideal to divide such activities in well-defined intermediate stages where assessment by the teacher is required to keep control of the progress of all groups. Ideally, such activities will undergo a task like the creation of architectural project, the design of a piece of software or the development of a new business model.

3.2 Work session example: Developing idea into viable project and presentation to investors.

We will show through a detailed example how the different aspects of each competence are worked in our methodology. The first example defines the following activity within the scope of an engineering degree:

“In groups of 4 or 5 students, students must create a project proposal to develop a novel system and pitch the idea to a funding body (either public or private). The activity will undergo 3 stages, Stage 1: Project definition, Stage 2: Project execution detail, Stage 3: Proposal presentation. Teacher approval is required to move from one stage to another. To achieve this goal, students will present their work to verify the correctness at each stage to be able to correct it and continue the flow of the project.”

Let us see how such an activity can work all three competences at the same time. We will detail each stage of the activity and see what specific items are being reinforced and how. When a specific digital or language area of competence is being worked, it will be indicated by mentioning in brackets the acronym of it. For professional skills as such common frame for competences does not exist, we will resort to mention it as it is. In Figure 1 we show a graphical depiction of how all individual language and digital competences are covered within the proposed example activity.

Stage 1: Project definition. Students in groups need to come up with an idea of a system. Such a system needs to be meaningful to a particular set of actors. This stage will require students to investigate different aspects of their idea: technical viability, existing solutions, potential clients, etc.

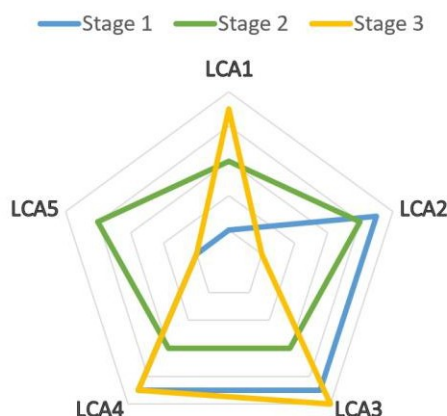
- **Professional Competence:** The teacher will verify the technical correctness of the proposed solution and suggest modifications that will solve issues or improve the overall concept from the standpoint of his technical knowledge on the subject.
- **Digital Competence:** Students need to identify which digital solutions will likely be required to undergo both the development and management of the idea (**DCA5**). At this stage, students will have to undergo a process of reviewing if similar solutions to the problem are already available (**DCA1**).
- **Language Competence:** The whole activity will be undergone in English, both with oral and written interactions with the teacher and between the members of the group. At this stage, students will need to understand the information they will get from several sources (**LCA2**) and discuss it with their colleagues (**LCA3**) while telling them what they have found themselves (**LCA4**).

Stage 2: Project planning. Once the idea has been thought through and given positive feedback from the lecturer, students will proceed to detail the plan to achieve it. Students will make use of management and coordination digital tools to allow for a good project proposal that should consider temporal planning and risk management and provide contingencies for such eventualities.

- **Professional Competence:** Students will need to come up with a plan to develop their idea and the teacher will guide them through the process and provide them with solutions when they get stuck, while also giving constructive criticism on the weaknesses of the plan. By undergoing this kind of project planning in a controlled environment, students have no penalties to take risks and learn from their mistakes, while also being supported by the instructor.
- **Digital Competence:** Undergoing the creation of a plan requires students to use the best digital tools at their disposal and to handle it while also they will need to think about the digital implications of taking such action. Students will work all 5 areas of digital competence, whether by using such digital tools or identifying the digital requirements that will need to be handled at each stage of the plan. **DCA1** will be worked by having to find and evaluate information that will be relevant for each of the stages of the plan. **DCA2** will be worked through the required interactions that students will need to undergo the develop and brainstorm the plan while also detailing the communication actions that would need to take place in developing the plan. **DCA3** will be worked through the need for the students to produce a digital version of the plan, at this stage the teacher will incentive the use of the best possible tools to describe the plan. At this point we seek to move from a simple text file to a more dynamic representation of the plan using digital tools that will create a better visual representation and flow mechanisms in the plan files. Safety (**DCA4**) will be needed to be specifically detailed in the plan; students will work this skill by thinking of the implications the planned actions will have. Problem solving (**DCA5**) will be less predominant at this point as most of the brainstorming for the plan has been done in the previous stage, nonetheless, each substage will also require specific thought as to the digital needs of it.
- **Language Competence:** At this stage the 2 main language skills that will be work will be (**LCA5**) writing skills and (**LCA2**) to understand the work done by their colleagues. It is at this stage that students will work how to describe the implementation of the ideas the have come up with in Stage 1, when work is distributed

between the different members of the group, it will be the responsibility of all members of the group to assure the quality of the produced detailed plan by checking the work done by the other members of the team and suggesting modifications. In a lesser form, skills **LCA1**, **LCA3** and **LCA4** will be worked through the debate students will need to undergo with their colleagues.

Language Competence Overlap



Digital Competence Overlap

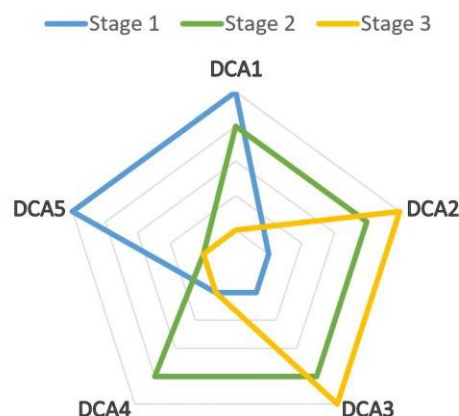


Figure 1. In this figure we can see how each of the different aspects of digital and language competence are worked within the proposed example. It can be clear seen that by performing activities like the one proposed by our methodology all principal competences are tackled.

Stage 3: Project presentation. With a concrete plan in place that the teacher has approved, students will begin to develop a presentation that will enable them to explain their plan to an audience. At this final stage, students should know the strengths and weaknesses of their idea and the plan to achieve such idea and work to their advantages while being honest about it. At this point the teacher will ask the students to detail the context in which the pitch is going to be given: Is it going to be an internal pitch within their company to develop a new product? Is it a pitch to be given to private investors to obtain funding for a start-up company? This will be an important decision as students will need to think about the best ways to present their plan to a specific audience, understanding the particularities that come with it.

- **Professional Competence:** Students will work at this stage transversal skills that will allow them to talk and explain aspects of their work to their peers or similar actors in a way that is meaningful to the audience. Students will also need to have a clear understanding of the technical aspects of their profession as they will be questioned by the rest of the students of the class. The rest of the students from the other groups will form the audience and will need to develop their critical evaluation skills to pinpoint the quality of the work of their colleagues. To enforce this critical thinking, students will be required to present an individual assessment of the work of their colleagues and such assessment will be marked for their final grade.
- **Digital Competence:** This final stage will require students to work digital competences (**DCA2**) Communication and Collaboration and (**DCA3**) Digital content creation. Students will need to develop an enticing presentation that is susceptible to have visual support of many types like videos, diagrams and workflows that will be enhanced by using the proper tools for each kind of representation. Also, students might want to develop mockup prototypes or 3D designs that show the final product of their plan.
- **Language Competence:** This final stage will have a very intensive language load that will help students work the use of English in the workplace. They will work oral expression skills (**LCA4**) by giving a presentation in

public to defend their plan. They will also need to work their oral interaction skills (**LCA3**) as a turn of questions and comments will be established at the end of the presentation. At this stage, the rest of the students of the class also become actors and will passively work their listening skills (**LCA1**) and their oral interaction skills (**LCA3**).

The final part will involve the presentation of all digital content created in the 3-stage process described before as well as each student's personal assessment on the work of their peers. The previous elements will establish the basis upon which students will be marked in the assignment. It is particularly important the evaluation process is described at the very beginning, so students have an incentive from the start. Another comment is that the activity is thought to take several weeks of work including class sessions and lab work from the students. Students will be required to show advance weekly and will require validation at the end of all stages, even stage 3; if issues are found they will be given notes on how to improve it. It is important to underline that before the final presentation in front of the rest of the class, students will require validation from the teacher as to create a closed loop of control in all three stages to allow students to learn through their mistakes.

4. CONCLUSIONS

The proposed methodology of combining the three types of competences together is applicable to most subjects. It might not be the best methodology to teach subjects like Algebra or Calculus as such courses conform the basis of the knowledge of the students, but it becomes a more suitable methodology the closer we get to students joining the workforce. All jobs have some kind of planning or assessment involved in it, and due to the digital transformation the workplace is undergoing, such professional interactions tend to be of a digital nature and in most cases take place in English. By allowing the students to learn in advance in an environment that allows failure and errors in a kinder fashion than an actual job, we are giving them the tools that will kickstart their careers and make them more versatile professionals.

We recommend the teachers to tailor in advance activities like the one that has been given as an example that work a wide array of skills of all three competences. It is important to enforce the use of English in the classroom and to provide students with examples of digital tools that might be adequate to enhance specific aspects of their proposal. A main shift that this kind of methodologies have is that the teacher shifts his role from that of the central actor to that of a conductor of sorts. It is key that the teacher does not lay back and only act as an evaluator of the work but that he alternates between groups and joins the discussion while pushing the less participative students to take a more active role.

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