CHAPTER 7

BACHELOR'S DEGREE IN USABILITY AND INTERACTION ENGINEERING (EUSIN)

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ABSTRACT — The absence of academic and professional regulation in the field of Agent-Technology Interaction (ATI) undermines both the legitimacy and reliability of technical analyses applied to complex and interactive constructs. This research proposes the development of an unprecedented undergraduate degree in Usability and Interaction Engineering, based on a progressive, standardized curriculum supported by a high-precision technical-scientific framework. The proposal articulates theory, practice, and institutional accountability, overcoming fragmented models that reduce the complexity of the field to operational modules or generic approaches. The core of the program lies in the training of the Usability and Interaction Engineer (EUSIN), a professional responsible for issuing standardized technical reports grounded in rigorous criteria of functional, cognitive, social, ethical, and technological analysis. The educational structure is anchored in the twelve integrated dimensions of the FCIA-OT and its associated systems and tools. The SPMI, SCDMIC, SGUI, and SCMI ensure analytical accuracy, depth, and reproducibility. The formalization of this field enables both academic and institutional recognition, redefining the standards of validation and quality control in interactive systems. The EUSIN engineer thus becomes the authoritative instance with legal and technical autonomy to intervene throughout the technological object's entire lifecycle. This proposal stands as a technical, scientific, and institutional model capable of transforming ATI practice, ensuring interaction safety, and establishing a new engineering paradigm centered on integrity, usability, interaction, and experience in the context of complex technological constructs.

KEYWORDS — Regulation; Undergraduate Program; Engineering; Usability; Interaction; ATI; Technical Reports.

1 INTRODUCTION

Agent-Technology Interaction (ATI) has emerged as a foundational technical-scientific domain for the design and evaluation of complex technological objects, involving multiple agents, human, artificial, or hybrid, within interactive and distributed computational ecosystems. This field surpasses the classical boundaries of Human-Computer Interaction (HCI), advancing a critical, modular, and systemic approach grounded in interactional quality engineering and the logic of meaningful experiences.

The absence of a specific undergraduate program, anchored in a consolidated epistemological structure and supported by recognized regulatory competence, has compromised the development of a professional body capable of operating, analyzing, and transforming interactive systems with theoretical depth and technical sophistication. The proposed Bachelor's Degree in Usability and Interaction Engineering responds to this educational void, drawing upon historical and scientific foundations that underscore the urgency of a profound, interdisciplinary, and technically rigorous curricular transformation.

A paradigmatic rupture in the university model was proposed by Jantsch (1972), who argued that, in order to confront the challenges of contemporary society, universities must move beyond multidisciplinary and pluridisciplinary approaches toward true interdisciplinarity. This requires coordination among adjacent hierarchical levels within systems of education and innovation. He suggests that education be conceived as an integrated innovation system, in which scientific disciplines are dynamically reorganized to meet social demands. He advocates for university education as a continuous process that integrates theoretical and practical learning.

Often reduced to graphical or organizational elements, the conceptual fragmentation of HCI is critically examined by Cockburn & Bell (1998), who point out that a common misconception is to treat HCI as merely concerning graphical or visual organization aspects, whereas it actually involves formal principles for designing underlying states and transitions. The integration of HCI into academic curricula enhances instructional quality and prepares students to critically evaluate computational systems and propose design improvements. The authors emphasize the importance of teaching HCI as a critical and analytical foundation rather than merely a technical skill.

The complexity of the training required for usability engineers was synthesized by Baecker (1989), who advocated for the formation of professionals with multidisciplinary competencies, emphasizing sensitive observation, insightful analysis, advanced conceptual thinking, and sophisticated theoretical construction.

He highlights creativity, imagination, and design excellence, combined with practical implementation skills. These professionals must master diverse disciplines such as perceptual psychology, cognitive science, software engineering, user interface management systems, graphic design, industrial design, organizational theory, and experimental design.

According to Rusu et al. (2015), the CS2013 report by ACM and IEEE formally acknowledges the relevance of HCI within Computer Science (CS) curricula, including it among the eighteen core knowledge areas. The growing number of companies specializing in usability consulting reflects an increasing professional appreciation of the field. HCI should be a fundamental component in the education of all CS professionals.

The undergraduate program proposed in this article integrates this conceptual legacy into a technically structured curricular framework, aimed at the scientific, methodological, and ethical training of usability and interaction engineers. The curricular construction, detailed in the following sections, defines the formative logic, epistemic axes, and applied competencies required to respond, with precision, to the increasing complexity of contemporary interactive systems..

2 CURRICULUM STRUCTURE: ENGINEERING OF USABILITY, INTERACTION, QUALITY, UTILITY, AND SYSTEMS LOGIC

The proposed curriculum integrates scientific foundations and applied competencies to support a high-level education in usability and interaction engineering. It is structured to merge theory and practice, bringing together knowledge from the exact sciences, the humanities, and technology, with a focus on the analysis, design, implementation, and critical evaluation of interactive products, services, and artifacts.

The program prepares professionals to operate in sectors of high technological responsibility and social impact. These engineers will be equipped to design and analyze innovative, ethically responsible, and sustainable solutions, grounded in rigorous evaluation of interfaces, interaction architectures, digital ecosystems, and complex constructs.

The curricular proposal is integrated into the structural core of the Integrated and Advanced Core Framework for the Analysis and Evaluation of Technological Objects (FCIA-OT), supported by an extensive scientific foundation and anchored in its Systemic Matrix of Integrated Vectorial Dimensions (MSDVI), composed of twelve high-complexity technical-analytical dimensions. This connection establishes the epistemic logic and modular organization of the program, offering a formative path aligned with the principles of Agent-Technology Interaction (ATI) and the contemporary demands of interaction engineering.

According to Ramsey & Atwood (1980), research on human factors in interactive systems remains fragmented, reflecting the dispersed nature of the relevant literature, which spans multiple disciplines. Existing studies on interface design guidelines are more advanced in physical aspects, such as characteristics of keyboards and display devices, but lack detailed guidance on broader cognitive and interactive issues.

Overcoming these gaps requires an educational structure that integrates multiple dimensions of interactional design. As noted by Shneiderman (1986), the maturity of a scientific discipline is reflected in the consensus surrounding its core issues. In the context of Human-Computer Interaction, he proposes seven primary topics that shape research and development in the field: interaction styles, input techniques, output organization, response time, error handling, individual differences, and explanatory and predictive theories.

The incorporation of these foundations guided the structuring of disciplinary cores and formative axes. The curriculum proposal takes into account the warning issued by Perlman (1990), who underscores the critical need for updated curricular materials in the teaching of user interface development. He suggests that such resources must encompass the full scope from interface design to evaluation.

Based on this directive, the program establishes continuous modules that cover the essential stages of the interactional process. This curricular alignment also responds to the observations of Faulkner & Culwin (2000), who criticize the excessive academic isolation of HCI education, often administered by departments lacking articulation with or recognition of software engineering. They draw a crucial distinction: usability engineering demands technical expertise in software development, thus qualifying the professional to design and implement systems, whereas usability evaluation constitutes a specific analytical activity, which alone does not confer the qualification of a usability engineer.

To overcome this disconnect, the foundations of software engineering, programming, and computational structures are introduced from the earliest stages of training. This principle aligns with the diagnosis by Chilana, Wobbrock, & Ko (2010), who note that although usability is gaining increasing recognition in the industrial sector, its application in complex domains still faces fundamental challenges. They identify strategies employed by professionals to address these challenges but emphasize that the full success of usability practice in such contexts may depend on long-term educational changes aimed at enhancing the training and capabilities of those involved.

This anticipation of systemic complexity guides the design of the program, which seeks to prepare professionals capable of acting critically within distributed and technologically advanced contexts. Marek & Wu (2021) highlight the significant gap between academic research and pedagogical practice, showing that the practical application of scientific findings in long-term curricula is frequently neglected. Technological affordances, the specific benefits or capacities of educational tools, must be carefully evaluated when designing learning experiences that maximize educational outcomes.

This principle guides the incorporation of integrated formative practices, including laboratories, active methodologies, and supervised internships, aligning the conceptual foundation with applied practice. The educational model is anchored in strategies that articulate theory, technique, and real-world application.

The curriculum's design required methodological rigor and a forward-looking perspective. The program spans from foundational topics in computer science and software engineering to advanced fields such as usability engineering, interaction design, and systemic quality evaluation. Its modular structure ensures a balance between conceptual formation and technical application. The overall curriculum meets current demands in interaction engineering, contributing to the consolidation of a technically grounded and socially responsible science. Tables 1 through 4 present the technical composition of the curricular matrix, the mandatory internships, the formative structure, and the definition of the professional profile of the Usability and Interaction Engineer, according to the principles of Agent-Technology Interaction (ATI).

This curricular structure (Table 1), organized over ten semesters, follows a modular, progressive, and articulated educational logic that ensures the development of high-complexity interactional and analytical competencies.

The undergraduate program was designed based on the advanced matrix of twelve technical-analytical dimensions from the FCIA-OT (see Chapters 1, 2, 3, 4, and 5), whose foundation is anchored in specialized literature from the fields of usability and interaction, systems engineering, and technological evaluation. This epistemic and forward-oriented foundation enabled the formulation of a training model aligned with the ATI paradigm and the emerging demands of interaction engineering. The degree prepares professionals with systemic mastery of the human, technical, cognitive, social, semiotic, and computational factors that govern the life cycles of interactive technological objects—from conception to final disposition. Rather than producing specialists in hardware or generic programming, the program trains usability and interaction engineers capable of evaluating, designing, and critically intervening in complex systems, with a focus on agent experience within hybrid, responsive, and distributed computational ecosystems.

TABLE 1: CURRICULUM STRUCTURE – ENGINEERING OF USABILITY, INTERACTION, QUALITY, UTILITY, AND SYSTEMS LOGIC

Term	#	Course Title	Description / Subtopics	C./H.
1st	**1**	Basic Mathematics I	Algebra, geometry, and functions. Foundation for modeling and mathematical analysis in ATI.	60
	2	Introduction to Computer Engineering	Fundamentals of hardware, software, and computational logic.	60
	3	Cultural and Social Anthropology	Cultural and social impacts on technological design and interaction.	60
	4	Ethnography	Application of ethnographic methods to the study of human behavior in digital environments. Includes analysis of interactions in social networks, interactive systems, and applications, with emphasis on direct observation and qualitative study of how agents use and adapt to systems. Focus on understanding cultural, social, and behavioral practices in technological contexts.	60
	5	Cognitive Psychology	Focus on individual mental processes that affect interaction with systems, such as perception, attention, memory, and decision-making. Application of cognitive theories to interface design for intuitive and efficient interaction.	60
	6	Sociology of Technology and Society	Analysis of the relationship between technology, society, and behavior	60
2nd	**7**	Basic Mathematics II	Differential and integral calculus applied to algorithm development.	60
	8	Algorithms and Data Structures	Lists, trees, graphs, and algorithms applied to interfaces.	60
	9	Design Fundamentals	Graphic design principles applied to interface design.	60
	10	Ergonomics and Human Factors	Physical and psychological aspects of agent-technology interaction.	60
	11	Communication Theories	Semiotics, semiosis, and symbolism in interactive system design.	60
	12	Statistics	Fundamentals of descriptive and inferential statistics applied to usability and interaction engineering. Includes quantitative and qualitative data analysis, hypothesis testing, probability distributions, and regression methods. Emphasis on statistical tools to evaluate and optimize interaction experiences.	60
3rd	**13**	Programming Logic	Logical structures and algorithms oriented toward ATI problem-solving.	80
	14	Representation and Modeling Systems	Cognitive and semiotic modeling in system design.	80
	15	Cognitive Engineering	Introduction to cognitive models of interaction, focusing on human cognitive capacities applied to system design. Covers semantic and articulatory distances.	80

	16	Human-Centered Design (HCD)	Theories and methodologies of agent-centered design. Includes accessibility principles, heuristics, and affordance concepts to ensure interfaces are intuitive and accessible to different agent profiles.	80
	17	Usability and System Evaluation	Tools and metrics for usability evaluation, with emphasis on interaction error severity. Covers Personas and error analysis tailored to agent profiles, identifying how failures impact agent experience and proposing mitigation strategies. Defines criteria for evaluating system effectiveness and agent satisfaction.	80
4th	**18**	Computer Networks	Fundamentals of networks and their impact on interaction within distributed systems.	80
	19	Interaction Design	Practical tools for interface prototyping and implementation. Emphasis on the use of personas to guide design and adapt interaction flows to specific agent needs.	80
	20	Experimental Psychology	Experimental methodologies to assess agent perceptions, reactions, and interactions with technological systems. Analysis of controlled experiment data to optimize agent experience.	80
	21	Graphic Interface and Visual Interaction	Analysis and application of visual principles in interactive design.	80
	22	Semiotic Engineering	Integration of signs and symbols for effective communication in systems.	80
5th	**23**	Operating Systems and Computer Architecture	Integration of hardware and software in interface development.	80
	24	Applied Social and Cognitive Psychology	Exploration of how cognitive processes interact with social and cultural factors in the use of interactive systems. Focus on the impact of social interactions on system design and collective experience optimization in digital environments.	80
	25	Accessibility and Digital Inclusion	Study of norms and guidelines to promote digital accessibility. Analysis of universal design and inclusive practices to ensure usability for diverse users, including persons with disabilities.	80
	26	QRSUER Technology	Design of technological systems integrating quality, sustainability, and social responsibility, focusing on product life cycles. Emphasizes efficient and ethical solutions, resource optimization, environmental preservation, and life quality improvement.	80
	27	Assistive Technologies	Exploration of inclusive technological solutions to promote digital accessibility. Focus on developing tools for agents with physical or cognitive impairments.	80

6th	**28**	Cognitive Engineering II	Practical and complex applications of cognitive models, such as technological symbiosis and co-evolution between agents and systems. Explores strategies for adaptive and responsive interactions.	80
	29	Task Design and Workflow Modeling	Workflow modeling for interaction optimization.	80
	30	Usability Standards and Legislation	Study of standards and compliance (ISO, WCAG, ergonomics).	80
	31	Social and Technological Interaction	Social impacts of emerging technologies in digital interaction.	80
	32	Usability Engineering	Study of usability principles in interactive systems, with emphasis on risk level analysis related to interaction. Evaluates how system errors or failures affect usability and safety, and how to design interfaces that minimize such risks, ensuring effectiveness and agent trust.	80
7th	**33**	Advanced Algorithms for Agent Interfaces	Optimization of algorithms to enhance agent experience.	80
	34	Prototyping and Usability Testing	Development of prototypes and execution of usability tests with real agents. Methods for collecting feedback, identifying problems, and refining interfaces to maximize agent experience.	80
	35	Agent Affectivity and Satisfaction	Study of how emotions influence interaction with technological systems, impacting perception, acceptance, and agent satisfaction. Explores methods to assess and optimize experience based on emotional and affective factors.	80
	36	Research in Interaction Design	Qualitative and quantitative research methods in design.	80
	37	Applied Semiotics in Interaction	Use of semiotic theories to create intuitive interfaces.	80
	38	ATI for IoT and Ubiquitous Computing	Interface design for IoT and ubiquitous computing environments, focusing on intelligent interaction in connected ecosystems and interactive devices.	80
8th	**39**	Augmented and Virtual Reality	Interface design for immersive environments.	80
	40	Multimodal Interface Technologies	Design for multi-channel interaction (voice, gesture, touch).	80
	41	Software Engineering and ATI	Integration of software engineering principles with specific usability and interaction requirements. Covers development lifecycle, agile methodologies, prototyping and testing techniques, and practices to ensure that technological solutions meet usability, accessibility, and agent experience demands.	80

	42	Interactive Systems and Cognitive Feedback	Development of intuitive and efficient feedback strategies in interactive systems, aimed at enhancing agent understanding and responsiveness. Covers cognitive techniques to optimize interaction and information perception.	80
	43	Cybernetics and Adaptive Feedback	Application of cybernetics to adaptive feedback systems in interfaces, focusing on responsiveness and real-time learning.	80
	44	UEM Methods for Usability	Quantitative and qualitative tools and techniques for system evaluation. Scoring scales are used to measure variables such as satisfaction and efficiency, providing quantifiable data to compare interfaces and identify improvements.	80
9th	**45**	Artificial Intelligence and Adaptive Interfaces	Application of Artificial Intelligence for dynamic interface customization and personalization, aiming to optimize agent experience based on individual preferences and contexts.	80
	46	Usability and Design Project Management	Agile methodologies and agent-centered management practices.	80
	47	Case Study: ATI Projects in Industry	Practical analysis and application of ATI in real-world contexts.	80
	48	Digital Service Design	Creation and integration of multichannel, interactive services.	80
10th	**49**	Ethics and Social Impacts of Technolog	Ethical and social reflections on the impact of technology.	80
	50	Ethical and Responsible Interaction with AI	Exploration of ethical principles in the development of AI interfaces, addressing transparency, fairness, and regulatory compliance.	80
	51	Usability and Interaction Design Consulting	Preparation for technical consulting in usability and ATI.	80
	52	Final Graduation Project (Capstone)	Development of a practical project focused on usability and interaction.	120

Source: Author.

Each course was designed to build, integrate, and expand the technical, scientific, and ethical knowledge required for usability engineering. The modules encompass everything from the formal foundations of mathematics, computing, and human sciences to the advanced cores of cognitive engineering, interactional risk assessment, agent-centered design, prototyping, technological ethics, and applied artificial intelligence. The academic journey is guided by criteria of utility, systemic quality, and technical responsibility, encompassing physical, symbolic, perceptual, affective, and social aspects of the user experience.

The structure is segmented by academic term and indicates, for each course, its technical description, key subtopics, and credit hours. This organization makes it possible to visualize the formative progression and the logical sequencing between the conceptual and practical cores of the curriculum. The matrix operates as a dense and coherent curricular architecture, aimed at preparing interaction engineers with high technical, epistemic, and decision-making competence.

Table 2 presents the structure of the mandatory practical internships that integrate the curriculum of the Bachelor's Degree in Usability, Interaction, Quality, Utility, and Systems Logic Engineering. These components represent advanced formative phases, designed to consolidate the articulation between theory, practice, and critical analysis of interaction in real and controlled empirical contexts. The experiences are developed in both laboratory and field environments, with scientific methodologies applied to the systemic evaluation of interactive products, services, and artifacts.

The internships function as technical-investigative immersion modules, in which the student applies the multidimensional knowledge acquired throughout the program, promoting the integration of principles from usability engineering, applied cognition, interaction design, and both qualitative and quantitative analysis of agent experience. They are organized according to increasing levels of complexity, varying by the nature of the testing environment and the degree of experimental control involved.

TABLE 2 – MANDATORY PRACTICAL INTERNSHIPS

#	Title	Description / Specification	Hours
53	**Internship in Laboratory Testing (Controlled Environment)**	Usability evaluation, controlled testing, and data analysis. (Laboratory Level).	100
54	**Internship in Field Testing Laboratory**	Real-world usability assessment and research with actual agents. (Field Level).	100
55	**Internship in Usability Analysis of Products or Services**	Usability testing projects, data analysis, and agent feedback. (Laboratory or Field Level).	100

Source: Author.

The first internship focuses on usability analysis under controlled laboratory conditions, employing rigorous metrics and replicable experimental protocols. The second module expands the application to situational field contexts, where contextual variables and real usage dynamics are observed and analyzed from a scientific perspective. The third internship allows students to engage in applied projects, either in controlled or real environments, centered on experience engineering, based on data collection, agent feedback, and continuous evaluation processes.

The practical internships are structured as essential formative fields for consolidating the technical, ethical, and analytical competencies of the interaction engineer. They function as privileged spaces for observation, diagnosis, and proposal of improvements in interactive systems. Their mandatory nature ensures the articulation between academic education and the technical-social demands of contemporary professional practice, aligning the formative path with the epistemic principles of Agent-Technology Interaction (ATI).

The complete training of the Usability and Interaction Engineer spans ten academic terms, totaling 4,260 hours (Table 3). The curriculum includes 51 theoretical courses, organized in a modular and progressive structure, with 3,840 hours dedicated to conceptual, technical, and scientific training.

TABLE 3 – EDUCATIONAL STRUCTURE AND TOTAL WORKLOAD

Category	Description / Specification	Hours
Program Duration	Academic Terms – 10 semesters	—
Theoretical Courses	51 Courses	**3.840hs**
Final Project	Undergraduate Thesis (Capstone Project)	**120hs**
Internships	3 Modules × 100 hours each	**300hs**
Total Workload	—	**4.260hs**
Modality:	(Yes) On-site (No) Live (No) Distance Learning (EAD)	

Source: Author.

Complementing this structure are the three mandatory practical internships, totaling 300 hours of application in laboratory and field environments, alongside the Undergraduate Final Project (Capstone), which dedicates 120 hours to the development of a technical-scientific project. The program modality is on-site, ensuring intensive practical experience and rigorous formative supervision.

Graduates earn the degree of Bachelor in Usability, Interaction, Quality, Utility, and Systems Logic Engineering (Table 4), formally recognized with the professional title of Usability and Interaction Engineer (EUSIN). This classification establishes a new benchmark in contemporary engineering, designed to address the technical and systemic complexity inherent to interaction processes.

TABELA 4: PERFIL PROFISSIONAL

Category	Description
Qualification	Bachelor's Degree in Usability, Interaction, Quality, Utility, and Systems Logic Engineering.
Professional Title	Usability and Interaction Engineer (EUSIN).
Professional Competence	Ability to operate technically and strategically throughout all stages of the interactive systems lifecycle. Encompasses detailed analysis of technical, human, and social factors impacting usability and interaction. Includes defining requirements, solutions, and methodologies to optimize the agent's experience, leading teams in design and implementation processes, and issuing technical reports based on rigorous evaluation criteria such as usability, accessibility, safety, regulatory compliance, and systemic efficacy.
Meeting Participation	Active collaboration in project definition, prototype development, beta version analysis, and parameter establishment for production. Engages in decision-making processes related to testing, ongoing adjustments, and improvements, ensuring compliance with technical standards of usability, interaction, functionality, and quality.
Functional Autonomy	Full performance in laboratory and field analyses, including the issuance of conclusive technical reports.
Professional Practice	Professional registration with the Engineering Council.

Source: Author.

Professional competence encompasses active engagement throughout all phases of the interactive systems lifecycle, from conception to post-use evaluation, with mastery over the analysis of technical, human, social, and ethical factors directly impacting the agents' experience. The professional holds authority to define requirements, propose evidence-based solutions, and guide design methodologies, in addition to issuing normative technical reports grounded in high-precision scientific criteria.

With functional autonomy in laboratory and operational settings, the EUSIN engineer participates in all decision-making stages of projects, from conceptual definition to technical supervision of prototypes and final versions. This professional practice is regulated by registration with the Engineering Council, ensuring legal, technical, and professional support for full exercise of the role.

The consolidation of this curricular structure marks a decisive advancement in formalizing Usability and Interaction Engineering as an autonomous technical-scientific field, strategically aligned with the Agent-Technology Interaction logic. The modular composition and rigorous articulation among scientific foundations, laboratory practices, international standards, and applied competencies ensure the training of professionals capable of addressing the technical, ethical, and social challenges of contemporary interactive systems. This educational trajectory not only addresses historical gaps in HCI teaching but inaugurates an academic and professional paradigm guided by excellence, social and environmental responsibility, and systemic transformation.

3 STRUCTURAL FOUNDATIONS FOR USABILITY AND INTERACTION ENGINEERING: TECHNICAL REPORTS

The consolidation of Usability and Interaction Engineering as an autonomous technical-scientific field demands a systemic and professional framework that surpasses fragmented, episodic curricular proposals lacking normative grounding. This proposition establishes a paradigmatic milestone by integrating academic training, regulated professional practice, and formalized technical-analytical instruments, such as structured technical reports, which function as core elements of the usability and interaction engineer's evaluative practice.

As Forlizzi & Battarbee (2004) emphasize, understanding interactive experiences is inherently interdisciplinary, requiring a combination of expertise in psychology, design, and engineering to foster meaningful interactions. Such integration demands from the professional a comprehensive education and critical capacity to analyze and assess constructs transversally and at multiple levels, surpassing the subjective perception of the average user.

Reinforcing this characteristic and scope of HCI, Lin, Qin, & Long (2016) assert that HCI is an interdisciplinary domain encompassing computer science, behavioral sciences, industrial design, media studies, among others. This complexity renders obsolete the notion of specialists trained in isolated modules or operational trainings disconnected from the logic of design, testing, standardization, and validation. Interaction engineering therefore requires a new technical-scientific profile: the Usability and Interaction Engineer, endowed with autonomy to issue comprehensive technical reports based on rigorous criteria and a specialized framework.

The proposal articulated here is directly linked to the Integrated and Advanced Core Framework for Analysis and Evaluation of Technological Objects (FCIA-OT), whose epistemological foundation and twelve-dimensional technical-analytical matrix enable the construction of complete technical reports. These documents, produced by qualified professionals, record, in standardized format, the analyses and assessments of technological constructs, from raw material extraction to final disposal. The depth and technical sophistication of this process exceed usual practices of review or technical opinion, integrating methodological rigor, scientific basis, and advanced measurement.

Theory and practice must be synchronized in this training. Lin, Qiu, & Lao (2019) highlight that the interdisciplinarity of HCI combines concepts from psychology, computer science, ergonomics, cognitive science, and industrial design. Education in the field should integrate theory and practice, aligning professional training with market demands. They emphasize incorporating ethical and legal values in intelligent systems to ensure they are nondiscriminatory and respect privacy. They analyze the evolution of educational practices, noting that while traditional methods focus on design with well-defined problems, contemporary approaches prioritize exploratory projects where both problem and solution are uncertain, reflecting their complexity.

The use of technical reports within the ATI logic, mediated by systems such as FCIA-OT, enables precisely the analysis under nondeterministic conditions, generating robust data even in complex, ambiguous, or uncertain contexts. These reports are issued exclusively by the Usability and Interaction Engineer and function as an advanced technical-analytical artifact. At the moment of evaluation, by activating the "Technical Report" feature, the professional formalizes that the analysis is normative, comprehensive, and endowed with institutional validity. Additionally, by selecting the "Assisted" function, the report identifies that the evaluation is conducted by a responsible specialist, with technical-analytical expertise and autonomy to issue a substantiated opinion.

This entire process is systematized through the technical-scientific resources integrated into FCIA-OT: the Integrated Modular Multidimensional Scoring System (SPMI), which organizes and measures analyses according to multiple technical-functional criteria; the Integrated Modular Color Classification and Definition System (SCDMIC), which can be coupled with other tools to present data in chromatic scales facilitating visualization of criticality, severity, or efficacy; the Global Usability and Interaction Score (SGUI), which maps the frequency of occurrence of components in the overall object evaluation; and the Integrated Modular Critical Score (SCMI), which identifies points of greatest impact or vulnerability in the usability and interaction experience. These systems operate integrally with the modular logic of the FCIA-OT matrix, allowing evaluations with technical consistency and interpretative precision.

This systemic investigation is addressed by Sadiku et al. (2021), who describe HCI as a multidisciplinary and expanding field, originally termed "man-machine studies", investigating dynamics between humans and computational systems from technical and social perspectives. They emphasize its dual focus: analyzing how users conceive and interact with technologies, including sociotechnical impacts, and optimizing interface usability through applied research. HCI establishes itself at the intersection of social sciences (human side) and computer science (technological side), with significant advances throughout its trajectory.

The structuring of technical reports within interaction engineering, when systematized through the FCIA-OT, fully addresses both dimensions. It enables a comprehensive understanding of the system as a sociotechnical ecosystem, in which variables are evaluated in depth, grounded in scientific evidence, normative rigor, and measurable impact.

The technical reports formalized by specialized engineers and issued based on the FCIA-OT criteria establish a new standard for the evaluation of interactive systems. More than a degree proposal, this represents a technical-scientific paradigm for professional practice in ATI. It constitutes a structural milestone capable of transforming both professional practice and education, and of consolidating interaction engineering as a technically, scientifically, and institutionally recognized field.

4 TECHNICAL REPORTS IN USABILITY AND INTERACTION ENGINEERING: CLASSIFICATION AND PRACTICAL APPLICATIONS

Based on the previously established foundations, the technical reports issued by the Usability and Interaction Engineer not only formalize advanced evaluations but also unfold into specific categories, each targeting the analysis of technical, functional, cognitive, social, and ethical dimensions of technological objects. Below are some of the main types of technical reports structured according to the criteria and methodologies of the FCIA-OT, ensuring validity, accuracy, and depth in the assessments.

Technical reports play a central role in the practice of professionals specialized in ATI. These documents are prepared with the purpose of providing detailed and objective analyses of the various aspects related to design, functionality, and agent experience within interactive systems. They are essential for optimizing, securing, and improving the accessibility of technological products and services. Each technical report constitutes an in-depth evaluation of specific elements, grounded in both quantitative and qualitative methods, which allow for precise measurement of object performance, identification of critical points, and assurance of compliance with agent needs and the technical-scientific standards of the field.

These documents go beyond validating superficial design features and serve as strategic instruments for decision-making, supporting corrective actions, structural improvements, and regulatory validations. In a scenario where technologies play central roles in social, economic, and political spheres, technical reports function as vectors of responsibility, quality, and ethics in development. Through them, the usability engineer fulfills their role with methodological rigor and technical commitment, supported by objective data and specialized methodologies, with a focus on creating accessible, secure, effective, and sustainable systems. Among the main technical reports structured under the FCIA-OT, the following stand out:

Affordance Adequacy Level Technical Report: Assesses the extent to which the elements of the construct intuitively communicate the possible actions to the agent. Measures the perceptual quality of affordances and their alignment with expected mental models, identifying whether there is ambiguity or cognitive overload in interpreting the object's functions.

Error Severity Level Technical Report: Classifies errors observed during usability and interaction according to their severity (critical, severe, moderate, minor). Examines their causes, frequency, and impact on the user experience, providing strategic recommendations for mitigation, prevention, and reengineering of the interface or functionality.

Risk Level Technical Report: Analyzes risks associated with the use of the technological object, covering aspects such as data protection, privacy, security failures, and adverse consequences to the agent's physical, digital, or emotional integrity. Based on parameters of reliability and regulatory compliance.

Accessibility Level Technical Report: Examines the system's compatibility with national and international accessibility guidelines, identifying physical, sensory, cognitive, or technological barriers. Proposes solutions to ensure that agents with different limitations can fully interact with the object.

QRSUER Technology Level Technical Report: Provides a holistic assessment across the dimensions of Quality, Social Responsibility, Sustainability, Usefulness, Ethics, Reason, and Relevance. Investigates whether the technology fulfills its social function without generating negative externalities, aligning with principles of justice, inclusion, and collective well-being.

Standards, Legislation, and Regulatory Compliance Level Technical Report: Verifies whether the object complies with current legal, regulatory, and normative requirements, both national and international. Examines adherence to technical standards, safety protocols, interoperability rules, accessibility norms, and usability guidelines.

Ergonomics, Articulatory Distance (AD), and Semantic Distance (SD) Level Technical Report: Analyzes whether the interaction is physically comfortable and cognitively efficient. Articulatory Distance measures the physical effort required to operate the system; Semantic Distance evaluates the alignment between the agent's intention and the system's response, minimizing friction and functional ambiguity.

Usability, Usefulness, and Durability Level Technical Report: Measures the agent's effectiveness, efficiency, and satisfaction when interacting with the system (usability), the system's ability to solve real-world problems (usefulness), and the technological object's functional longevity (durability). Identifies recurring operational failures and suggests improvements based on usage cycles.

The classification of these technical reports, as described, reflects the maturity and complexity of the Usability and Interaction Engineer's role. These instruments, integrated within the FCIA-OT framework, not only establish a new standard for technological assessment but also consolidate Interaction Engineering as a profession of high technical, normative, and social responsibility. The following section discusses how these foundations articulate with the academic, professional, and institutional landscape of the ATI field.

5 DISCUSSION

The Agent-Technology Interaction (ATI) field, by lacking a formally regulated academic structure, undermines not only the legitimacy of professional practice but also compromises the technical quality of analyses, decisions, and interventions in interactive systems. The current landscape remains anchored in fragmented approaches that reduce the complexity of HCI to isolated courses, extension modules, or generalist perspectives that disregard the technical and scientific requirements necessary for the systematic analysis of technological constructs. There is no functional standardization, nor institutional support for the issuance of analytical reports that demand rigor, autonomy, and technical accountability.

This disconnect between the sophistication of emerging technologies and the training of those who evaluate them creates a critical gap: complex and advanced constructs continue to be designed, tested, and validated by agents who are not formally recognized, without structured technical reports, without multidimensional criteria, and without professional responsibility for the decisions made. HCI practice remains permeated by empiricism, impressionistic judgments, and lack of methodological systematization, which compromises the reliability of results and exposes agents to functional, cognitive, ethical, and social risks.

In contrast to this scenario of imprecision and institutional fragility, the present proposal offers an unprecedented and regulated solution for ATI practice, centered on the academic and professional formalization of the Usability and Interaction Engineer (EUSIN). This systematic training breaks with the fragmented models that have historically characterized the field and establishes, for the first time, an integrated and progressive curricular architecture grounded in normative criteria. The consolidation of a ten-semester degree program, composed of foundational, technical, and emerging disciplines, combined with the issuance of structured technical reports, represents a qualitative leap in the preparation of specialists who not only understand interactive systems but evaluate them with authority, methodological rigor, and professional responsibility.

The distinguishing feature of this proposal lies in the incorporation of an advanced framework, the FCIA-OT, which provides both technical and methodological support for the entire analytical process, from raw material extraction to the final disposal of the technological object. Through its dedicated resources, such as the SPMI, SCDMIC, SGUI, SCMI, and SIDyCP, the evaluation process moves beyond subjectivity or partiality and is redefined by a logic of technical precision, reproducibility, and professional legitimacy.

In this context, the EUSIN engineer becomes the sole professional authority empowered to issue technical-scientific reports with institutional validity and regulated accountability. The activation of the "Technical Report" and "Assisted" resources within the FCIA-OT system formalizes this evaluative process as a professional act of analysis, governed by strict normative criteria. Each technical report issued under these conditions constitutes not merely a technical document, but a decision-making instance that underpins the logic of system design, validation, and control.

This structure directly challenges the lack of standardization that defines current educational models in HCI, where specialists lack legal standing to issue reports or exercise functional autonomy. While international proposals recognize the field's complexity and attempt to integrate technical and social aspects, they continue to operate under a logic of informal interdisciplinarity, absent of professional regulation. The model presented herein addresses this impasse through a comprehensive solution, supported by an original technical-scientific matrix and grounded in solid, measurable, and replicable assessment parameters.

The impact of this structure extends far beyond the academic domain. By formally defining the profession, its instruments, and its operational parameters, a new technical, scientific, and institutional paradigm is established for ATI practice. This systematization ensures that critical decisions regarding interactive products, systems, and services are no longer made by agents without technical endorsement or by unregulated entities. Instead, these decisions are transferred to a framework that unites formal training, structured reporting, and professional responsibility within a single operative chain.

The proposal, therefore, not only addresses a significant gap but redefines the logic of validation, analysis, and control across the entire life cycle of technological objects, with direct implications for the safety, functionality, usability, and efficacy of interactive experiences.

6 CONCLUSION

This study outlined an unprecedented framework for the formal education and regulation of Usability and Interaction Engineering (EUSIN), establishing a structured and systemic path for the professional practice of the Usability and Interaction Engineer. The progressive curricular construction, combined with the formalization of technical reports as decision-making instruments, reinforces the legitimacy and autonomy of this profession within a multidisciplinary, complex, and rapidly evolving field.

By integrating technical, scientific, and normative foundations, this proposal addresses the current demand for rigor and accountability, which remain insufficient in fragmented models. The implementation of the FCIA-OT framework and its analytical systems enhances professional practice, enabling robust, precise, and replicable evaluations that keep pace with the complexity of contemporary technological constructs.

This research contributes to the consolidation of Usability and Interaction Engineering as both an academic discipline and a regulated profession, with direct impact on the quality, safety, and efficiency of interactive constructs. It is acknowledged, however, that institutional adoption and ongoing methodological refinement represent significant challenges for the sustainable development of the field.

Accordingly, a fertile ground is opened for future research, which may expand assessment methodologies, incorporate new technological dimensions, and further deepen the articulation between theory, practice, and professional standardization. The consolidation of this proposal holds the potential to transform not only academic training, but also the culture of development and evaluation in ATI, generating significant progress for both society and the technological market.

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