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„Димитър А. Ценов" - Свищов

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Международна научно-практическа конференция

90 години дарителство, знание, иновации и устойчиво развитие в СА „Д. А. Ценов" – Свищов

Том I



5-7 ноември 2026 г.

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PREPARING FUTURE PROFESSIONALS IN BUSINESS SCIENCES FOR THE AI ERA: COMPETENCIES AND CURRICULAR CHALLENGES

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Abstract: *The growing integration of Artificial Intelligence (AI) into organizational processes is profoundly reshaping managerial roles and practices. At the same time, there appears to be an increasing gap between the competencies currently promoted in many Higher Education curricula and those demanded by the labor market in a context characterized by data-driven environments, algorithms, and AI-supported decision-making systems. This communication proposes to identify the AI competencies considered essential for students in business sciences and related fields to develop throughout their academic journey, in alignment with emerging professional and labor market requirements. The methodology is based on a documentary analysis of reference competency frameworks for Higher Education, considering both transversal competencies and those specifically related to business sciences. The results aim to support institutional decision-making and contribute to the adaptation and renewal of curricula in business sciences and related fields in response to AI-related challenges. In this way, the study contributes to ongoing academic and institutional discussions on the integration of AI into Higher Education curricula, particularly regarding the identification of key competencies and the development of strategies for their effective curricular integration.*

Keywords: *Artificial Intelligence; AI literacy; AI Competencies; Business education; Higher education*

JEL: *I21, I23, J24, M10, O33*

1. Introduction

The increasing incorporation of Artificial Intelligence (AI) into organizational processes is reshaping managerial work, decision-making and professional responsibilities. AI systems are now embedded in daily operations such as customer segmentation, demand forecasting, financial analysis, recruitment, performance monitoring, fraud detection, supply-chain optimization and strategic planning (Kaya et al., 2023; McKinsey & Company, 2026; Sollosy & McInerney, 2022). In this sense, graduates in business sciences and related fields are expected to operate in environments where AI is increasingly present (Kaya et al., 2023; Sollosy & McInerney, 2022; World Economic Forum, 2025).

This transformation creates a curriculum challenge. Higher Education institutions must prepare students not only to use AI tools, but also to interpret

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their outputs, identify their limitations and assess their organizational consequences. In various managerial contexts, the relevant question is not whether future professionals will encounter AI, but whether they will be able to use it in ways that are analytically sound, ethically responsible and strategically meaningful (Chinoracky et al., 2026; Gimpel et al., 2024).

In response to the constantly evolving environment surrounding AI, considerable effort has been devoted to identifying the competencies that AI-related education should develop. DigComp 3.0 integrates AI competence across all 21 competences of the European digital competence framework (Cosgrove & Cachia, 2025). Additionally, the OECD and the European Commission have proposed an AI literacy framework for primary and secondary education (OECD & European Commission, 2026). UNESCO's AI competency framework for students organizes competencies around four pillars and three progression levels: Understand, Apply and Create (Miao et al., 2024). Although these two frameworks are directed towards primary and secondary educational settings, they are relevant to higher education, due to the potential of their core principles to inform curriculum development and support the acquisition of key competencies in university contexts. Despite this body of work, translating these frameworks into curricula remains difficult. DigComp 3.0 is a generic framework that does not specify how AI competence should be sequenced within university programs. For the OECD framework, its target is primary and secondary education, failing to contextualize it to the higher education context. In the case of the UNESCO framework, although it offers a progression, it still requires translation into higher education course outcomes, assessment tasks and disciplinary examples (Marques et al., in press). Institutions are therefore left to interpret and combine these frameworks on their own.

Within this landscape, Marques et al. (in press) compared these three frameworks and, to identify the competencies students should develop and to determine how their promotion should unfold across the curriculum, established a transversal progression model for students across higher education settings. Its progression logic is particularly valuable because it moves beyond tool familiarity towards understanding, critical use, evaluation, creation and responsible autonomy. However, because the model is intentionally general, it does not specify how its competencies should be expressed in different disciplinary contexts.

This paper proposes a disciplinary extension of this progression model for students in business sciences and related fields. The objective of this study is to identify the AI competencies specific to business sciences and, building on the competency progression model developed by Marques et al. (in press), to construct a progression model adapted to students in this field. To this end, a qualitative documentary analysis is used to identify the competencies relevant to organizational settings characterized by complex discipline-specific tasks. These competencies are then integrated into the successive stages of the reference model,

respecting its structure and developmental logic. The contribution is conceptual: the resulting model is not an empirically validated competency instrument, but an evidence-informed basis for curriculum design in business and related areas, subjected to future validation.

2. Literature Review

2.1. AI competencies and Higher Education

The Artificial Intelligence Act (Regulation (EU) 2024/1689) is the European Union's regulation laying down harmonised rules on AI. It addresses AI literacy in Article 4 (as amended by Regulation (EU) 2026/1744) and defines it as the skills, knowledge and understanding that allow an informed deployment of AI systems and awareness of their opportunities, risks and possible harm. AI literacy is, however, distinct from AI competencies. It is generally framed as a baseline capacity to understand and live with AI (Long & Magerko, 2020; Ng et al., 2021), whereas AI competence refers to a more applied, context-dependent ability to perform specific tasks with AI support (Almatrafi et al., 2024; Marques et al., in press). As this paper concerns what business students should be able to do in managerial tasks, it adopts the term competencies.

AI competency frameworks in Higher Education increasingly go beyond technical operation. They emphasize conceptual understanding, critical use, verification, ethical awareness, communication, creativity and judgement (Chee et al., 2025; Chinoracky et al., 2026; Gimpel et al., 2024). Chee et al. (2025), for example, argue that AI literacy varies across learner groups and should be understood as a developmental pathway rather than as a single static skill.

A progression-based approach is especially useful because meaningful AI use requires more than familiarity with tools (Chinoracky et al., 2026; Gimpel et al., 2024). Students must first understand AI systems and their limitations; then apply them in guided activities; later use them autonomously and critically; and eventually create or lead responsible AI-enabled practices. This logic is compatible with the transversal matrix developed by Marques et al. (in press), which serves as the base model for the present extension.

2.2. AI competencies for business education

Business education literature suggests that AI-related learning must combine technical awareness with managerial interpretation. Chen (2022) examined AI curricula in business schools and differentiated between learning to develop AI systems and learning to use AI appropriately in business contexts. This distinction matters because most business sciences students are not being prepared as AI developers. Instead, they need enough understanding to assess AI outputs, identify limitations and make informed decisions about the use of AI in organizations (AACSB, 2026; Kaya et al., 2023).

Sollosy and McInerney (2022) argue that business education should respond to AI not by focusing only on technical knowledge, but by strengthening the intellectual and professional capabilities that remain essential in AI-augmented workplaces: judgement, creativity, communication, leadership, ethical reasoning and change management. Their argument is particularly relevant to the present study because it supports the idea that business education should focus on AI-enabled managerial practice, rather than on generic tool operation or advanced algorithmic development alone.

Xu and Babaian (2021)'s work supports the inclusion of applied and scaffolded learning activities, rather than treating AI only as theoretical content. However, practical engagement must be progressively structured: students need foundational understanding before they can apply AI autonomously to complex management problems.

Kaya et al. (2023) propose an integrative model of AI competencies for business students. However, this model does not sequence these competencies into a curricular progression nor does it indicate in which stage of one's academic journey the proposed competencies should be introduced. Gimpel et al. (2024), on the other hand, discuss AI competencies for future-proof graduates, diving deeper into AI competencies for business sciences and presenting real-life examples of how programs approach the topic of AI Competencies in Higher Education. However, they don't propose a concrete model nor any curriculum sequencing. Together, these studies support the need to integrate AI into business curriculum, following a logical progression, while preserving critical reflection, ethical awareness and professional responsibility (AACSB, 2026; Wu et al., 2026).

3. Methodology

This paper extends a previously established curricular proposal for AI competency development to adapt it to business sciences students. The analysis addresses two questions: which business-related competencies merit explicit inclusion in students' AI education? What point in their academic development should these capabilities be expected?

A qualitative documentary approach was adopted to connect competency-related literature with curricular decision-making, examining the educational relevance of the selected documents and the reasoning required to incorporate them into a degree program. The documents were purposively selected and analyzed one by one to identify the competencies relevant to AI-supported business-related activities. These competencies were recorded in a structured table, which was then used to organize them into the curricular stages of the base progression. Placement at a given stage followed two criteria: the complexity of the task and the scope of the achivement expected of the student. The results of this table were then transferred to the final progression table.

The documentary basis combines studies on AI competencies in business education and related professional fields, such as accounting, finance and marketing, with studies on business curricula and learning. A small number of complementary references on forecasting, generative AI limitations and AI risk management support the wording of specific competencies. The documents are descrybed in Section 4.1.

Three considerations guided the use of the selected material. A candidate addition needed an identifiable connection to AI-supported managerial activity, a clear educational contribution beyond a generic restatement of the existing matrix, and a formulation that could reasonably by extended to different areas of business sciences.

4. Results: Business-Specific Extension of the Original Competency Progression

4.1. Overview of the proposed additions

The proposed additions build on two types of sources. The first is the base model (Marques et al., in press), which resulted from the comparison of DigComp 3.0, the OECD AI literacy framework and UNESCO's AI competency framework for students. However, being transversal, the model does not address the tasks that distinguish managerial work. The second type consists of studies on AI competencies in management and related areas, which were selected to address that gap.

Several studies in accounting, finance and marketing identify competencies that are transferable to business education, even though their empirical settings are discipline-specific (Anica-Popa et al., 2024; Arise & Moloi, 2025; Riley et al., 2026; Saranrom, 2026). These areas share with general management a common task profile, namely analyzing data, forecasting, assessing risk, supporting decisions under uncertainty and answering for professional recommendations, which justifies using their findings as a basis for the proposed additions.

Several competencies relate to organizational analysis and decision-making. Anica-Popa et al. (2024) identify data analysis and management, prompt formulation, communication, skeptical thinking, problem-solving, forecasting, risk identification, risk assessment, risk mitigation, and support for strategic and investment decisions. These competencies connect AI use with analytical tasks and managerial decision making. This study is a crucial reference for the specification of competencies in this area, describing accounting and audit professionals.

Other studies highlight diagnostic and prognostic capabilities, adaptability and problem-solving. Meesook et al. (2025) examine the association between AI literacy, diagnostic and prognostic capabilities, and risk-management skills among accounting students. Imjai et al. (2025) relate AI literacy and adaptability to financial analyst skills through critical thinking, while Promma et al. (2025) connect AI literacy with complex problem-solving through systematic and intuitive thinking. Although these studies focus on Thai accounting students and

cannot be generalized directly to other business and management programs, they identify competencies relevant to organizational analysis, forecasting, risk management and problem-solving. Their value for this proposal is that they link AI literacy to these competencies, which supports the inclusion of the corresponding competencies in the extended progression model.

Critical evaluation and responsible decision-making are also highlighted. Riley et al. (2026) discuss AI integration in marketing education, emphasizing the evaluation of AI outputs, ethical considerations and students' responsibility for professional recommendations. Córdova et al. (2024) examine the use of AI tools in finance education, highlighting student perceptions, emotional responses and educator experience. Arise and Moloi (2025) address the opportunities and challenges of integrating AI into accounting curricula, while Saranrom (2026) examines AI literacy in marketing education and its implications for digital pedagogy. Together, these studies show that the integration of AI in business-related curricula makes critical evaluation, ethical judgment and professional responsibility necessary components of students' preparation, which supports specifying them explicitly in business education.

Studies on AI in business education provide the curricular and competency context for these additions. Chen (2022) analyzes AI curricula in business schools and distinguishes between learning to develop AI systems and learning to use them appropriately in business contexts, while Xu and Babaian (2021) examine the pedagogy and learning outcomes of AI in the business curriculum. Kaya et al. (2023) propose an integrative model of AI competencies for business students, Gimpel et al. (2024) discuss AI competencies for graduates with examples of how different programs approach them, and Chinoracky et al. (2026) analyze the AI-readiness of university students through a competency measurement framework that includes interpersonal capabilities. These studies inform which competencies are relevant to business students and how they can be taught, but not how they should be sequenced in business-related areas' curriculums.

Three further references support the identification of business relevant competencies. Hyndman and Athanasopoulos (2021) provide principles for evaluating forecasts, and Ji et al. (2023) document the production of fluent but unfounded content by generative models. Together, they support distinguishing a forecast based on an analytical method from a generated narrative about possible futures. The NIST AI Risk Management Framework (NIST, 2023) treats the assessment and monitoring of AI risks and impacts as a continuing organizational task, which supports the evaluation of AI-supported organizational processes and the research-oriented inquiry specified at the more advanced stages.

Finally, Hanson and Ott (2026) distinguish trust in AI from broader forms of financial, digital and technological literacy. For business education, this distinction highlights the importance of evaluating AI outputs rather than accepting them uncritically, taking into account the available evidence, context, task and

potential consequences. It is therefore used to support the emphasis on the evaluation of AI outputs in the proposed additions.

Taken together, these studies inform the identification of business-relevant AI competencies in organizational analysis, problem-solving, forecasting, risk management, decision-making and critical evaluation. Their contribution to business education lies in informing the specification of competencies that connect AI use with managerial tasks and professional responsibility. Because the evidence differs in type and discipline, the additions are presented as an evidence-informed specification, not as a validated competency set.

The analysis produced thirteen business-specific additions, identified as M1-M13. They address the use of AI in organizational understanding, business-information evaluation, analytical work, managerial recommendations and advanced professional inquiry. To facilitate the interpretation, the original transversal AI competencies from Marques et al (in press) were individually identified as T1-T19.

Table 1. AI competency progression with proposed additions for business sciences.

Stage	Transversal AI competencies (Marques et al., in press)	Business competencies to be added
Introductory stage	Foundational digital and AI awareness: **T1**. Recognizing common AI systems **T2**. Explaining basic concepts, capabilities and limitations **T3**. Identifying when AI outputs require verification **T4**. understanding basic privacy and data protection risks.	**M1**. Recognizing AI applications in organizational functions: identify common uses of AI in marketing, finance, accounting, human resources and operations, and explain their intended managerial purpose. **M2.** Recognizing business-data sensitivity and the limits of AI-generated business information: distinguish public information from confidential organizational, customer and employee data, and recognize that AI-generated business claims require verification.
Early undergraduate stage	Responsible and evaluative use: **T5**. Using AI transparently for study support **T6**. Comparing AI-generated outputs with academic sources **T7**. Identifying unsupported claims, bias and missing evidence **T8**. Documenting AI assistance	**M3.** Verifying AI-generated business information in guided learning tasks: compare AI-generated market descriptions, company information, financial explanations or business summaries with identified sources, distinguishing documented information from unsupported claims. **M4.** Identifying and explaining bias and missing evidence in business recommendations: recognize unsupported assumptions and potentially biased representations of customers, employees or organizational performance, and document the corrections made.
Intermediate undergraduate stage	Purposeful application and workflow design:	**M5.** Designing AI-supported business-analysis workflows: define an analytical objective, select suitable tools, structure

	T9. Selecting AI tools for specific academic tasks **T10**. Designing prompts or workflows **T11**. Evaluating output quality using criteria **T12**. Protecting sensitive data **T13**. Explaining when AI should not be used.	prompts and data inputs, establish output-quality criteria and identify human-review points. **M6.** Investigating organizational problems systematically with AI support: organize relevant information, identify patterns and develop alternative explanations without treating generated explanations as established causes. **M7.** Producing and interpreting bounded forecasts and scenarios: use AI-supported tools to explore a defined business problem, stating data requirements, assumptions, uncertainties and limits on the interpretation of predictions.
Final undergraduate stage	Discipline-sensitive integration **T14**. Applying AI within disciplinary methods and evidence standards **T15**. Documenting methods **T16**. Evaluating ethical, legal and social implications **T17**. Maintaining human responsibility for conclusions.	**M8.** Integrating AI-supported analysis into justified managerial decisions: evaluate diagnostic findings and scenarios against relevant disciplinary methods, organizational objectives, alternatives and stakeholder implications; justify acceptance, modification or rejection of AI-supported recommendations. **M9.** Assessing and mitigating risks in a management case or project: evaluate data, model and implementation risks alongside ethical, legal and social implications, and propose proportionate safeguards. **M10.** Communicating and defending AI-supported managerial recommendations: explain methods, evidence, uncertainty, limitations and the contribution of AI to the analysis, while retaining responsibility for conclusions.
Postgraduate or advanced professional stage	Critical, research-oriented and professional use **T18**. Assessing AI systems or outputs in research and professional contexts **T19**. Considering validity, accountability, bias, transparency and impact.	**M11.** Critically evaluating AI-supported organizational processes: assess the validity, accountability, bias, transparency and organizational consequences of AI-supported processes, distinguishing demonstrated benefits from unverified claims. **M12.** Developing and critically appraising responsible AI-adoption proposals: justify strategic objectives, organizational readiness, resource and training requirements, governance arrangements and evaluation criteria. **M13.** Conducting advanced inquiry into AI-supported management practice: formulate research or professional evaluation questions, justify methods, assess evidence quality and explain the limits of conclusions about organizational impact.

4.2. Introductory stage: recognizing organizational uses and information sensitivity

M1 concerns recognizing AI applications in organizational functions and explaining their intended purpose. Chen's (2022) analysis of business-school curricula provides a relevant curricular perspective, while Anica-Popa et al. (2024) illustrate connections between AI and professional processes in accounting and audit.

M2 concerns recognizing sensitive business information and the need to verify generated business claims. Anica-Popa et al.'s (2024) treatment of professional data use supports this focus. The proposed formulation asks students to distinguish information that can be used openly from information whose disclosure could affect an organization, customer or employee.

Both M1 and M2 belong in this stage because they are necessary before students move on to practical use. A student should recognize that a customer record may be sensitive before including it in a prompt. Similarly, recognizing that an AI-generated company statement requires checking precedes the ability to conduct that verification systematically.

4.3. Early undergraduate stage: checking and correcting business information

M3 specifies verification of AI-generated business information in guided tasks. It draws on the analytical and skeptical-thinking competencies discussed by Anica-Popa et al. (2024) and the critical-evaluation orientation of Riley et al. (2026). Students are expected to compare material such as a market description or financial explanation with identified sources and explain any correction.

M4 addresses bias and missing evidence in business recommendations. Supported by the same emphasis on critical evaluation, it asks students to identify assumptions or omissions affecting representations of customers, employees or organizational performance (Anica-Popa et al., 2024; Arise & Moloi, 2025; Gimpel et al., 2024).

4.4. Intermediate undergraduate stage: organizing analytical work

M5 concerns designing AI-supported business-analysis workflows. The formulation brings together data analysis, prompt formulation and process understanding discussed by Anica-Popa et al. (2024). Xu and Babaian (2021) also provide a relevant basis for this practical engagement with AI in business education. Students must specify the objective, inputs, tool, checking criteria and human-review points of a bounded analysis.

M6 concerns systematic investigation of organizational problems. Meesook et al. (2025) provide support through their examination of diagnostic capability, while Promma et al. (2025) and Anica-Popa et al. (2024) address systematic thin-

king and complex problem-solving. Students should organize relevant information and compare possible explanations, rather than accept a generated explanation as a demonstrated cause.

M7 concerns bounded forecasts and scenarios. Its primary support comes from Meesook et al.'s (2025) examination of prognostic capability and the forecasting applications discussed by Anica-Popa et al. (2024). Imjai et al. (2025) provide complementary context through financial-analyst skills. At this stage, students should explain assumptions, uncertainty and interpretation limits, while also distinguishing a generated narrative about possible futures from a forecast supported by an analytical method (Hyndman & Athanasopoulos, 2021; Ji et al., 2023).

4.5. Final undergraduate stage: defending managerial conclusions

M8 concerns integrating AI-supported analysis into justified managerial decisions. Anica-Popa et al. (2024) discuss strategic and investment decision support, while Riley et al. (2026) address decision support in marketing education and Imjai et al. (2025) examine the contribution of critical thinking to analytical skills. The additional demand at this stage is disciplinary justification. Students must explain whether an analysis is adequate for its intended decision, compare alternatives and state why an AI-supported recommendation should be accepted, modified or rejected, which is different from simply producing a plausible diagnosis or scenario.

M9 concerns risk assessment and mitigation within a management case or project. It is supported by Anica-Popa et al.'s (2024) treatment of risk identifycation, assessment and mitigation, alongside Meesook et al.'s (2025) work on risk-management skills. This placement does not imply that privacy and bias should be ignored earlier. Rather, students now need to combine these concerns with project-specific data, implementation and stakeholder implications, then propose proportionate safeguards.

M10 concerns communicating and defending managerial recommenddations. Anica-Popa et al. (2024) identify communication as professionally relevant, while Chinoracky et al. (2026) include interpersonal capabilities in their AI-readiness framework. Communication occurs to a degree, but the performance specified here is more demanding than presenting results. Students must explain methods, evidence, uncertainty and the division between AI assistance and their own contribution.

4.6. Postgraduate or advanced professional stage: evaluating organizational practice

M11 concerns critical evaluation of AI-supported organizational processes. It synthesizes the process understanding and professional judgement discussed by Anica-Popa et al. (2024) with the accountable-use perspective of Riley et al. (2026). The defining feature is the object of evaluation. Rather than checking one

output or defending a bounded project, students examine a process and its consequences, including the evidence supporting claimed benefits, allocation of responsibility and effects across stakeholders (Kaya et al., 2023; National Institute of Standards and Technology, 2023). This broader scope justifies the advanced placement.

M12 concerns developing and appraising AI-adoption proposals. It extends the project-management, process and strategic-decision perspectives in Anica-Popa et al. (2024) into a curricular synthesis covering objectives, feasibility, resources, training, accountability and evaluation. This is an advanced expectation because the proposal must connect analytical suitability with organizational conditions.

M13 concerns advanced inquiry into AI-supported management practice. It specifies the management focus of the research-oriented activity. This focus is consistent with the NIST AI Risk Management Framework, which treats the analysis, assessment and monitoring of AI risks and impacts as a continuing task (NIST, 2023), and with the risk assessment and support for strategic decisions that Anica-Popa et al. (2024) identify among professional competencies. The expected performance is to formulate an evaluable question, justify a method and delimit conclusions about organizational impact. Its placement reflects the requirement to investigate the quality and implications of practice, rather than simply using AI within a task.

5. Discussion

The proposed progression connects AI education with a central requirement of business: the need to distinguish information, analysis and recommendations from decisions for which people and organizations remain accountable. Its contribution lies in making these distinctions explicit within an existing curricular sequence.

The additions should not be interpreted as thirteen isolated modules, as several may be developed at the same time. A customer-analysis project, for example, may involve verification, workflow design and interpretation, while a final undergraduate project may additionally require a defensible recommendation and contextual risk assessment. What changes is the responsibility assumed by the student, not merely the complexity of the tool. For example, recognizing a confidentiality issue, applying a data-protection procedure and evaluating organizational safeguards are related but not equivalent performances. Recognizing an issue requires awareness that a task involves sensitive information, which corresponds to the understanding of privacy and data-protection risks expected at the introductory stage. Applying a procedure requires the student to act on that awareness in a concrete task, for example by deciding what information may be entered into an AI tool, as in the protection of sensitive data expected at the intermediate stage. Each performance builds on the previous one but demands

more advanced analytical and evaluative judgment, and none can be assumed from the earlier one. The recurrence of a competency across levels is therefore a deliberate feature of the progression, in line with the spiral logic of the base model, and not redundancy.

Having discussed the proposed model, it is important to stress that its success depends on the preparation of educators, who must be able to integrate AI into teaching and learning practices and to support these distinctions in assessment (AACSB, 2026; CNIPES, 2026; Córdova et al., 2024).

In addition, to ensure the success of the initiative, implementation strategies must be aligned with institutional policies and guidelines. In Portugal, for example, the National Council for Pedagogical Innovation in Higher Education (CNIPES) promotes national guidelines and initiatives that higher education institutions can adapt and implement, namely regarding the integration of AI into teaching and learning processes. Its national diagnostic of 68 institutions found that only 14.7% had AI policies formally in force (CNIPES, 2026). These figures illustrate why curricular proposals should be developed alongside institutional policies.

6. Conclusion

Preparing business sciences students for AI-supported work requires more than familiarity with applications. Students need to recognize the purpose and limitations of AI use, organize analytical work, judge the adequacy of evidence and explain the basis of managerial recommendations.

This study proposes an AI competency progression model for business sciences, built on the model of Marques et al. (in press) and adapted to the particularities of this field. The model maintains all the 19 generic competencies from the base matrix and 13 business-specific competencies (M1–M13) distributed across its five stages. In response to the research questions, the study identifies the business-related competencies that merit explicit inclusion and places each at the stage justified by the complexity of the task and the scope of the outcome expected of the student. The progression moves from organizational recognition and business-information verification to analytical workflows, justified decisions and advanced evaluation of organizational practice. The distinction between these performances provides the rationale for their placement.

The contribution is consequently a curricular specification, not a validated account of how students learn or a demonstration of employment outcomes. The main limitations stem from the theoretical corpus that supports the proposal. The corpus is purposive and cannot establish exhaustive coverage of relevant competencies. The evidence combines conceptual arguments and empirical associations, which should not be interpreted as equivalent validation. Conceptual arguments, such as the framework that Anica-Popa et al. (2024) propose for accounting and

audit professionals, which draws on a literature review to identify the competencies required, indicate which competencies may be relevant, but the study itself does not test them with students or in organizational practice. Some of the empirical studies report relationships between AI literacy and related skills, estimated from survey data in specific samples, as in the studies of Thai accounting students (Imjai et al., 2025; Promma et al., 2025), which did not test the proposed sequence. These sources provide a sound basis for identifying relevant competencies, but none of the selected sources specifies how business-related AI competencies should progress across the stages of a degree. This is the gap that the proposed model addresses: rather than deriving a new progression from these sources, it extends the transversal curricular progression of Marques et al. (in press) with business-specific competencies. Findings from specific disciplines and national contexts also require scrutiny before being transferred to other programs.

Future work should therefore focus on the operationalization and validation of the model, namely through its application in real teaching and learning contexts. Student-facing pilot studies could examine whether the additions are relevant, sufficiently distinct and appropriately positioned. Assessment research should investigate whether tasks reveal students' reasoning and verification rather than only the quality of AI-assisted products, and longitudinal studies could examine transferability to unfamiliar problems. Institutional implementation and policy evaluation should accompany this work without being confused with competency identification.

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