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Towards a Digital Competence Framework for Business Management Engineering: A Contextualized Adaptation Proposal of Dig Comp 2.2

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ABSTRACT: Business management graduates now work in organizations whose administrative and commercial processes run on digital platforms, yet the digital competencies expected of them are rarely defined in assessable terms. DigComp 2.2, the European framework for citizens' digital competence, is a widely used reference. Few studies, however, have adapted it to engineering management profiles in Latin American universities. Drawing on a review of the specialized literature, this article proposes a contextualized digital competence framework for the Business Management Engineering degree and describes the four-phase mixed-methods design through which it will be diagnosed, co-designed, piloted and validated. The preliminary framework comprises twelve competencies taken from the five DigComp 2.2 areas and aligned with the productive structure of Colima, Mexico, a state whose port, logistics, agro-industrial and commercial activity gives it national and continental relevance. The proposal is compared with earlier educational adaptations of DigComp, and its limitations and validation agenda are stated. Both the framework and the validation procedure can be transferred to technological higher education institutions with comparable programs, with implications for employability-oriented training.

KEYWORDS: Digital competence, DigComp 2.2, Business Management Engineering, Higher education, Digital transformation, Framework validation.

I. INTRODUCTION

Data analytics, e-commerce, ERP and CRM systems, and cloud collaboration tools have changed what employers expect from business management graduates. Curricula have been slower to respond. In Business Management Engineering programs, digital content is usually added course by course, with no common framework that sets proficiency levels, performance indicators or a progression across the degree.

The European Digital Competence Framework for Citizens (DigComp), in its 2.2 version [1], is among the international references most often used to describe and assess digital competence. It was written for the general population. Applying it to a particular professional profile therefore calls for explicit contextualization, as was done for teachers with DigCompEdu [2].

This article proposes an adaptation of DigComp 2.2 to the graduate profile of Business Management Engineering, grounded in the literature, and sets out how the proposal will be diagnosed, co-designed with stakeholders, tested in the classroom and validated. Section II reviews the development of DigComp, its earlier adaptations to professional profiles and the gap addressed here. Sections III and IV state the objectives and the method. The preliminary framework appears in Section V. Section VI discusses contributions and limitations, and Section VII concludes.

II. LITERATURE REVIEW

2.1 The DigComp Framework: Conceptual Evolution

DigComp was first formulated by Ferrari [3] and has since been revised three times. DigComp 2.0 [4] updated the conceptual reference model, and DigComp 2.1 [5] added eight proficiency levels with examples of use. Version 2.2 [1] contributed new examples of knowledge, skills and attitudes, several of them concerning artificial intelligence and digital well-being. Its twenty-one competencies are grouped into five areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving.

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2.2 Adaptations of DigComp to Professional Profiles

Teacher education offers the clearest precedents. DigCompEdu [2] in Europe and the Common Framework for Teachers' Digital Competence published by INTEF in Spain [6] both derive a profession-specific model from DigComp while keeping its structure recognizable. Research in higher education points in a related direction: digital competence is treated less as the handling of tools than as a combination of cognitive, ethical and socio-emotional dimensions [7].

2.3 Research Gap

Comparable work on management and business engineering profiles in Latin American higher education is scarce. Fewer studies still relate the adaptation to the productive setting in which a program operates. The present proposal takes up that gap in a Business Management Engineering program located in a region whose economy rests on logistics, port operations, agro-industry and commerce.

III. OBJECTIVES OF THE PROPOSED STUDY

The general objective is to design and validate a digital competence framework for the Business Management Engineering degree by adapting DigComp 2.2 to the technological and business context of the region. The specific objectives are (a) to diagnose the digital competence of the program's students and teachers; (b) to adapt twelve DigComp 2.2 competencies to the professional profile in co-design with teachers and business representatives; (c) to produce training materials and assessment rubrics aligned with the framework; and (d) to pilot the framework in six courses and estimate its effect on learning and perceived employability.

IV. PROPOSED METHOD

4.1 Design

The study follows a sequential exploratory mixed-methods design [8]. An initial qualitative and documentary phase, made up of the literature review and the co-design workshops, informs the construction of the quantitative instruments used later for piloting and evaluation.

4.2 Participants

The population consists of students enrolled in the Business Management Engineering program and the teachers who serve it. The diagnostic phase will use a sample stratified by semester (95% confidence level, 5% margin of error). In the pilot, the intact groups of six courses, chosen for their affinity with the adapted competence areas, will take part.

4.3 Instruments

Data will be collected with a self-assessment questionnaire based on the DigComp 2.2 structure and on instruments already validated with university populations, together with a performance rubric for each competence. An expert panel will judge the content validity of both instruments. Reliability will be estimated with Cronbach's alpha [9] before final application.

4.4 Procedure

Four phases are planned. Phase 1 covers document review, mapping of the graduate profile and a self-assessment diagnosis. In Phase 2, teachers and representatives of regional firms will co-design the framework and the training materials in workshops. Phase 3 pilots the framework in six courses, measuring competence development and perceived employability before and after the intervention. Phase 4 adjusts the framework, systematizes the results and prepares a plan for institutional scale-up.

4.5 Data Analysis Plan

Pilot data will be summarized with descriptive statistics. Pre–post differences will be tested with the paired t-test, or with the Wilcoxon signed-rank test where normality cannot be assumed, and effect sizes will be reported. Workshop records will be examined through thematic content analysis.

V. PRELIMINARY PROPOSAL FOR A DIGITAL COMPETENCE FRAMEWORK

Twelve competencies were selected from the review in Section II, two or three per DigComp 2.2 area, as the starting point for co-design in Phase 2. Table 1 lists them with a first adaptation to the professional profile. Both the selection and the wording are provisional.

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Table 1. Preliminary adaptation of DigComp 2.2 competencies to the Business Management Engineering graduate profile

DigComp 2.2 area	DigComp 2.2 competence	Contextualized adaptation to the Business Management Engineering profile
1. Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content	Searching for and curating market, regulatory and financial information for decision-making.
	1.2 Evaluating data, information and digital content	Critical evaluation of sources and data quality in administrative and logistics reports.
	1.3 Managing data, information and digital content	Organization and analysis of data in spreadsheets and management information systems.
2. Communication and collaboration	2.1 Interacting through digital technologies	Professional communication with clients, suppliers and authorities through digital channels.
	2.4 Collaborating through digital technologies	Work in virtual teams on shared project-management platforms.
	2.6 Managing digital identity	Building a personal and professional brand consistent with the graduate profile.
3. Digital content creation	3.1 Developing digital content	Creation of digital marketing materials and executive reports.
	3.3 Copyright and licences	Ethical and legal use of information, images and software in business products.
4. Safety	4.1 Protecting devices	Basic cybersecurity practices in the management of business information.
	4.2 Protecting personal data and privacy	Responsible management of customer and employee data in accordance with current legislation.
5. Problem solving	5.1 Solving technical problems	Diagnosis and resolution of problems in the digital systems used by the organization.
	5.3 Creatively using digital technologies	Identification of opportunities for innovation and process improvement through technology.

Note: Prepared by the authors from Vuorikari, Kluzer and Punie [1]. Codes and names follow the official DigComp 2.2 numbering; the adaptation column is provisional and will be revised during co-design (Phase 2).

VI. DISCUSSION: EXPECTED CONTRIBUTIONS AND LIMITATIONS

Most earlier adaptations of DigComp were written for teachers or for the general public. This one is built for a business management engineering profile and brings regional employers into the process from the design stage. Its main conceptual contribution lies in linking an international framework, a professional profile and a local productive context, which answers the gap described in Section 2.3.

Three limitations can be anticipated. The twelve competencies are provisional and may change during co-design or in light of pilot evidence. Because the study is confined to one program, its results cannot be generalized until it is replicated elsewhere. Much of the evidence will also come from self-assessment, whose validity rests on the procedures described in Section 4.3.

The diagnosis, co-design, piloting and impact evaluation will be reported in a second article, together with the quantitative and qualitative results of the implementation.

VII. CONCLUSIONS

A preliminary digital competence framework for Business Management Engineering has been derived from DigComp 2.2, along with a four-phase mixed-methods design for validating it. Technological higher education institutions with similar programs can adopt both the framework and the procedure. The proposal also opens a line of research on curricular relevance and graduate employability in regions that depend on logistics, agro-industry and commerce. Empirical results will follow in a later study.

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Magdalena Torres Pacheco: Conceptualization, Investigation, Writing – original draft.

Data availability: The instruments and the resulting data will be available from the corresponding author on reasonable request once data collection is complete, subject to confidentiality requirements and institutional regulations.

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